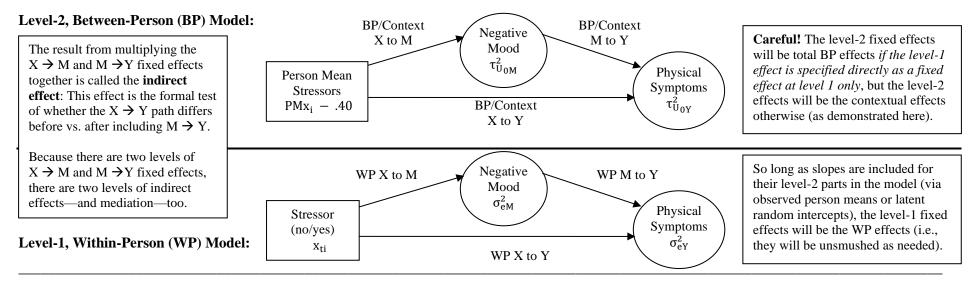
Example 4b: Mediation of Within-Person Fluctuation in Univariate MLM in STATA MIXED and R LMER Compared to Multivariate MLM in Mplus via Multilevel and Single-Level Structural Equation Modeling (complete syntax, data, and output available for STATA, R, and Mplus electronically)

The limitations of univariate multilevel models (MLMs) can be addressed by switching to multivariate MLMs (via SEM or multilevel SEM), as in Mplus. The **primary difference is that rather than obtaining between and within effects through observed variable predictors, in multivariate MLMs the between and within parts of any level-1 predictor can be partitioned into level-2 random intercept variances and level-1 residual variances in the model**, the same as for the outcome in univariate MLMs. This example features multivariate MLMs in which a level-1 variable can be both a predictor and an outcome simultaneously, as is necessary in order to do multilevel mediational analysis of direct and indirect fixed effects. These models use the data from Hoffman (2015) chapter 8 examining fluctuation across 5 days for 105 older adults in daily stressors, daily negative mood, and daily physical symptoms.



We will examine two options for how to include variables in these models: (1) They can be treated as observed predictors, which is the same as in univariate MLM. This means that although the model estimates their fixed effects in predicting the outcome(s), their means, variances, and covariances are *not* model parameters, and these predictors do not have distributional assumptions. This also means that because they are *not* part of the model likelihood, **any** rows (occasions) with missing predictors will be deleted. (2) They can be treated as (latent) outcomes, either by predicting them with other variables, or just by letting the model estimate their variances and covariances at each applicable level (and mean at the highest level). So because outcomes are part of the model likelihood, they can have missing data given their distributional assumptions, such that any case that has at least one outcome will still be included. Using ML in Mplus, it is not possible to turn categorical predictors into outcomes when using the multilevel SEM syntax (although it does appear to be allowed using Bayes estimation instead within version 8.8, as shown in the electronic materials). For this reason, in the multivariate MLMs we will include our "X" daily stressor (0=no, 1=yes) as an observed level-1 predictor and its person mean (centered such that 0=0.40) as an observed level-2 predictor. In contrast, our "M" daily negative mood and our "Y" daily physical symptoms will be outcomes whose variance is model-partitioned into latent variables (as depicted above).

There are two ways of specifying level-1 fixed slopes in Mplus M-SEM, and they create different level-2 fixed slopes: (1) If a level-1 fixed slope is specified directly in the level-1 % WITHIN% model, any level-2 fixed slope of the same variable will carry their total BP effects. (2) If the level-1 placeholder

syntax is used instead, such that the variable's level-1 fixed and level-2 random slope show up in the level-2 %BETWEEN% model—regardless of whether the random slope variance is estimated—then the variable's level-2 fixed slopes will instead carry the contextual effects. We will show both versions to illustrate this result, although based on previous analyses for these data, the **WP effects in this example will be fixed only**, as no random WP effects were significant. Further, we will also examine how to specify interactions in this multivariate MLM framework, which become **latent variable interactions** for which ML estimation requires numeric integration. Finally, there is no REML within Mplus, so **we will use ML for all models**. We will first examine the effects of X and M in predicting Y separately. Then, within a full mediation model, we will examine the $X \rightarrow M$ effect and the unique effects of X and M in predicting Y.

Step 1: Fitting the Between-Person and Within-Person Stress (X) → Symptoms (Y) Effects (i.e., before controlling for M Negative Mood)

vs. level-2 contextual effects by observed variables:	
	TITLE: Step 1: Predicting symptoms outcome from OBSERVED stress (so X> Y)
	DATA: FILE = Example4b.csv; ! Can just list file if in same directory
In STATA MIXED:	VARIABLE:
	! List of ALL variables in stacked data file, in order
display "Step 1: X Stressors Predicting Symptoms Y"	! Mplus does NOT know what they used to be called, though
mixed symptoms c.women c.age80 c.stressor c.PMstress40 ///	NAMES = PersonID women age80 session symptoms mood2 PMmood2 stress PMstr40;
c.women#c.age80, PersonID: , mle nolog	! List of ALL variables used in model (DEFINED variables at end)
<pre>lincom c.stressor*1 + c.PMstress40*1 // BP X to Y Effect</pre>	USEVARIABLES = symptoms women age80 stress PMstr40 agesex;
	! Missing data codes (here, -999)
LDIMED	MISSING = ALL (-999);
In R LMER:	! Identify level-2 ID
	CLUSTER = PersonID;
<pre>print("Step 1: X Stressors Predicting Symptoms Y")</pre>	! Predictor variables with variation ONLY at level 1
<pre>Step1 = lmer(data=Example4b, REML=FALSE,</pre>	WITHIN = stress;
formula=symptoms~1+women+age80+	! Predictor variables with variation ONLY at level 2
<pre>stressor+PMstress40+women:age80+(1 PersonID))</pre>	BETWEEN = age80 women agesex PMstr40;
<pre>print("Show results using Satterthwaite DDF")</pre>	
<pre>summary(Step1, ddf="Satterthwaite")</pre>	DEFINE: agesex = age80*women; ! Create observed level-2 interaction
<pre>print("BP X to Y Effect");</pre>	
<pre>contest1D(Step1, ddf="Satterthwaite", L=c(0,0,0,1,1,0))</pre>	ANALYSIS: TYPE = TWOLEVEL RANDOM; ! 2-level model with random slopes
	ESTIMATOR = ML; ! Can also use MLR for non-normality
	MODEL: ! X Stress> Y Symptoms Model ! Level-1, Within-Person (WP) Model
	! Level-1, within-Person (WP) Model %WITHIN%
	symptoms; ! L1 R: residual variance in symptoms
	WPXtoY symptoms ON stress; ! Placeholder for L1 WP stress->symptoms
	WEALOI Symptoms on Scress, : Fraceholder for hi we scress->symptoms
	! Level-2, Person-Level Model;
	BETWEEN
	[symptoms]; ! Fixed intercept for symptoms
	symptoms; ! L2 random intercept variance in symptoms
	[WPXtoY] (WPXtoY); ! L1 WP fixed effect (label) of stress->symptoms
	WPXtoY@0; ! L2 G: No random stress slope variance->symptoms
	symptoms ON women (SextoY); ! BP fixed effect of women->symptoms
	symptoms ON age80 (AgetoY); ! BP fixed effect of age->symptoms
	symptoms ON agesex (AgesexY); ! BP fixed effect of age*women->symptoms
	symptoms ON PMstr40 (conXtoY); ! Contextual fixed effect of stress->symptoms
	MODEL CONSTRAINT: ! Linear combinations of fixed effects
	NEW (BPXtoY); ! Need to name each new created fixed effect
	BPXtoY = WPXtoY + conXtoY; ! BP effect of stress->symptoms

Univariate MLM Results: This is the exact same model in STATA MIXED, R	Univariate MLM R	esults in Mp	olus M-SE	EM:	
LMER, and Mplus M-SEM (given ML estimation for all three programs, although p-values differ when using Satterthwaite DDF in R LMER) because	MODEL FIT INFORMATI	-			
both daily stressors and person mean stressors are treated as observed predictors,	Number of Free Para	meters		8	
whereas symptoms is an outcome whose variance is partitioned into model-	Loglikelihood				
estimated latent variables.	H0 Value			-704.220	
AIC BIC logLik deviance df.resid 1424.4 1458.3 -704.2 1408.4 501 Random effects:		IC)		1424.440 1458.299 1432.906	
Groups Name Variance Std.Dev.	MODEL RESULTS				
PersonID (Intercept) 0.83721 0.91499 Residual 0.61340 0.78320 Number of obs: 509, groups: PersonID, 105	MODEL RESOLIS	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
	Within Level				
Fixed effects: Estimate Std. Error df t value Pr(> t) (Intercept) 1.586495 0.193743 115.159896 8.1887 0.00000000004043	Residual Variances SYMPTOMS	0.613	0.043	14.191	0.000
women-0.5186850.219907105.308416-2.35870.020186age800.0967640.033291108.2033372.90660.004432stressor0.1100130.094868403.4596321.15960.246882PMstress401.3351600.301870127.4659584.42300.0000206452444176women:age80-0.1064950.037894107.128853-2.81030.005886	Between Level SYMPTOMS ON WOMEN AGE80 AGESEX PMSTR40	-0.519 0.097 -0.106 1.335	0.220 0.033 0.038 0.302	-2.358 2.906 -2.810 4.423	0.018 0.004 0.005 0.000
<pre>> print("BP X to Y Effect") [1] "BP X to Y Effect"</pre>	Means				
<pre>> contest1D(Step1, ddf = "Satterthwaite", L = c(0, 0, 0, 1, 1, + 0)) Estimate Std. Error df t value Pr(> t) 1 1.4451731 0.28643326 103.60072 5.0454096 0.0000019391296</pre>	WPXTOY Intercepts SYMPTOMS	0.110	0.095	1.159 8.188	0.246
	Variances WPXTOY	0.000	0.000	999.000	999.000
	Residual Variances SYMPTOMS	0.837	0.134	6.233	0.000
	New/Additional Para BPSTRESS	meters 1.445	0.286	5.046	0.000

Step 2: Fitting the Between-Person and Within-Person Mood (M) → Symptoms (Y) Effects (i.e., before controlling for X Symptoms)

Univariate MLMs partitioning mood into level-1 WP	In multivariate Mplus, partitioning mood into WP vs. Contextual in the
vs. level-2 contextual effects by observed variables:	MODEL using placeholder syntax for level-1 effects (Model 2a):
<pre>In STATA MIXED: display "Step 2ish: Mood M Predicting Symptoms Y" mixed symptoms c.women c.age80 c.mood2 c.PMmood2 /// c.women#c.age80, PersonID: , mle nolog lincom c.mood2*1 + c.PMmood2*1 // BP M to Y Effect In R LMER: print("Step 2ish: M Mood Predicting Symptoms Y") Step2 = lmer(data=Example4b, REML=FALSE,</pre>	<pre>TITLE: Step 2a: Predicting symptoms outcome from mood OUTCOME (so M> Y) (DATA is the same) VARIABLE: ! List of ALL variables in stacked data file, in order ! Mplus does NOT know what they used to be called, though NAMES = PersonID women age80 session symptoms mood2 PMmood2 stress PMstr40; ! List of ALL variables used in model (DEFINED variables at end) USEVARIABLES = symptoms women age80 mood2 agesex; ! Missing data codes (here, -999) MISSING = ALL (-999); ! Identify level-2 ID CLUSTER = PersonID; ! Predictor variables with variation ONLY at level 1 none now WITHIN = ;</pre>
<pre>contest1D(Step2, ddf="Satterthwaite", L=c(0,0,0,1,1,0))</pre>	<pre>! Predictor variables with variation ONLY at level 2 no PMmood2 BETWEEN = age80 women agesex;</pre>
MLM Results: Although this is the same idea, this is NOT the same model as in Mplus M-SEM (right), in which mood is treated like another outcome (and so its mean and level-specific variances are model parameters, even though it is not being predicted). AIC BIC logLik deviance df.resid 1421.7 1455.5 -702.8 1405.7 501 Random effects: Groups Name Variance Std.Dev. PersonID (Intercept) 0.81615 0.90341 Residual 0.61273 0.78277	<pre>(DEFINE and ANALYSIS are the same) MODEL: ! M Mood> Y Symptoms Model ! Level-1, Within-Person (WP) Model %WITHIN% symptoms; ! L1 R: residual variance in symptoms mood2; ! L1 R: residual variance in mood WPMtoY symptoms ON mood2; ! Placeholder for L1 WP mood> symptoms ! Level-2, Person-Level Model; %BETWEEN% [symptoms]; ! Fixed intercept for symptoms symptoms; ! L2 random intercept variance in symptoms [mood2]; ! Fixed intercept for mood mood2; ! L2 random intercept variance in mood</pre>
Number of obs: 509, groups: PersonID, 105 Fixed effects: Estimate Std. Error df t value Pr(> t) (Intercept) 3.265483 0.345801 105.879511 9.4432 1.015e-15 women -0.518135 0.217506 105.334759 -2.3822 0.01900 age80 0.066899 0.033494 107.758448 1.9973 0.04831 mood2 0.159103 0.127716 404.161789 1.2458 0.21358 PMmood2 1.810999 0.390993 132.127349 4.6318 8.572e-06 women:age80 -0.091762 0.037637 107.045874 -2.4381 0.01641 [1] "BP M to Y Effect" Estimate Std. Error df t value Pr(> t) 1 1.9701027 0.36873211 104.877 5.3429107 0.00000053576549	<pre>[WPMtoY] (WPMtoY); ! L1 WP fixed effect of mood ->symptoms WPMtoY@0; ! L2 G: No rand mood slope var>symptoms symptoms ON women (SextoY); ! BP fixed effect of women ->symptoms symptoms ON age80 (AgetoY); ! BP fixed effect of age ->symptoms symptoms ON mood2 (conMtoY); ! DP fixed effect of age*women ->symptoms MODEL CONSTRAINT: ! Linear combinations of fixed effects NEW(BPMtoY); ! Name each new created fixed effect BPMtoY = WPMtoY + conMtoY; ! BP fixed effect of mood ->symptoms</pre>

1	te Results usir			Same model specifying level-1 fixed effect in %WITHIN% instead (Model 2b):						
underlined values	indicate the 3 p	arameters	for mood no	OW	(all previous commands are the same) MODEL: ! M Mood> Y Symptoms Model WITHOUT THE LEVEL-1 PLACEHOLDER					
as an "outcome" no	ot estimated in	univariate	MLM versi	on	! Level-1, Within-Pe			WITHOUT THE	LEVEL-1 PLACEH	OLDER
MODEL FIT INFORMA	ΨΤΟN				%WITHIN%					
Number of Free Pa			11		symptoms;				variance in syn	
Number of free ra	Lameters		11		mood2;				variance in moo	
Loglikelihood					symptoms ON mood2	(WPMTOY);	! NO P	lacenolder,	L1 WP mood->sy	mptoms here
HO Valu	e		-890.792		! Level-2, Person-Le	wal Madal				
no vara	-		000.702		<pre>! Level-2, Person-Le %BETWEEN%</pre>	ver Moder				
Information Crite	ria				[symptoms];		l Fivo	d intercent	for symptoms	
Akaike	(AIC)		1803.583		symptoms;			-	cept variance i	n symptoms
Bayesia			1850.140		[mood2];			d intercept	-	II Symptoms
	Size Adjusted	BIC	1815.225		Mood2;			-	cept variance i	n mood
-	(n + 2) / 24)				! References to fixe	d and random			-	
					symptoms ON women	(SextoY);			of women->symp	toms
Model fit is the sa	me either way	but with	out placehol	der syntax	symptoms ON age80	(AgetoY);			of age->sympto	
	•		·	•	symptoms ON agesex				of age*women->	
absolute fit tests al	* *			a saturated	symptoms ON mood2	(BPMtoY);			fect of mood->s	
(unstructured) mat	rix of variances	s per level.								
× ,		1			MODEL CONSTRAINT:		! Line	ar combinati	ions of fixed e	ffects
T () 1 (1	1, 1, 00, 1	1 /1			NEW(conMtoY);		! Name	each new ci	reated fixed ef	fect
Let's see how the r	esults differ ba	sed on the	syntax:		conMtoY = BPMtoY -	WPMtoY;	! Cont	extual fixed	d effect of mod	d->symptoms
bolded terms that a	tre missing are	noted in ()							
	0	· · · · · · · · · · · · · · · · · · ·	/							
				Two-Tailed					Two-Tailed	
	Estimate	S.E.	Est./S.E.	P-Value		Estimate	S.E.	Est./S.E.	P-Value	
Within Level					Within Level					
(SYMPTOMS ON					SYMPTOMS ON					
MOOD2)					MOOD2	0.167	0.128	1.303	0.193	
Variances					Variances					
MOOD2	0.093	0 007				0.093			0 000	
		0.007	14.156	0.000	MOOD2		0.007	14.157	0.000	
Residual Varianc	es	0.007	14.156	0.000	MOOD2 Residual Variances		0.007	14.157	0.000	
Residual Varianco SYMPTOMS	es 0.613	0.007	14.156	0.000		0.613	0.007	14.157 14.185	0.000	
					Residual Variances SYMPTOMS					
					Residual Variances SYMPTOMS Between Level					
SYMPTOMS	0.613	0.043	14.185	0.000	Residual Variances SYMPTOMS Between Level SYMPTOMS ON	0.613	0.043	14.185	0.000	
SYMPTOMS Between Level	0.613	0.043	14.185 -2.458		Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN	0.613	0.043	14.185 -2.458	0.000	
SYMPTOMS Between Level SYMPTOMS ON	0.613 -0.540 0.074	0.043 0.220 0.034	14.185 -2.458 2.181	0.000 0.014 0.029	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80	0.613 -0.540 0.074	0.043 0.220 0.034	14.185 -2.458 2.181	0.000 0.014 0.029	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX	0.613 -0.540 0.074 -0.098	0.043 0.220 0.034 0.038	14.185 -2.458 2.181 -2.582	0.000 0.014 0.029 0.010	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX	0.613 -0.540 0.074 -0.098	0.043 0.220 0.034 0.038	14.185 -2.458 2.181 -2.582	0.000 0.014 0.029 0.010	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80	0.613 -0.540 0.074	0.043 0.220 0.034	14.185 -2.458 2.181	0.000 0.014 0.029	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2	0.613 -0.540 0.074	0.043 0.220 0.034	14.185 -2.458 2.181	0.000 0.014 0.029	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX	0.613 -0.540 0.074 -0.098	0.043 0.220 0.034 0.038 0.558	14.185 -2.458 2.181 -2.582 4.196	0.000 0.014 0.029 0.010 0.000	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means	-0.540 0.074 -0.098 2.506	0.043 0.220 0.034 0.038 0.530	14.185 -2.458 2.181 -2.582 4.727	0.000 0.014 0.029 0.010 0.000	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2	-0.540 0.074 -0.098 2.340 -0.795	0.043 0.220 0.034 0.038 0.558 0.026	14.185 -2.458 2.181 -2.582 4.196 -30.456	0.000 0.014 0.029 0.010 0.000 0.000	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2	0.613 -0.540 0.074 -0.098	0.043 0.220 0.034 0.038	14.185 -2.458 2.181 -2.582	0.000 0.014 0.029 0.010	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means	0.613 -0.540 0.074 -0.098 2.340	0.043 0.220 0.034 0.038 0.558	14.185 -2.458 2.181 -2.582 4.196	0.000 0.014 0.029 0.010 0.000	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 (WPMTOY)	-0.540 0.074 -0.098 2.506	0.043 0.220 0.034 0.038 0.530	14.185 -2.458 2.181 -2.582 4.727	0.000 0.014 0.029 0.010 0.000	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 WPMTOY Intercepts	0.613 -0.540 0.074 -0.098 2.340 <u>-0.795</u> 0.167	0.043 0.220 0.034 0.038 0.558 0.026 0.128	14.185 -2.458 2.181 -2.582 4.196 -30.456 1.303	0.000 0.014 0.029 0.010 0.000 0.000 0.193	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 (WPMTOY) Intercepts	0.613 -0.540 0.074 -0.098 2.506 -0.795	0.043 0.220 0.034 0.038 0.530 0.026	14.185 -2.458 2.181 -2.582 4.727 -30.454	0.000 0.014 0.029 0.010 0.000 0.000	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 WPMTOY Intercepts SYMPTOMS	-0.540 0.074 -0.098 2.340 -0.795	0.043 0.220 0.034 0.038 0.558 0.026	14.185 -2.458 2.181 -2.582 4.196 -30.456	0.000 0.014 0.029 0.010 0.000 0.000	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 (WPMTOY) Intercepts SYMPTOMS	-0.540 0.074 -0.098 2.506	0.043 0.220 0.034 0.038 0.530	14.185 -2.458 2.181 -2.582 4.727	0.000 0.014 0.029 0.010 0.000	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 WPMTOY Intercepts SYMPTOMS Variances	0.613 -0.540 0.074 -0.098 2.340 <u>-0.795</u> 0.167 3.710	0.043 0.220 0.034 0.038 0.558 0.026 0.128 0.463	14.185 -2.458 2.181 -2.582 4.196 -30.456 1.303 8.020	0.000 0.014 0.029 0.010 0.000 0.000 0.193 0.000	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 (WPMTOY) Intercepts SYMPTOMS Variances	0.613 -0.540 0.074 -0.098 2.506 -0.795 3.710	0.043 0.220 0.034 0.038 0.530 0.026 0.463	14.185 -2.458 2.181 -2.582 4.727 -30.454 8.020	0.000 0.014 0.029 0.010 0.000 0.000 0.000	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 WPMTOY Intercepts SYMPTOMS Variances MOOD2	0.613 -0.540 0.074 -0.098 2.340 <u>-0.795</u> 0.167 3.710 <u>0.052</u>	0.043 0.220 0.034 0.038 0.558 0.026 0.128 0.463 0.010	14.185 -2.458 2.181 -2.582 4.196 -30.456 1.303 8.020 5.174	0.000 0.014 0.029 0.010 0.000 0.000 0.193 0.000 0.000	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 (WPMTOY) Intercepts SYMPTOMS Variances MOOD2	0.613 -0.540 0.074 -0.098 2.506 -0.795	0.043 0.220 0.034 0.038 0.530 0.026	14.185 -2.458 2.181 -2.582 4.727 -30.454	0.000 0.014 0.029 0.010 0.000 0.000	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 WPMTOY Intercepts SYMPTOMS Variances MOOD2 WPMTOY	0.613 -0.540 0.074 -0.098 2.340 <u>-0.795</u> 0.167 3.710 <u>0.052</u> 0.000	0.043 0.220 0.034 0.038 0.558 0.026 0.128 0.463	14.185 -2.458 2.181 -2.582 4.196 -30.456 1.303 8.020	0.000 0.014 0.029 0.010 0.000 0.000 0.193 0.000	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 (WPMTOY) Intercepts SYMPTOMS Variances MOOD2 (WPMTOY)	0.613 -0.540 0.074 -0.098 2.506 -0.795 3.710	0.043 0.220 0.034 0.038 0.530 0.026 0.463	14.185 -2.458 2.181 -2.582 4.727 -30.454 8.020	0.000 0.014 0.029 0.010 0.000 0.000 0.000	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 WPMTOY Intercepts SYMPTOMS Variances MOOD2 WPMTOY Residual Variance	0.613 -0.540 0.074 -0.098 2.340 <u>-0.795</u> 0.167 3.710 <u>0.052</u> 0.000 es	0.043 0.220 0.034 0.38 0.558 0.026 0.128 0.463 0.010 0.000	14.185 -2.458 2.181 -2.582 4.196 -30.456 1.303 8.020 5.174 999.000	0.000 0.014 0.029 0.010 0.000 0.193 0.000 0.000 999.000	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 (WPMTOY) Intercepts SYMPTOMS Variances MOOD2 (WPMTOY) Residual Variances	0.613 -0.540 0.074 -0.098 2.506 -0.795 3.710 <u>0.052</u>	0.043 0.220 0.034 0.038 0.530 0.026 0.463 0.010	14.185 -2.458 2.181 -2.582 4.727 -30.454 8.020 5.174	0.000 0.014 0.029 0.010 0.000 0.000 0.000 0.000	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 WPMTOY Intercepts SYMPTOMS Variances MOOD2 WPMTOY	0.613 -0.540 0.074 -0.098 2.340 <u>-0.795</u> 0.167 3.710 <u>0.052</u> 0.000	0.043 0.220 0.034 0.038 0.558 0.026 0.128 0.463 0.010	14.185 -2.458 2.181 -2.582 4.196 -30.456 1.303 8.020 5.174	0.000 0.014 0.029 0.010 0.000 0.000 0.193 0.000 0.000	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 (WPMTOY) Intercepts SYMPTOMS Variances MOOD2 (WPMTOY)	0.613 -0.540 0.074 -0.098 2.506 -0.795 3.710	0.043 0.220 0.034 0.038 0.530 0.026 0.463	14.185 -2.458 2.181 -2.582 4.727 -30.454 8.020	0.000 0.014 0.029 0.010 0.000 0.000 0.000	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 WPMTOY Intercepts SYMPTOMS Variances MOOD2 WPMTOY Residual Variance SYMPTOMS	0.613 -0.540 0.074 -0.098 2.340 <u>-0.795</u> 0.167 3.710 <u>0.052</u> 0.000 es 0.754	0.043 0.220 0.034 0.38 0.558 0.026 0.128 0.463 0.010 0.000	14.185 -2.458 2.181 -2.582 4.196 -30.456 1.303 8.020 5.174 999.000	0.000 0.014 0.029 0.010 0.000 0.193 0.000 0.000 999.000	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 (WPMTOY) Intercepts SYMPTOMS Variances MOOD2 (WPMTOY) Residual Variances SYMPTOMS	0.613 -0.540 0.074 -0.098 2.506 -0.795 3.710 <u>0.052</u> 0.754	0.043 0.220 0.034 0.038 0.530 0.026 0.463 0.010	14.185 -2.458 2.181 -2.582 4.727 -30.454 8.020 5.174	0.000 0.014 0.029 0.010 0.000 0.000 0.000 0.000	
SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 WPMTOY Intercepts SYMPTOMS Variances MOOD2 WPMTOY Residual Variance	0.613 -0.540 0.074 -0.098 2.340 <u>-0.795</u> 0.167 3.710 <u>0.052</u> 0.000 es 0.754	0.043 0.220 0.034 0.38 0.558 0.026 0.128 0.463 0.010 0.000	14.185 -2.458 2.181 -2.582 4.196 -30.456 1.303 8.020 5.174 999.000	0.000 0.014 0.029 0.010 0.000 0.193 0.000 0.000 999.000	Residual Variances SYMPTOMS Between Level SYMPTOMS ON WOMEN AGE80 AGESEX MOOD2 Means MOOD2 (WPMTOY) Intercepts SYMPTOMS Variances MOOD2 (WPMTOY) Residual Variances	0.613 -0.540 0.074 -0.098 2.506 -0.795 3.710 <u>0.052</u> 0.754	0.043 0.220 0.034 0.038 0.530 0.026 0.463 0.010	14.185 -2.458 2.181 -2.582 4.727 -30.454 8.020 5.174	0.000 0.014 0.029 0.010 0.000 0.000 0.000 0.000	

Step 3: Fitting the Full Mediation Model: Between-Person and Within-Person Stress (X) → Mood (M) → Symptoms (Y) For parallel interpretation of the level-2 fixed effects of stress, the sex, age, and their interaction predictors also now predict mood.

```
A full simultaneous mediation model is not possible in univariate MLM.
so here is Multivariate Mplus using placeholder syntax
\rightarrow WP + Contextual effects:
TITLE: Step3: Full mediation MLM of Stress --> Mood --> Symptoms
( DATA is the same )
VARIABLE:
! List of ALL variables in stacked data file, in order
 NAMES = PersonID women age80 session symptoms mood2 PMmood2
          stress PMstr40;
! List of ALL variables used in model (DEFINED variables at end)
 USEVARIABLES = symptoms women age80 mood2 stress PMstr40 agesex;
! Missing data codes (here, -999)
 MISSING = ALL (-999);
! Identify level-2 ID
 CLUSTER = PersonID;
! Predictor variables with variation ONLY at level 1
 WITHIN = stress:
! Predictor variables with variation ONLY at level 2
 BETWEEN = age80 women agesex PMstr40;
( DEFINE and ANALYSIS are the same )
MODEL:
         ! Full X Stress --> M Mood --> Y Symptoms Mediation Model
! Level-1, Within-Person (WP) Model
%WITHIN%
  symptoms;
                                ! L1 R: residual variance in symptoms
 mood2;
                               ! L1 R: residual variance in mood
 WPXtoM | mood2 ON stress: ! Placeholder L1 WP stress->mood
  WPXtoY | symptoms ON stress; ! Placeholder L1 WP stress->symptoms
  WPMtoY | symptoms ON mood2; ! Placeholder L1 WP mood->symptoms
! Level-2, Person-Level Model
%BETWEEN%
 [symptoms];
                     ! Fixed intercept for symptoms
 symptoms;
                     ! L2 random intercept variance in symptoms
 [mood21;
                     ! Fixed intercept for mood
 mood2;
                     ! L2 random intercept variance in mood
 [WPXtoM] (WPXtoM); ! L1 WP fixed effect of stress->mood
                     ! L2 G: No random stress slope variance->mood
 WPXtoM@0;
 [WPXtoY] (WPXtoY); ! L1 WP fixed effect of stress->symptoms
 WPXtoY@0;
                     ! L2 G: No random stress slope variance->symptoms
 [WPMtoY] (WPMtoY); ! L1 WP fixed effect of mood->symptoms
                     ! L2 G: No random mood slope variance->symptoms
 WPMtoY@0;
symptoms mood2 ON women; ! BP fixed effects women->mood, symptoms
symptoms mood2 ON age80; ! BP fixed effects age->mood, symptoms
symptoms mood2 ON agesex; ! BP fixed effects age*women
mood2
         ON PMstr40 (conXtoM) ; ! Contextual fixed effect stress->mood
symptoms ON PMstr40(conXtoY); ! Contextual fixed effect stress->symptoms
symptoms ON mood2 (conMtoY); ! Contextual fixed effect mood->symptoms
```

```
! Getting BP fixed effects and all indirect effects
MODEL CONSTRAINT:
NEW(BPXtoM BPXtoY BPMtoY WPind Conind BPind);
! BP effects;
BPXtoM = WPXtoM + conXtoM; ! BP effect stress->mood
BPXtoY = WPXtoY + conXtoY; ! BP effect stress->symptoms
BPMtoY = WPMtoY + conMtoY; ! BP effect of mood->symptoms
! Indirect effects;
WPind = WPXtoM*WPMtoY; ! WP indirect effect
Conind = conXtoM*conMtoY; ! Contextual indirect effect
BPind = BPXtoM*BPMtoY; ! BP indirect effect
```

Note: MODEL INDIRECT is the usual way of obtaining indirect effects in Mplus but is not available for multilevel models. So we are using MODEL CONSTRAINT to calculate the indirect effects ourselves to accomplish the same thing. Further, although one can get bootstrapped *p*-values and confidence intervals for single-level mediation models, they are not available for multilevel mediation models. That means the *p*-values from the indirect effects may be a little suspect, and other methods of assessing significance may be needed for "best practice" (see Kris Preacher's website for online tools for bootstrapping parameter estimates).

Mplus Multivariate Results:

MODEL FIT INFORMATION	
Number of Free Parameters	18
Loglikelihood H0 Value	-864.198
Information Criteria Akaike (AIC) Bayesian (BIC) Sample-Size Adjusted BIC (n* = (n + 2) / 24)	1764.396 1840.580 1783.446

MODEL RESULTS					
				Two-Tailed	Step 4: Same Model, Adding Mood*Sex Interactions → Symptoms
	Estimate	S.E.	Est./S.E.	P-Value	
					When I tried to estimate a latent variable interaction between level-2 observed variable
Within Level					women and level-2 random intercept mood2, Mplus insisted that was an observed
					variable interaction, which would instead be between original level-1 mood and
Residual Variance					.
SYMPTOMS	0.612	0.043	14.184	0.000	women. So I had to create a work-around that involved renaming the mood random
MOOD2	0.089	0.006	14.146	0.000	intercept:
Between Level					
SYMPTOMS ON					(all previous commands are the same after adding ALGORITHM = INTEGRATION)
WOMEN	-0.534	0.209	-2.553	0.011	MODEL: ! X Stress> M Mood> Y Symptoms Mediation Model + Mood*Sex
	-0.534 0.070	0.209			! Level-1, Within-Person (WP) Model
AGE80			2.121	0.034	WITHIN
AGESEX	-0.094	0.036	-2.596	0.009	symptoms; ! L1 R: residual variance in symptoms
PMSTR40	1.091	0.304	3.589	0.000	mood2: ! L1 R: residual variance in mood
MOOD2	1.852	0.606	3.058	0.002	
					WPXtoM mood2 ON stress; ! Placeholder L1 WP stress->mood
MOOD2 ON					WPXtoY symptoms ON stress; ! Placeholder L1 WP stress->symptoms
WOMEN	0.008	0.054	0.151	0.880	WPMtoY symptoms ON mood2;
AGE80	0.013	0.008	1.629	0.103	
AGESEX	-0.006	0.009	-0.628	0.530	! Level-2, Person-Level Model;
PMSTR40	0.124	0.079	1.561	0.119	%BETWEEN%
					[symptoms]; ! Fixed intercept for symptoms
Means					symptoms; ! L2 random intercept variance in symptoms
WPXTOM	0.162	0.036	4.486	0.000	
WPXTOY	0.085	0.097	0.872	0.383	moodint BY mood2@1; ! Rename mood random intercept as latent variable
WPMTOY	0.141	0.131	1.077	0.281	[moodint mood200]; ! Fixed intercept for moodint, not mood
WEMICI	0.141	0.131	1.077	0.201	moodint mood2@0; ! L2 G: random intercept variance for moodint, not mood
Intercepts					! Now moodint replaces mood2 everywhere in the syntax below
SYMPTOMS	3.340	0.540	6.184	0.000	
MOOD2	-0.880	0.049	-17.879	0.000	[WPXtoM] (WPXtoM); ! L1 WP fixed effect of stress->mood
MOODZ	-0.000	0.049	-17.079	0.000	WPXtoM@0; ! L2 G: No random stress slope variance->mood
					[WPXtoY] (WPXtoY); ! L1 WP fixed effect of stress->symptoms
Variances					WPXtoY@0; ! L2 G: No random stress slope variance->symptoms
WPXTOM	0.000	0.000	999.000	999.000	
WPXTOY	0.000	0.000	999.000	999.000	[WPMtoY] (WPMtoY); ! L1 WP fixed effect of mood->symptoms
WPMTOY	0.000	0.000	999.000	999.000	WPMtoY@0; ! L2 G: No random mood slope variance->symptoms
Residual Variance	es				symptoms moodint ON women; ! BP fixed effects women->mood, symptoms
SYMPTOMS	0.678	0.122	5.547	0.000	symptoms moodint ON age80; ! BP fixed effects age->mood, symptoms
MOOD2	0.040	0.008	4.802	0.000	symptoms moodint ON agesex; ! BP fixed effects age*women
New/Additional Par	rameters				<pre>moodint ON PMstr40(conXtoM); ! Contextual fixed effect stress->mood</pre>
BPXTOM	0.286	0.070	4.063	0.000	symptoms ON PMstr40(conXtoY); ! Contextual fixed effect stress->symptoms
BPXTOY	1.175	0.289	4.067	0.000	symptoms ON moodint (conMtoY); ! Contextual effect of mood->symptoms
BPMTOY	1.993	0.205	3.459	0.000	
DIMUVI		0.070	5.155	0.001	WPMtoY ON women (WPMsexY); ! Level-1 mood by sex->symptoms
WPIND	0.023	0.022	1.048	0.295	moddsex women XWITH modint; ! Latent interaction of sex*context mood
					symptoms ON moodsex (conMsexY); ! Contextual mood*sex->symptoms
CONIND	0.229	0.164	1.393	0.164	-Internet of modeler (competent), . concertate model ber / Symptoms
BPIND	0.570	0.217	2.630	0.009	MODEL CONSTRAINT:
					(all previous new effects stayed here)
					NEW (BPMsexY);
L					BPMsexY = WPMsexY + conMsexY; ! BP mood*sex->symptoms

Stop 4 Multivariate Mplus Results (a few minutes later): Vertification Vertification Number of Pare Parameters 20 Number of Pare Parameters 0.000 0.000 999.000 999.000 Number of Pare Parameters 20 Number of Pare Parameters 0.000 0.000 0.000 999.000 999.000 Number of Pare Parameters -662.992 Number of Pare Parameters 0.000 0.000 0.000 999.000 999.000 Number of Pare Parameters -662.992 Number of Pare Parameters 0.000 0.000 999.000 999.000 Number of Pare Parameters -662.992 1769.994 0.000 0.000 999.000 999.000 Number of Pare Parameters -1769.994 1769.094 0.000 0.000 0.000 999.000 999.000 Number of Pare Parameters -1.000 0.000 999.000 999.000 999.000 999.000 1.230 0.000 0.230 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200 0.200	1										
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	WENTOI	0.005	0.201	0.201	0./94						
	l										

Example Results Section for Steps 1 to 3:

The relationships among time-varying stressors (i.e., whether or not a stressor was reported on a given day), negative mood (constructed as the mean of five items), and physical symptoms (constructed as the sum of five reported symptoms) were examined using multivariate multilevel models (i.e., multilevel structural equation modeling) within Mplus v. 8 (Muthén & Muthén, 1998-2017) using maximum likelihood (ML) estimation. (We obtained an identical pattern of results using a robust ML estimator to account for potential non-normality and so the original ML results are reported below.) Two observed variables were used to partition the effect of binary daily stressors (0=no, 1=yes) into its contextual (level-2; incremental between-person) and within-person (level-1) effects, in which the level-2 predictor was created as the person mean of stressors centered at 40% of days (PMstress_i – .40) and the level-1 predictor was daily stressor variable. This same type of variance partitioning was accomplished within the model estimation for the continuous level-1 outcomes of negative mood and physical symptoms, such that random intercept variances were estimated for each at level 2, and residual variances were estimated for each at level 1. Under this specification, level-1 fixed effects indicate within-person effects, whereas level-2 fixed effects reflect contextual effects. The MODEL CONSTRAINT command was used to obtain model-implied between-person effects and all indirect effects. Age, sex, and their interaction (with 80-year-old men as the reference group) were included as predictors in the level-2 model for both negative mood and physical symptoms. In addition, likelihood ratio revealed no significant random within-person direct effects in any of the models (all $-2\Delta LL(-2) < 5.99$, p > .05), and so all within-person effects of stressors on physical symptoms, we began by estimating separate models for stress and mood each predicting symptoms before controlling for each effect for the other.

First, a univariate multilevel model of observed stressors predicting physical symptoms $(X \rightarrow Y)$ revealed significant positive contextual (1.335) and betweenperson (1.445) effects but no significant within-person effect. These first results indicate that, after controlling for age and sex but before controlling for negative mood, physical symptoms were higher on average for persons who experienced more stressor days than others (even after controlling for daily stressors), but physical symptoms on a given day were not related to whether a stressor was experienced that day. Second, a separate multivariate multilevel model of negative mood predicting physical symptoms ($M \rightarrow Y$) revealed significant contextual (2.339) and between-person (2.506) effects but no significant within-person effect. These second results indicate that, after controlling for age and sex but before controlling for stressors, physical symptoms on a given day were not related to whether a negative mood than others (even after controlling for daily negative mood), but physical symptoms on a given day were not related to whether a negative mood was higher than usual that day. Thus, to summarize, significant direct effects were found between persons (at level 2) for both $X \rightarrow Y$ and $M \rightarrow Y$, but no significant direct effects were found within persons.

Third, the extent to which daily negative mood mediated the relationship between daily stressors and daily physical symptoms at each level was examined in a multilevel mediation model with all three variables, each specified as previously described. For comparable interpretation of the level-2 effects of stressors on mood and symptoms, level-2 effects of age, sex, and their interaction were added to predict negative mood (as well as symptoms, as before). Results are shown in Table X. At level 2, although there was a significant positive between-person effect (0.286) of observed stressors predicting negative mood ($X \rightarrow M$), the corresponding contextual effect (0.124) was not significant, indicating that negative mood was not significantly higher in persons with more stressor days after controlling for daily stressors. In addition, the between-person effect of stressors on physical symptoms ($X \rightarrow Y$) was significantly reduced (from 1.445 to 1.175) after controlling for the between-person effect of negative mood, as indicated by a significant between-person indirect effect of stressors on physical symptoms through negative mood. Likewise, the between-person effect of negative mood on physical symptoms ($M \rightarrow Y$) was reduced (from 2.506 to 1.852) after controlling for stressors. Both between-person effects of stressors and negative mood predicting symptoms (and their contextual effects) remained uniquely significant. Thus, reporting more stressor days than others is related to reporting more physical symptoms than others (even after controlling for daily stressors), but this link did not result solely from a concomitant difference in negative mood. However, the contextual indirect effect was not significant, indicating that some of this mediation is reduced after controlling for daily stressors and daily negative mood. At level 1, there was a significant $X \rightarrow M$ within-person effect (0.162), indicating that greater stressors than usual on a given day did predict greater negative mood than usual that day. However, t

indicated by a nonsignificant within-person indirect effect of stressors on physical symptoms through negative mood. Thus, after controlling for people's general tendencies to do so, reporting a stressor did not predict reporting more physical symptoms that day. Finally, the within-person effect of negative mood on symptoms ($M \rightarrow Y$) remained nonsignificant after controlling for stressors as well.

Equation for Step 3 (using placeholder syntax in ML, the full level-1 outcome is used as a predictor, not just the within-person latent residual):

Level 1: $Mood_{ti} = \beta_{0iM} + \beta_{1iM}(Stress_{ti}) + e_{tiM}$ Level 1: $Symptoms_{ti} = \beta_{0iY} + \beta_{1iY}(Stress_{ti}) + \beta_{2iY}(Mood_{ti}) + e_{tiY}$

Level 2: $\beta_{0iM} = \gamma_{00M} + \gamma_{01M}(Age_i - 80) + \gamma_{02M}(Women_i) + \gamma_{04M}(Women_i)(Age_i - 80) + \gamma_{05M}(PMstressor_i - .40) + U_{0iM}$ $\beta_{1iM} = \gamma_{10M}$

Level 2:

 $\begin{aligned} \beta_{0iY} &= \gamma_{00Y} + \gamma_{01Y}(Age_i - 80) + \gamma_{02Y}(Women_i) + \gamma_{04Y}(Women_i)(Age_i - 80) + \gamma_{05Y}(PMstressor_i - .40) + \gamma_{06Y}(\beta_{0iM}) + U_{0iY} \\ \beta_{1iY} &= \gamma_{10Y} \\ \beta_{2iY} &= \gamma_{20Y} \end{aligned}$

Bonus Step 5: Fitting the Full Mediation Model via SEM: Between-Person and Within-Person Stress (X) → Mood (M) → Symptoms (Y) Level-1 stress now must be treated as an outcome, which means this model is not equivalent to the previous Step 3 in MLM

```
TITLE: Step 5: SEM Full Mediation Model using Stress Intercept Factor
DATA:
       FILE = Example4b.csv; ! Can just list file if in same directory
                                                                             ! L2 mediation model
                                                                               FMint ON FXint (conXtoM); ! Contextual effect stress->mood
! Unstacking to multivariate format
                                                                               FYint ON FXint (conXtoY); ! Contextual effect stress->symptoms
DATA LONGTOWIDE:
                                                                               FYint ON FMint (conMtoY); ! Contextual effect mood->symptoms
! Names of old stacked former variables (without numbers)
 LONG = stress|mood|symptom;
                                                                             ! L1 WP fixed effect stress->mood
! Names of new multivariate variables (that use numbers)
                                                                               mood1-mood5 PON stress1-stress5 (WPXtoM):
 WIDE = stress1-stress5|mood1-mood5|symptom1-symptom5;
                                                                             ! L1 WP fixed effect stress->symptoms
! Variable with level-2 ID info
                                                                               symptom1-symptom5 PON stress1-stress5 (WPXtoY);
  IDVARIABLE = PersonID;
                                                                             ! L1 WP fixed effect mood->symptoms
! Old level-1 identifier
                                                                               symptom1-symptom5 PON mood1-mood5 (WPMtoY);
 REPETITION = session (2 \ 3 \ 4 \ 5 \ 6);
                                                                             ! Getting BP total fixed effects and all indirect effects
VARIABLE:
                                                                             MODEL CONSTRAINT:
! List of ALL variables in stacked data file, in order
                                                                             NEW (BPXtoM BPXtoY BPMtoY WPind Conind BPind);
! Mplus does NOT know what they used to be called, though
                                                                             ! BP effects:
 NAMES = PersonID women age80 session symptom mood PMmood2
                                                                               BPXtoM = WPXtoM + conXtoM; ! BP effect stress->mood
          stress PMstr40;
                                                                               BPXtoY = WPXtoY + conXtoY; ! BP effect stress->symptoms
! List of ALL variables used in model (DEFINED variables at end)
                                                                               BPMtoY = WPMtoY + conMtoY; ! BP effect of mood->symptoms
 USEVARIABLES = women age80 stress1-stress5 mood1-mood5
                                                                             ! Indirect effects;
                 symptom1-symptom5 agesex;
                                                                               WPind = WPXtoM*WPMtoY:
                                                                                                           ! WP indirect effect
! Missing data codes (here, -999)
                                                                               Conind = conXtoM*conMtoY; ! Contextual indirect effect
 MISSING = ALL (-999);
                                                                               BPind = BPXtoM*BPMtoY;
                                                                                                           I BP indirect effect
! Identify stress as binary outcome
 CATEGORICAL = stress1-stress5;
                                                                             Note: We are again using MODEL CONSTRAINT to calculate the
DEFINE:
           agesex = age80*women; ! Create observed level-2 interaction
                                                                            indirect effects ourselves. Further, although one can get bootstrapped p-
ANALYSIS: ESTIMATOR = ML; MODEL = NOCOVARIANCES;
           INTEGRATION = MONTECARLO(1000);
                                                                            values and confidence intervals for single-level mediation models, they are
                                                                             not available for multilevel mediation models. That means the p-values
MODEL: ! X = stress, M = mood, Y = symptoms
                                                                             from the indirect effects may be a little suspect, and other methods of
! All variable thresholds and intercepts fixed to 0
 [stress1$1-stress5$1@0 mood1-mood5@0 symptom1-symptom5@0];
                                                                             assessing significance may be needed for "best practice" (see Kris
                    (Mresvar); ! L1 R: M residual variances held equal
 mood1-mood5
                                                                             Preacher's website for online tools for bootstrapping parameter estimates).
 symptom1-symptom5 (Yresvar);
                                ! L1 R: Y residual variances held equal
! Define L2 intercept latent factors for each
 FXint BY stress1-stress501:
                                                                            Mplus SEM Results:
 FMint BY mood1-mood5@1;
 FYint BY symptom1-symptom5@1;
! Fixed intercepts estimated
                                                                             Number of Free Parameters
                                                                                                                              20
  [FXint FMint FYint];
! L2 G: Random intercept variances estimated
                                                                             Loglikelihood
 FXint FMint FYint:
                                                                                       H0 Value
                                                                                                                       -1180.753
! L2 fixed effects of age and sex
                                                                             Information Criteria
  FYint FMint ON women; ! BP fixed effects women->mood, symptoms
                                                                                       Akaike (AIC)
                                                                                                                       2401.505
 FYint FMint ON age80; ! BP fixed effects age->mood, symptoms
                                                                                                                       2454.585
                                                                                       Bayesian (BIC)
 FYint FMint ON agesex; ! BP fixed effects age*women
                                                                                       Sample-Size Adjusted BIC
                                                                                                                       2391,401
                                                                                         (n^* = (n + 2) / 24)
```

		few minutes la	ter): Diff	erent effect	s are in bold	Means	0.250	0 1 0 4	1 210	0 107	
2 new effect	ts are	underlined				FXINT	-0.256	0.194	-1.319	0.187	
						Intercepts					
					Two-Tailed	Intercepts fixed	d to O are omi	tted			
		Estimate	S.E.	Est./S.E.	P-Value	FMINT	-0.863	0.050	-17.096	0.000	
						FYINT	3.221	0.558	5.769	0.000	
actor load	ings f	fixed to 1 are	omitted								
FMINT	ON					Thresholds	0 000	0 000	000 000	999.000	
FXINT	014	0.038	0.021	1.798	0.072	STRESS1\$1	0.000	0.000	999.000		
FAINT		0.030	0.021	1.190	0.072	STRESS2\$1	0.000	0.000	999.000	999.000	
						STRESS3\$1	0.000	0.000	999.000	999.000	
FYINT	ON					STRESS4\$1	0.000	0.000	999.000	999.000	
FXINT		0.264	0.088	3.005	0.003 context	STRESS5\$1	0.000	0.000	999.000	999.000	
FMINT		1.597	0.637	2.506	0.012						
FYINT	ON					Variances	0 500	0 700	2 600	0 000	
WOMEN	014	-0.519	0.210	-2.476	0.013	FXINT	2.599	0.720	3.608	0.000	
		0.072	0.210	-2.476 2.201	0.013	Residual Variance					
AGE80						MOOD1	0.089	0.006	14.151	0.000	
AGESEX		-0.096	0.036	-2.635	0.008	MOOD2	0.089	0.006	14.151	0.000	
						MOOD3	0.089	0.006	14.151	0.000	
FMINT	ON					MOOD4	0.089	0.006	14.151	0.000	
WOMEN		0.010	0.054	0.192	0.848	MOOD5	0.089	0.006	14.151	0.000	
AGE80		0.013	0.008	1.614	0.106	SYMPTOM1	0.612	0.043	14.184	0.000	
AGESEX		-0.006	0.009	-0.620	0.536	SYMPTOM2	0.612	0.043	14.184	0.000	
						SYMPTOM3	0.612	0.043	14.184	0.000	
MOOD1	ON					SYMPTOM4	0.612	0.043	14.184	0.000	
STRESS1	011	0.156	0.036	4.277	0.000 x> m						
MOOD2	ON	0.100	0.000	7.277	0.000 A > A	SYMPTOM5	0.612	0.043	14.184	0.000	
STRESS2		0.156	0.036	4.277	0.000	FMINT	0.038	0.008	4.559	0.000	
MOOD3	ON	0.130	0.050	4.2//	0.000	FYINT	0.637	0.128	4.970	0.000	
STRESS3		0.156	0 0 2 6	4.277	0.000						
		0.130	0.036	4.2//	0.000	New/Additional Par					
MOOD4	ON					BPXTOM	0.194	0.033	5.942	0.000	
STRESS4		0.156	0.036	4.277	0.000	BPXTOY	0.356	0.110	3.231	0.001	
MOOD5	ON					BPMTOY	1.738	0.609	2.854	0.004	
STRESS5		0.156	0.036	4.277	0.000						
						WPIND	0.022	0.021	1.044	0.297	
SYMPTOM1	ON					CONIND	0.061	0.038	1.606	0.108	
STRESS1		0.093	0.097	0.955	0.340 X> Y	BPIND	0.337	0.129	2.615	0.009	
MOOD1		0.141	0.131	1.077	0.282 M> Y						
SYMPTOM2	ON					Previous results fi	rom MLM tre	ating stres	s as observe	ed:	
STRESS2		0.093	0.097	0.955	0.340	Means		uning stites			
MOOD2		0.141	0.131	1.077	0.282		0 1 0 0	0 020	1 100	0.000	
SYMPTOM3	ON					WPXTOM	0.162	0.036	4.486	0.000	
STRESS3		0.093	0.097	0.955	0.340	WPXTOY	0.085	0.097	0.872	0.383	
MOOD3		0.141	0.131	1.077	0.282	WPMTOY	0.141	0.131	1.077	0.281	
SYMPTOM4	ON										
STRESS4		0.093	0.097	0.955	0.340	New/Additional Par					
MOOD4		0.141	0.131	1.077	0.282	BPXTOM	0.286	0.070	4.063	0.000	
SYMPTOM5	ON	0.1.11	0.101			BPXTOY	1.175	0.289	4.067	0.000	
SIMPIOMS STRESS5		0.093	0.097	0.955	0.340	BPMTOY	1.993	0.576	3.459	0.001	
		0.141	0.097	1.077	0.282						
MOOD5		0.141	0.131	1.0//	0.202	WPIND	0.023	0.022	1.048	0.295	
						CONIND	0.229	0.164	1.393	0.164	
						BPIND	0.570	0.217	2.630	0.009	