Supplemental Material for
A Bayesian Approach to More Stable Estimates of Group-Level Effects in Contextual Studies
(published in Multivariate Behavioral Research)

Steffen Zitzmann and Oliver Lüdtke
Leibniz Institute for Science and Mathematics Education

Alexander Robitzsch
Federal Institute for Education Research, Innovation, and Development of the Austrian School
System

Author Note

Correspondence concerning this material should be addressed to Steffen Zitzmann, Leibniz
Institute for Science and Mathematics Education, 24118 Kiel, Germany. E-mail:
zitzmann@ipn.uni-kiel.de

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This material provides (a) further results of the simulation study and (b) the computer code used in the illustrative example. Tables S1 and S2 compare the maximum likelihood (ML) estimator with the Bayesian maximum a posteriori (MAP) estimators of the group-level effect with respect to the relative bias and the relative root mean squared error (RMSE) for the conditions that are not included in the tables of the manuscript. Table S3 compares the confidence interval (CI) with the Bayesian credible interval (BCI) with respect to the coverage rate for these conditions. Tables S4 and S5 compare the ML estimator of the individual-level effect with the MAP estimators of this effect for all conditions in the simulation study. Table S6 compares the CI with the BCI for these conditions. Tables S7 to S14 compare the ML estimator with the Bayesian expected a posteriori and the Bayesian posterior median estimators for the group-level and the individual-level effect. Table S15 compares the characteristics of the estimators' sampling distributions.

Table S1
Further Simulation Study Results: Relative Bias in Estimating the Group-Level Effect for the Maximum Likelihood and the Bayesian Maximum a Posteriori Estimators

Number of groups	Estimator	Intraclass correlation of the predictor variable								
		ICC _X = .05			ICC _X = .1			ICC _X = .2		
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 25	ML	-0.01	0.23	0.17	0.13	0.12	0.05	0.04	0.02	0.01
	$\tau_X^2 \sim \text{IG}(.001, .001)$	-0.27	-0.03	0.07	-0.10	0.03	0.03	-0.05	0.00	0.01
	$\tau_X^2 \sim \text{IG}(.01, .01)$	-0.32	-0.10	0.01	-0.15	0.00	0.02	-0.06	-0.01	0.01
	$\tau_X^2 \sim \text{IG}(.1, .1)$	-0.39	-0.22	-0.11	-0.22	-0.08	-0.02	-0.10	-0.03	0.00
	$\tau_X^2 \sim \text{U}(0, 100)$	-0.40	-0.18	-0.06	-0.23	-0.08	-0.01	-0.13	-0.04	-0.01
	$\tau_X^2 \sim \text{U}(0, 25)$	-0.39	-0.19	-0.06	-0.23	-0.07	-0.01	-0.13	-0.04	-0.01
	$\tau_X^2 \sim \text{U}(0, 4)$	-0.39	-0.18	-0.07	-0.24	-0.07	-0.01	-0.13	-0.04	-0.01
	$\tau_X \sim \text{HC}(100)$	-0.33	-0.09	0.02	-0.16	-0.02	0.01	-0.08	-0.02	0.00
	$\tau_X \sim \text{HC}(25)$	-0.33	-0.09	0.01	-0.17	-0.01	0.02	-0.08	-0.02	0.00
	$\tau_X \sim \text{HC}(5)$	-0.33	-0.10	0.02	-0.16	-0.01	0.01	-0.08	-0.02	0.00
	$\tau_X \sim \text{U}(0, 10)$	-0.33	-0.09	0.03	-0.16	-0.02	0.01	-0.08	-0.02	0.00
	$\tau_X \sim \text{U}(0, 5)$	-0.33	-0.09	0.01	-0.16	-0.02	0.01	-0.08	-0.02	0.00
	$\tau_X \sim \text{U}(0, 2)$	-0.32	-0.10	0.01	-0.17	-0.02	0.01	-0.08	-0.02	0.00
<i>J</i> = 100	ML	0.24	0.09	0.01	0.07	0.01	0.00	0.02	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.001, .001)$	0.09	0.09	0.00	0.05	0.00	0.00	0.00	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.01, .01)$	-0.05	0.02	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.1, .1)$	-0.22	-0.10	-0.05	-0.07	-0.03	-0.01	-0.01	0.01	0.00
	$\tau_X^2 \sim \text{U}(0, 100)$	-0.15	-0.03	-0.03	-0.06	-0.02	-0.01	-0.02	0.00	0.00
	$\tau_X^2 \sim \text{U}(0, 25)$	-0.16	-0.04	-0.03	-0.06	-0.02	-0.01	-0.02	0.00	0.00
	$\tau_X^2 \sim \text{U}(0, 4)$	-0.15	-0.04	-0.02	-0.06	-0.03	-0.01	-0.02	0.00	0.00
	$\tau_X \sim \text{HC}(100)$	0.01	0.04	-0.01	0.01	-0.01	-0.01	-0.01	0.01	0.00
	$\tau_X \sim \text{HC}(25)$	0.01	0.05	-0.01	0.01	-0.01	-0.01	-0.01	0.01	0.00
	$\tau_X \sim \text{HC}(5)$	0.01	0.04	-0.01	0.01	-0.01	-0.01	-0.01	0.01	0.00
	$\tau_X \sim \text{U}(0, 10)$	0.01	0.06	-0.01	0.01	-0.01	-0.01	-0.01	0.01	0.00
	$\tau_X \sim \text{U}(0, 5)$	0.02	0.05	-0.01	0.01	-0.01	-0.01	-0.01	0.00	0.00
	$\tau_X \sim \text{U}(0, 2)$	0.02	0.06	-0.01	0.02	-0.01	-0.01	-0.01	0.01	0.00

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S2
Further Simulation Study Results: Relative Root Mean Squared Error in Estimating the Group-Level Effect for the Maximum Likelihood and the Bayesian Maximum a Posteriori Estimators

Number of groups	Estimator	Intraclass correlation of the predictor variable								
		ICC _X = .05			ICC _X = .1			ICC _X = .2		
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 25	ML	1.95	1.68	1.15	1.17	0.79	0.54	0.55	0.36	0.27
	$\tau_X^2 \sim \text{IG}(.001, .001)$	1.02	1.03	0.92	0.74	0.66	0.52	0.46	0.33	0.27
	$\tau_X^2 \sim \text{IG}(.01, .01)$	0.90	0.90	0.83	0.67	0.61	0.51	0.43	0.33	0.27
	$\tau_X^2 \sim \text{IG}(.1, .1)$	0.77	0.72	0.67	0.59	0.53	0.47	0.41	0.32	0.27
	$\tau_X^2 \sim \text{U}(0, 100)$	0.79	0.78	0.74	0.59	0.55	0.48	0.40	0.32	0.27
	$\tau_X^2 \sim \text{U}(0, 25)$	0.79	0.78	0.75	0.59	0.55	0.47	0.40	0.32	0.26
	$\tau_X^2 \sim \text{U}(0, 4)$	0.79	0.79	0.74	0.60	0.55	0.47	0.40	0.32	0.27
	$\tau_X \sim \text{HC}(100)$	0.91	0.93	0.85	0.67	0.62	0.50	0.44	0.33	0.27
	$\tau_X \sim \text{HC}(25)$	0.91	0.93	0.85	0.67	0.60	0.49	0.44	0.33	0.27
	$\tau_X \sim \text{HC}(5)$	0.91	0.93	0.86	0.67	0.61	0.50	0.43	0.33	0.27
	$\tau_X \sim \text{U}(0, 10)$	0.90	0.94	0.86	0.67	0.60	0.50	0.44	0.33	0.27
	$\tau_X \sim \text{U}(0, 5)$	0.90	0.93	0.85	0.66	0.61	0.50	0.43	0.32	0.27
	$\tau_X \sim \text{U}(0, 2)$	0.90	0.93	0.86	0.67	0.60	0.50	0.43	0.33	0.27
<i>J</i> = 100	ML	1.27	0.64	0.40	0.54	0.32	0.23	0.24	0.16	0.13
	$\tau_X^2 \sim \text{IG}(.001, .001)$	0.98	0.63	0.40	0.51	0.31	0.23	0.23	0.16	0.13
	$\tau_X^2 \sim \text{IG}(.01, .01)$	0.77	0.55	0.40	0.46	0.31	0.23	0.23	0.16	0.13
	$\tau_X^2 \sim \text{IG}(.1, .1)$	0.60	0.45	0.37	0.40	0.30	0.23	0.23	0.16	0.13
	$\tau_X^2 \sim \text{U}(0, 100)$	0.68	0.51	0.39	0.42	0.30	0.22	0.22	0.16	0.13
	$\tau_X^2 \sim \text{U}(0, 25)$	0.67	0.51	0.38	0.41	0.30	0.22	0.22	0.16	0.13
	$\tau_X^2 \sim \text{U}(0, 4)$	0.67	0.50	0.39	0.42	0.30	0.23	0.22	0.16	0.13
	$\tau_X \sim \text{HC}(100)$	0.87	0.59	0.40	0.47	0.31	0.22	0.23	0.16	0.13
	$\tau_X \sim \text{HC}(25)$	0.88	0.59	0.40	0.47	0.31	0.23	0.23	0.16	0.13
	$\tau_X \sim \text{HC}(5)$	0.88	0.59	0.39	0.47	0.31	0.23	0.23	0.16	0.13
	$\tau_X \sim \text{U}(0, 10)$	0.89	0.60	0.40	0.48	0.31	0.23	0.23	0.16	0.13
	$\tau_X \sim \text{U}(0, 5)$	0.91	0.60	0.40	0.47	0.31	0.23	0.23	0.16	0.13
	$\tau_X \sim \text{U}(0, 2)$	0.90	0.59	0.40	0.48	0.31	0.23	0.23	0.16	0.13

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S3
Further Simulation Study Results: Coverage Rate in Estimating the Group-Level Effect for the 95% Confidence Interval and the 95% Bayesian Credible Interval

Number of groups	Estimator	Intraclass correlation of the predictor variable							
		ICC _X = .05			ICC _X = .1			ICC _X = .2	
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10
<i>J</i> = 25	ML	89.1	91.88	93.4	90.9	92.0	91.5	91.1	92.9
	$\tau_X^2 \sim \text{IG}(.001, .001)$	100.0	99.6	98.1	99.4	98.7	96.2	99.2	97.6
	$\tau_X^2 \sim \text{IG}(.01, .01)$	99.6	99.0	97.0	99.2	98.5	95.7	99.0	97.2
	$\tau_X^2 \sim \text{IG}(.1, .1)$	98.1	97.1	96.2	98.2	97.2	96.3	98.5	97.0
	$\tau_X^2 \sim \text{U}(0, 100)$	99.3	98.6	96.6	98.7	97.5	96.2	98.4	96.9
	$\tau_X^2 \sim \text{U}(0, 25)$	99.3	98.5	96.6	98.7	97.6	96.1	98.5	97.1
	$\tau_X^2 \sim \text{U}(0, 4)$	99.1	98.6	96.8	98.6	97.9	96.2	98.5	96.9
	$\tau_X \sim \text{HC}(100)$	100.0	99.5	97.8	99.4	98.7	96.4	99.2	97.2
	$\tau_X \sim \text{HC}(25)$	99.9	99.5	97.9	99.3	98.8	96.0	99.1	97.2
	$\tau_X \sim \text{HC}(5)$	100.0	99.7	97.6	99.4	98.5	96.3	99.3	97.2
	$\tau_X \sim \text{U}(0, 10)$	100.0	99.3	97.7	99.3	98.6	96.4	99.1	97.2
	$\tau_X \sim \text{U}(0, 5)$	99.9	99.5	97.4	99.3	98.4	96.3	99.3	97.2
	$\tau_X \sim \text{U}(0, 2)$	100.0	99.4	97.8	99.3	98.4	95.8	99.2	97.2
<i>J</i> = 100	ML	94.8	96.9	95.9	94.4	94.1	94.3	95.2	94.8
	$\tau_X^2 \sim \text{IG}(.001, .001)$	99.1	95.6	95.9	96.8	93.6	95.5	96.0	95.6
	$\tau_X^2 \sim \text{IG}(.01, .01)$	98.1	95.2	96.1	96.0	94.9	95.0	96.0	95.6
	$\tau_X^2 \sim \text{IG}(.1, .1)$	95.7	95.4	95.8	95.2	94.6	95.0	96.0	95.7
	$\tau_X^2 \sim \text{U}(0, 100)$	98.0	96.2	95.9	95.9	94.5	95.2	96.1	95.7
	$\tau_X^2 \sim \text{U}(0, 25)$	98.1	96.0	95.5	96.1	94.1	95.4	96.1	95.7
	$\tau_X^2 \sim \text{U}(0, 4)$	98.0	96.3	95.7	95.5	94.6	95.1	96.0	95.9
	$\tau_X \sim \text{HC}(100)$	99.3	96.5	95.8	97.0	94.5	95.1	96.2	95.6
	$\tau_X \sim \text{HC}(25)$	99.1	96.7	96.4	96.8	94.2	95.3	96.3	95.7
	$\tau_X \sim \text{HC}(5)$	98.9	96.4	95.9	96.5	94.1	95.4	96.3	96.0
	$\tau_X \sim \text{U}(0, 10)$	98.9	96.1	96.3	96.4	94.5	95.1	96.2	95.6
	$\tau_X \sim \text{U}(0, 5)$	99.2	96.5	96.5	96.3	94.2	95.0	96.1	95.6
	$\tau_X \sim \text{U}(0, 2)$	99.0	96.1	96.1	96.6	94.4	94.9	95.9	95.7

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S4
Simulation Study Results: Relative Bias in Estimating the Individual-Level Effect for the Maximum Likelihood and the Bayesian Maximum a Posteriori Estimators

		Intraclass correlation of the predictor variable								
		ICC _X = .05			ICC _X = .1			ICC _X = .2		
Number of groups	Estimator	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 25	ML	0.00	0.00	0.00	0.02	0.00	-0.01	0.01	0.00	0.01
	$\tau_X^2 \sim \text{IG}(.001, .001)$	0.03	0.02	0.01	0.08	0.01	-0.01	0.07	0.01	0.01
	$\tau_X^2 \sim \text{IG}(.01, .01)$	0.02	0.01	0.00	0.06	0.01	-0.01	0.05	0.01	0.01
	$\tau_X^2 \sim \text{IG}(.1, .1)$	0.01	0.01	0.00	0.04	0.00	-0.01	0.03	0.01	0.01
	$\tau_X^2 \sim \text{U}(0, 100)$	0.01	0.01	0.00	0.05	0.00	-0.01	0.03	0.01	0.01
	$\tau_X^2 \sim \text{U}(0, 25)$	0.02	0.01	0.01	0.05	0.00	-0.01	0.04	0.01	0.01
	$\tau_X^2 \sim \text{U}(0, 4)$	0.01	0.01	0.00	0.05	0.00	-0.01	0.03	0.01	0.00
	$\tau_X \sim \text{HC}(100)$	0.03	0.02	0.01	0.07	0.01	-0.01	0.06	0.01	0.01
	$\tau_X \sim \text{HC}(25)$	0.03	0.02	0.01	0.07	0.01	-0.01	0.06	0.01	0.01
	$\tau_X \sim \text{HC}(5)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01
	$\tau_X \sim \text{U}(0, 10)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01
	$\tau_X \sim \text{U}(0, 5)$	0.03	0.02	0.01	0.07	0.01	-0.01	0.06	0.01	0.01
	$\tau_X \sim \text{U}(0, 2)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01
<i>J</i> = 50	ML	0.01	0.01	0.00	0.02	0.01	0.00	-0.01	0.00	0.01
	$\tau_X^2 \sim \text{IG}(.001, .001)$	0.04	0.01	0.00	0.06	0.01	0.00	0.03	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.01, .01)$	0.02	0.01	0.00	0.04	0.01	0.00	0.02	0.01	0.01
	$\tau_X^2 \sim \text{IG}(.1, .1)$	0.01	0.01	0.00	0.03	0.01	0.00	0.01	0.01	0.01
	$\tau_X^2 \sim \text{U}(0, 100)$	0.02	0.01	0.00	0.04	0.01	0.00	0.01	0.01	0.01
	$\tau_X^2 \sim \text{U}(0, 25)$	0.02	0.01	0.00	0.04	0.01	0.00	0.01	0.01	0.01
	$\tau_X^2 \sim \text{U}(0, 4)$	0.02	0.01	0.00	0.04	0.01	0.00	0.01	0.01	0.01
	$\tau_X \sim \text{HC}(100)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01
	$\tau_X \sim \text{HC}(25)$	0.04	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.00
	$\tau_X \sim \text{HC}(5)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01
	$\tau_X \sim \text{U}(0, 10)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01
	$\tau_X \sim \text{U}(0, 5)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01
	$\tau_X \sim \text{U}(0, 2)$	0.03	0.01	0.00	0.06	0.01	-0.01	0.02	0.01	0.01

Table S4 continues

Table S4 continued

		Intraclass correlation of the predictor variable								
		ICC _X = .05			ICC _X = .1			ICC _X = .2		
Number of groups	Estimator	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 100	ML	-0.01	0.00	0.00	0.00	0.00	0.00	-0.01	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.02	0.00	0.00	0.03	0.00	0.00	0.00	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
	$\tau_X^2 \sim \text{IG}(.1,.1)$	-0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	$\tau_X^2 \sim \text{U}(0,100)$	0.00	0.00	0.00	0.01	0.00	0.00	-0.01	0.01	0.00
	$\tau_X^2 \sim \text{U}(0,25)$	0.00	0.00	0.00	0.01	0.00	0.00	-0.01	0.01	0.00
	$\tau_X^2 \sim \text{U}(0,4)$	0.00	0.00	0.00	0.01	0.00	0.00	-0.01	0.01	0.00
	$\tau_X \sim \text{HC}(100)$	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00
	$\tau_X \sim \text{HC}(25)$	0.02	0.00	0.00	0.02	0.00	0.00	-0.01	0.01	0.00
	$\tau_X \sim \text{HC}(5)$	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
	$\tau_X \sim \text{U}(0,10)$	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00
	$\tau_X \sim \text{U}(0,5)$	0.02	0.00	0.00	0.02	0.00	0.00	-0.01	0.01	0.00
	$\tau_X \sim \text{U}(0,2)$	0.02	0.00	0.00	0.02	0.00	0.00	-0.01	0.00	0.00
<i>J</i> = 200	ML	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	$\tau_X^2 \sim \text{U}(0,100)$	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	$\tau_X^2 \sim \text{U}(0,25)$	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
	$\tau_X^2 \sim \text{U}(0,4)$	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	$\tau_X \sim \text{HC}(100)$	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	$\tau_X \sim \text{HC}(25)$	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	$\tau_X \sim \text{HC}(5)$	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	$\tau_X \sim \text{U}(0,10)$	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	$\tau_X \sim \text{U}(0,5)$	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00
	$\tau_X \sim \text{U}(0,2)$	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S5
Simulation Study Results: Relative Root Mean Squared Error in Estimating the Individual-Level Effect for the Maximum Likelihood and the Bayesian Maximum a Posteriori Estimators

Number of groups	Estimator	Intraclass correlation of the predictor variable							
		ICC _X = .05				ICC _X = .1			
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	
<i>J</i> = 25	ML	0.40	0.26	0.19	0.40	0.28	0.20	0.44	0.29
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.40	0.26	0.19	0.40	0.28	0.20	0.43	0.29
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.40	0.26	0.19	0.40	0.28	0.20	0.44	0.29
	$\tau_X^2 \sim \text{U}(0,100)$	0.40	0.26	0.19	0.40	0.28	0.20	0.44	0.29
	$\tau_X^2 \sim \text{U}(0,25)$	0.40	0.26	0.19	0.40	0.28	0.20	0.44	0.29
	$\tau_X^2 \sim \text{U}(0,4)$	0.40	0.26	0.19	0.40	0.28	0.20	0.44	0.29
	$\tau_X \sim \text{HC}(100)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29
	$\tau_X \sim \text{HC}(25)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29
	$\tau_X \sim \text{HC}(5)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29
	$\tau_X \sim \text{U}(0,10)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29
	$\tau_X \sim \text{U}(0,5)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29
	$\tau_X \sim \text{U}(0,2)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29
<i>J</i> = 50	ML	0.28	0.19	0.13	0.28	0.20	0.13	0.32	0.21
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.27	0.19	0.13	0.28	0.20	0.13	0.31	0.21
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.27	0.19	0.13	0.28	0.20	0.13	0.31	0.21
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.28	0.19	0.13	0.28	0.20	0.13	0.31	0.20
	$\tau_X^2 \sim \text{U}(0,100)$	0.27	0.19	0.13	0.28	0.20	0.13	0.31	0.21
	$\tau_X^2 \sim \text{U}(0,25)$	0.27	0.19	0.13	0.28	0.20	0.13	0.31	0.21
	$\tau_X^2 \sim \text{U}(0,4)$	0.27	0.19	0.13	0.28	0.20	0.13	0.31	0.21
	$\tau_X \sim \text{HC}(100)$	0.27	0.19	0.13	0.28	0.20	0.13	0.31	0.21
	$\tau_X \sim \text{HC}(25)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20
	$\tau_X \sim \text{HC}(5)$	0.27	0.19	0.14	0.28	0.20	0.13	0.31	0.21
	$\tau_X \sim \text{U}(0,10)$	0.27	0.19	0.13	0.28	0.20	0.14	0.31	0.21
	$\tau_X \sim \text{U}(0,5)$	0.27	0.19	0.13	0.28	0.20	0.13	0.31	0.21
	$\tau_X \sim \text{U}(0,2)$	0.27	0.19	0.14	0.28	0.20	0.13	0.31	0.21

Table S5 continues

Table S5 continued

Intraclass correlation of the predictor variable										
Number of groups	Estimator	ICC _X = .05			ICC _X = .1			ICC _X = .2		
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 100	ML	0.19	0.13	0.09	0.20	0.14	0.09	0.22	0.14	0.10
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X^2 \sim \text{U}(0,100)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X^2 \sim \text{U}(0,25)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X^2 \sim \text{U}(0,4)$	0.19	0.13	0.09	0.20	0.14	0.09	0.22	0.14	0.10
	$\tau_X \sim \text{HC}(100)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.15	0.10
	$\tau_X \sim \text{HC}(100)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X \sim \text{HC}(25)$	0.19	0.13	0.09	0.20	0.14	0.09	0.22	0.14	0.10
	$\tau_X \sim \text{HC}(5)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X \sim \text{U}(0,10)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X \sim \text{U}(0,5)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
$\tau_X \sim \text{U}(0,2)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10	
<i>J</i> = 200	ML	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X^2 \sim \text{U}(0,100)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X^2 \sim \text{U}(0,25)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X^2 \sim \text{U}(0,4)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X \sim \text{HC}(100)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X \sim \text{HC}(25)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X \sim \text{HC}(5)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X \sim \text{U}(0,10)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X \sim \text{U}(0,5)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X \sim \text{U}(0,2)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S6
Simulation Study Results: Coverage Rate in Estimating the Individual-Level Effect for the 95% Confidence Interval and the 95% Bayesian Credible Interval

Intraclass correlation of the predictor variable												
Number of groups	Estimator	ICC _X = .05						ICC _X = .1		ICC _X = .2		
		<i>n</i> = 5			<i>n</i> = 10			<i>n</i> = 5			<i>n</i> = 10	
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20		
<i>J</i> = 25	ML	92.6	92.8	92.5	92.6	91.9	92.4	92.9	93.6	92.0		
	$\tau_X^2 \sim \text{IG}(.001,.001)$	96.0	96.1	94.1	94.5	94.7	93.7	94.2	95.8	94.9		
	$\tau_X^2 \sim \text{IG}(.01,.01)$	96.1	96.3	94.2	95.0	94.8	93.9	94.9	95.9	95.2		
	$\tau_X^2 \sim \text{IG}(.1,.1)$	96.0	95.8	94.4	95.3	95.0	93.9	95.3	96.0	95.1		
	$\tau_X^2 \sim \text{U}(0,100)$	96.1	96.1	94.3	95.3	95.0	94.0	95.2	96.0	95.1		
	$\tau_X^2 \sim \text{U}(0,25)$	96.2	96.2	94.4	95.2	95.1	93.8	95.2	95.9	95.1		
	$\tau_X^2 \sim \text{U}(0,4)$	96.0	96.0	94.3	95.3	95.0	93.6	95.2	95.9	95.1		
	$\tau_X \sim \text{HC}(100)$	95.9	95.9	94.4	94.8	94.9	93.8	94.5	95.9	95.2		
	$\tau_X \sim \text{HC}(25)$	95.8	96.0	94.4	94.6	94.8	93.8	94.7	95.8	94.9		
	$\tau_X \sim \text{HC}(5)$	95.8	95.9	94.3	94.8	94.9	93.8	94.3	95.8	94.9		
	$\tau_X \sim \text{U}(0,10)$	95.9	96.1	94.4	94.7	94.9	93.8	94.7	95.7	95.2		
	$\tau_X \sim \text{U}(0,5)$	95.9	95.8	94.2	94.6	95.0	93.7	94.6	95.8	95.2		
	$\tau_X \sim \text{U}(0,2)$	95.8	96.0	94.3	94.7	94.6	93.9	94.5	95.8	95.1		
<i>J</i> = 50	ML	94.0	95.0	94.5	94.6	94.0	94.7	93.9	93.3	95.5		
	$\tau_X^2 \sim \text{IG}(.001,.001)$	95.3	96.7	95.0	95.9	95.3	95.3	94.8	95.0	96.4		
	$\tau_X^2 \sim \text{IG}(.01,.01)$	95.4	96.7	94.9	96.6	95.5	95.1	95.0	95.1	96.5		
	$\tau_X^2 \sim \text{IG}(.1,.1)$	95.1	96.6	95.0	96.5	95.6	95.4	95.0	95.0	96.5		
	$\tau_X^2 \sim \text{U}(0,100)$	95.3	96.6	94.8	96.5	95.7	95.2	94.6	94.9	96.3		
	$\tau_X^2 \sim \text{U}(0,25)$	95.5	96.6	94.9	96.5	95.7	95.1	94.9	95.0	96.4		
	$\tau_X^2 \sim \text{U}(0,4)$	95.4	96.8	95.2	96.5	95.5	95.3	94.8	95.0	96.6		
	$\tau_X \sim \text{HC}(100)$	95.1	96.4	95.0	96.1	95.4	95.4	95.0	95.0	96.3		
	$\tau_X \sim \text{HC}(25)$	95.1	96.3	95.1	96.1	95.3	95.2	95.0	95.1	96.4		
	$\tau_X \sim \text{HC}(5)$	95.2	96.4	95.2	95.9	95.3	95.3	94.9	95.2	96.6		
	$\tau_X \sim \text{U}(0,10)$	95.1	96.5	95.1	96.0	95.3	95.4	94.9	94.8	96.5		
	$\tau_X \sim \text{U}(0,5)$	95.0	96.7	94.8	96.1	95.5	95.3	94.9	94.9	96.4		
	$\tau_X \sim \text{U}(0,2)$	95.1	96.6	94.9	96.1	95.5	95.3	95.1	95.0	96.6		

Table S6 continues

Table S6 continued

Number of groups	Estimator	Intraclass correlation of the predictor variable								
		ICC _X = .05			ICC _X = .1			ICC _X = .2		
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 100	ML	95.3	94.3	94.9	95.3	94.5	95.7	95.4	95.2	95.7
	$\tau_X^2 \sim \text{IG}(.001, .001)$	95.7	94.6	95.0	95.9	94.7	95.8	95.7	95.8	96.2
	$\tau_X^2 \sim \text{IG}(.01, .01)$	95.5	94.7	95.1	96.0	95.0	96.0	95.7	95.9	96.1
	$\tau_X^2 \sim \text{IG}(.1, .1)$	95.4	94.9	95.1	96.0	94.7	95.7	95.6	95.8	96.1
	$\tau_X^2 \sim \text{U}(0, 100)$	95.5	94.8	95.1	96.0	94.7	95.8	95.6	95.7	96.1
	$\tau_X^2 \sim \text{U}(0, 25)$	95.4	94.8	94.7	96.1	95.0	95.7	95.5	95.7	96.0
	$\tau_X^2 \sim \text{U}(0, 4)$	95.4	94.7	95.4	96.0	94.8	95.9	95.5	95.8	96.2
	$\tau_X \sim \text{HC}(100)$	95.7	94.8	95.1	95.8	95.0	95.9	95.8	95.9	96.2
	$\tau_X \sim \text{HC}(25)$	95.9	94.8	95.3	95.7	94.5	95.6	95.8	95.9	96.1
	$\tau_X \sim \text{HC}(5)$	95.6	94.8	95.1	95.7	94.9	96.0	95.9	95.7	96.1
	$\tau_X \sim \text{U}(0, 10)$	95.5	94.8	95.1	95.8	94.5	95.7	95.7	96.0	96.0
	$\tau_X \sim \text{U}(0, 5)$	95.8	95.0	95.4	95.7	94.9	96.0	95.8	95.8	96.0
	$\tau_X \sim \text{U}(0, 2)$	95.4	95.1	95.0	95.8	94.8	95.8	95.6	96.0	96.1
<i>J</i> = 200	ML	94.3	95.9	95.0	95.9	93.8	95.2	94.3	95.5	94.7
	$\tau_X^2 \sim \text{IG}(.001, .001)$	94.8	95.7	95.7	96.3	93.9	94.8	94.9	95.8	95.4
	$\tau_X^2 \sim \text{IG}(.01, .01)$	94.8	96.0	95.1	96.6	94.0	94.4	94.6	96.2	95.0
	$\tau_X^2 \sim \text{IG}(.1, .1)$	94.7	96.1	95.5	96.5	94.0	94.8	94.6	95.9	95.2
	$\tau_X^2 \sim \text{U}(0, 100)$	95.3	96.1	95.3	96.4	93.8	94.9	94.5	95.7	95.0
	$\tau_X^2 \sim \text{U}(0, 25)$	94.8	96.0	95.6	96.4	93.8	94.7	94.6	96.0	95.1
	$\tau_X^2 \sim \text{U}(0, 4)$	94.6	96.1	95.6	96.5	93.8	95.1	94.7	95.7	94.6
	$\tau_X \sim \text{HC}(100)$	94.7	96.0	95.7	96.2	94.1	95.1	94.7	95.9	95.1
	$\tau_X \sim \text{HC}(25)$	94.7	95.7	95.6	96.4	94.0	94.8	94.5	96.0	94.9
	$\tau_X \sim \text{HC}(5)$	94.5	96.0	95.5	96.3	93.9	94.9	94.4	95.8	95.5
	$\tau_X \sim \text{U}(0, 10)$	94.5	96.0	95.9	96.4	93.8	94.8	94.7	96.0	95.2
	$\tau_X \sim \text{U}(0, 5)$	94.6	96.1	95.4	96.3	93.8	94.7	94.9	95.8	95.3
	$\tau_X \sim \text{U}(0, 2)$	94.5	96.2	95.5	96.5	94.0	94.5	94.5	95.7	94.8

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S7
Simulation Study Results: Relative Bias in Estimating the Group-Level Effect for the Maximum Likelihood and the Bayesian Expected a Posteriori Estimators

Intraclass correlation of the predictor variable										
Number of groups	Estimator	ICC _X = .05			ICC _X = .1			ICC _X = .2		
		n = 5	n = 10	n = 20	n = 5	n = 10	n = 20	n = 5	n = 10	n = 20
J = 25	ML	-0.01	0.23	0.17	0.13	0.12	0.05	0.04	0.02	0.01
	$\tau_X^2 \sim \text{IG}(.001,.001)$	-0.11	0.37	0.54	0.23	0.49	0.19	0.28	0.11	0.02
	$\tau_X^2 \sim \text{IG}(.01,.01)$	-0.23	0.10	0.21	0.04	0.23	0.12	0.13	0.07	0.02
	$\tau_X^2 \sim \text{IG}(.1,.1)$	-0.37	-0.17	-0.06	-0.16	-0.01	0.02	-0.03	0.01	0.01
	$\tau_X^2 \sim \text{U}(0,100)$	-0.26	0.02	0.16	-0.08	0.09	0.06	-0.01	0.01	0.00
	$\tau_X^2 \sim \text{U}(0,25)$	-0.30	0.04	0.16	-0.09	0.11	0.06	-0.02	0.01	0.00
	$\tau_X^2 \sim \text{U}(0,4)$	-0.30	0.01	0.15	-0.08	0.12	0.06	0.00	0.01	0.00
	$\tau_X \sim \text{HC}(100)$	-0.26	0.24	0.40	0.01	0.27	0.13	0.10	0.04	0.01
	$\tau_X \sim \text{HC}(25)$	-0.22	0.11	0.31	0.12	0.27	0.12	0.13	0.06	0.01
	$\tau_X \sim \text{HC}(5)$	-0.21	0.16	0.41	-0.02	0.32	0.12	0.07	0.05	0.01
	$\tau_X \sim \text{U}(0,10)$	-0.25	0.15	0.38	0.01	0.35	0.13	0.10	0.05	0.01
	$\tau_X \sim \text{U}(0,5)$	-0.19	0.14	0.45	0.09	0.28	0.12	0.15	0.05	0.01
	$\tau_X \sim \text{U}(0,2)$	-0.24	0.24	0.38	0.02	0.31	0.13	0.10	0.05	0.01
J = 50	ML	0.12	0.18	0.08	0.10	0.07	0.02	0.04	0.01	0.01
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.24	0.80	0.42	0.52	0.39	0.05	0.21	0.04	0.02
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.02	0.30	0.20	0.22	0.22	0.05	0.14	0.03	0.02
	$\tau_X^2 \sim \text{IG}(.1,.1)$	-0.25	-0.07	-0.01	-0.06	0.05	0.02	0.04	0.02	0.01
	$\tau_X^2 \sim \text{U}(0,100)$	-0.08	0.28	0.15	0.09	0.13	0.02	0.05	0.01	0.01
	$\tau_X^2 \sim \text{U}(0,25)$	-0.07	0.23	0.16	0.08	0.13	0.02	0.05	0.01	0.01
	$\tau_X^2 \sim \text{U}(0,4)$	-0.07	0.29	0.16	0.10	0.13	0.02	0.05	0.01	0.01
	$\tau_X \sim \text{HC}(100)$	0.03	0.59	0.31	0.27	0.25	0.04	0.11	0.02	0.01
	$\tau_X \sim \text{HC}(25)$	0.13	0.44	0.28	0.37	0.28	0.04	0.13	0.02	0.01
	$\tau_X \sim \text{HC}(5)$	0.09	0.45	0.31	0.30	0.26	0.04	0.13	0.02	0.01
	$\tau_X \sim \text{U}(0,10)$	0.02	0.60	0.25	0.30	0.25	0.04	0.12	0.02	0.01
	$\tau_X \sim \text{U}(0,5)$	-0.06	0.41	0.33	0.30	0.24	0.04	0.12	0.02	0.01
	$\tau_X \sim \text{U}(0,2)$	-0.05	0.49	0.27	0.28	0.24	0.04	0.12	0.02	0.01

Table S7 continues

Table S7 continued

		Intraclass correlation of the predictor variable								
Number of groups	Estimator	ICC _X = .05			ICC _X = .1			ICC _X = .2		
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 100	ML	0.24	0.09	0.01	0.07	0.01	0.00	0.02	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.81	0.81	0.09	0.68	0.10	0.01	0.06	0.02	0.01
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.31	0.34	0.06	0.33	0.07	0.01	0.06	0.02	0.01
	$\tau_X^2 \sim \text{IG}(.1,.1)$	-0.11	-0.01	-0.02	0.04	0.02	0.00	0.03	0.02	0.00
	$\tau_X^2 \sim \text{U}(0,100)$	0.30	0.31	0.04	0.17	0.03	0.00	0.02	0.01	0.00
	$\tau_X^2 \sim \text{U}(0,25)$	0.23	0.32	0.03	0.18	0.03	0.00	0.02	0.01	0.00
	$\tau_X^2 \sim \text{U}(0,4)$	0.28	0.32	0.04	0.18	0.03	0.00	0.02	0.01	0.00
	$\tau_X \sim \text{HC}(100)$	0.44	0.66	0.07	0.55	0.06	0.00	0.04	0.02	0.00
	$\tau_X \sim \text{HC}(25)$	0.45	0.57	0.07	0.38	0.06	0.00	0.04	0.02	0.00
	$\tau_X \sim \text{HC}(5)$	0.56	0.71	0.06	0.49	0.06	0.00	0.04	0.02	0.00
	$\tau_X \sim \text{U}(0,10)$	0.43	0.74	0.06	0.47	0.06	0.00	0.04	0.02	0.00
	$\tau_X \sim \text{U}(0,5)$	0.29	0.66	0.06	0.45	0.06	0.00	0.04	0.02	0.00
	$\tau_X \sim \text{U}(0,2)$	0.50	0.67	0.06	0.45	0.06	0.00	0.04	0.02	0.00
<i>J</i> = 200	ML	0.16	0.06	0.01	0.03	0.02	0.00	0.01	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.001,.001)$	1.32	0.45	0.04	0.34	0.05	0.01	0.03	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.52	0.23	0.03	0.22	0.04	0.01	0.03	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.00	0.03	0.00	0.07	0.03	0.01	0.03	0.01	0.00
	$\tau_X^2 \sim \text{U}(0,100)$	0.47	0.18	0.02	0.13	0.03	0.00	0.02	0.00	0.00
	$\tau_X^2 \sim \text{U}(0,25)$	0.44	0.18	0.02	0.14	0.03	0.00	0.02	0.00	0.00
	$\tau_X^2 \sim \text{U}(0,4)$	0.48	0.17	0.02	0.14	0.03	0.00	0.02	0.00	0.00
	$\tau_X \sim \text{HC}(100)$	0.90	0.32	0.02	0.24	0.04	0.00	0.02	0.01	0.00
	$\tau_X \sim \text{HC}(25)$	1.01	0.31	0.03	0.23	0.03	0.00	0.02	0.01	0.00
	$\tau_X \sim \text{HC}(5)$	0.97	0.35	0.02	0.22	0.04	0.00	0.02	0.01	0.00
	$\tau_X \sim \text{U}(0,10)$	0.92	0.32	0.03	0.19	0.04	0.01	0.02	0.01	0.00
	$\tau_X \sim \text{U}(0,5)$	1.06	0.29	0.03	0.21	0.04	0.01	0.03	0.01	0.00
	$\tau_X \sim \text{U}(0,2)$	0.97	0.32	0.03	0.22	0.04	0.01	0.02	0.01	0.00

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S8
Simulation Study Results: Relative Root Mean Squared Error in Estimating the Group-Level Effect for the Maximum Likelihood and the Bayesian Expected a Posteriori Estimators

Intraclass correlation of the predictor variable											
Number of groups	Estimator	ICC _X = .05			ICC _X = .1			ICC _X = .2			
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	
<i>J</i> = 25	ML	1.95	1.68	1.15	1.17	0.79	0.54	0.55	0.36	0.27	
	$\tau^2_X \sim \text{IG}(.001,.001)$	1.37	1.66	1.68	1.14	1.20	0.70	0.78	0.43	0.28	
	$\tau^2_X \sim \text{IG}(.01,.01)$	1.06	1.16	1.07	0.86	0.84	0.59	0.59	0.38	0.28	
	$\tau^2_X \sim \text{IG}(.1,.1)$	0.80	0.77	0.71	0.63	0.58	0.49	0.44	0.34	0.27	
	$\tau^2_X \sim \text{U}(0,100)$	1.02	1.17	1.12	0.79	0.75	0.54	0.49	0.35	0.27	
	$\tau^2_X \sim \text{U}(0,25)$	1.02	1.19	1.14	0.77	0.73	0.54	0.49	0.35	0.27	
	$\tau^2_X \sim \text{U}(0,4)$	1.05	1.15	1.16	0.79	0.74	0.54	0.49	0.35	0.27	
	$\tau_X \sim \text{HC}(100)$	2.01	2.43	2.26	1.73	1.44	0.66	0.94	0.39	0.27	
	$\tau_X \sim \text{HC}(25)$	2.07	2.48	2.26	1.72	1.38	0.70	0.98	0.41	0.27	
	$\tau_X \sim \text{HC}(5)$	2.09	2.42	2.20	1.70	1.40	0.71	0.92	0.40	0.27	
	$\tau_X \sim \text{U}(0,10)$	2.08	2.50	2.49	1.75	1.51	0.71	0.97	0.40	0.27	
	$\tau_X \sim \text{U}(0,5)$	2.13	2.46	2.33	1.63	1.42	0.67	1.01	0.39	0.28	
	$\tau_X \sim \text{U}(0,2)$	2.05	2.46	2.18	1.73	1.48	0.70	0.94	0.39	0.27	
<i>J</i> = 50	ML	1.54	1.11	0.67	0.76	0.48	0.34	0.35	0.23	0.18	
	$\tau^2_X \sim \text{IG}(.001,.001)$	1.62	1.83	1.15	1.20	0.85	0.36	0.51	0.24	0.18	
	$\tau^2_X \sim \text{IG}(.01,.01)$	1.12	1.10	0.79	0.80	0.60	0.36	0.41	0.23	0.18	
	$\tau^2_X \sim \text{IG}(.1,.1)$	0.74	0.66	0.57	0.53	0.44	0.34	0.32	0.23	0.17	
	$\tau^2_X \sim \text{U}(0,100)$	1.14	1.21	0.82	0.73	0.55	0.34	0.34	0.22	0.17	
	$\tau^2_X \sim \text{U}(0,25)$	1.16	1.24	0.81	0.73	0.53	0.35	0.34	0.22	0.17	
	$\tau^2_X \sim \text{U}(0,4)$	1.14	1.20	0.80	0.73	0.53	0.34	0.34	0.22	0.17	
	$\tau_X \sim \text{HC}(100)$	2.58	2.74	1.30	1.77	0.84	0.35	0.51	0.23	0.17	
	$\tau_X \sim \text{HC}(25)$	2.50	2.73	1.27	1.82	0.93	0.35	0.52	0.23	0.18	
	$\tau_X \sim \text{HC}(5)$	2.60	2.70	1.36	1.89	0.87	0.35	0.50	0.23	0.18	
	$\tau_X \sim \text{U}(0,10)$	2.92	2.83	1.12	1.85	0.82	0.36	0.51	0.23	0.17	
	$\tau_X \sim \text{U}(0,5)$	2.74	2.73	1.41	1.81	0.88	0.35	0.50	0.23	0.17	
	$\tau_X \sim \text{U}(0,2)$	2.65	2.83	1.25	1.87	0.82	0.35	0.53	0.23	0.18	

Table S8 continues

Table S8 continued

		Intraclass correlation of the predictor variable								
		ICC _X = .05			ICC _X = .1			ICC _X = .2		
Number of groups	Estimator	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 100	ML	1.27	0.64	0.40	0.54	0.32	0.23	0.24	0.16	0.13
	$\tau_X^2 \sim \text{IG}(.001,.001)$	1.99	1.58	0.48	1.20	0.39	0.23	0.27	0.17	0.13
	$\tau_X^2 \sim \text{IG}(.01,.01)$	1.17	0.88	0.44	0.74	0.36	0.23	0.26	0.17	0.13
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.67	0.51	0.39	0.46	0.32	0.23	0.24	0.16	0.13
	$\tau_X^2 \sim \text{U}(0,100)$	1.31	0.93	0.43	0.65	0.33	0.23	0.24	0.16	0.13
	$\tau_X^2 \sim \text{U}(0,25)$	1.33	0.96	0.42	0.65	0.34	0.23	0.24	0.16	0.13
	$\tau_X^2 \sim \text{U}(0,4)$	1.35	0.99	0.43	0.65	0.34	0.23	0.24	0.16	0.13
	$\tau_X \sim \text{HC}(100)$	3.15	2.24	0.47	1.52	0.36	0.23	0.26	0.17	0.13
	$\tau_X \sim \text{HC}(25)$	3.19	2.14	0.48	1.61	0.36	0.23	0.25	0.17	0.13
	$\tau_X \sim \text{HC}(5)$	3.45	2.15	0.48	1.55	0.36	0.23	0.25	0.17	0.13
	$\tau_X \sim \text{U}(0,10)$	3.48	2.09	0.46	1.53	0.36	0.23	0.25	0.17	0.13
	$\tau_X \sim \text{U}(0,5)$	3.54	2.14	0.46	1.50	0.36	0.23	0.25	0.16	0.13
	$\tau_X \sim \text{U}(0,2)$	3.59	2.21	0.45	1.50	0.36	0.23	0.25	0.17	0.13
<i>J</i> = 200	ML	0.83	0.43	0.28	0.33	0.21	0.16	0.16	0.11	0.09
	$\tau_X^2 \sim \text{IG}(.001,.001)$	2.31	0.97	0.29	0.69	0.22	0.16	0.17	0.11	0.09
	$\tau_X^2 \sim \text{IG}(.01,.01)$	1.13	0.60	0.29	0.49	0.22	0.16	0.17	0.11	0.09
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.55	0.39	0.28	0.34	0.21	0.16	0.17	0.11	0.09
	$\tau_X^2 \sim \text{U}(0,100)$	1.32	0.57	0.28	0.42	0.22	0.16	0.17	0.11	0.09
	$\tau_X^2 \sim \text{U}(0,25)$	1.29	0.56	0.28	0.41	0.22	0.16	0.17	0.11	0.09
	$\tau_X^2 \sim \text{U}(0,4)$	1.37	0.56	0.28	0.42	0.22	0.16	0.17	0.11	0.09
	$\tau_X \sim \text{HC}(100)$	3.32	0.97	0.30	0.64	0.22	0.16	0.17	0.11	0.09
	$\tau_X \sim \text{HC}(25)$	3.31	0.97	0.29	0.64	0.22	0.16	0.17	0.11	0.09
	$\tau_X \sim \text{HC}(5)$	3.70	0.95	0.30	0.62	0.22	0.17	0.17	0.11	0.09
	$\tau_X \sim \text{U}(0,10)$	3.07	0.84	0.29	0.54	0.22	0.16	0.17	0.11	0.09
	$\tau_X \sim \text{U}(0,5)$	3.23	0.79	0.29	0.56	0.22	0.16	0.17	0.11	0.09
	$\tau_X \sim \text{U}(0,2)$	3.37	0.87	0.29	0.57	0.22	0.16	0.17	0.11	0.09

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S9
Simulation Study Results: Relative Bias in Estimating the Individual-Level Effect for the Maximum Likelihood and the Bayesian Expected a Posteriori Estimators

		Intraclass correlation of the predictor variable								
		ICC _X = .05			ICC _X = .1			ICC _X = .2		
Number of groups	Estimator	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 25	ML	0.00	0.00	0.00	0.02	0.00	-0.01	0.01	0.00	0.01
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.03	0.02	0.00	0.08	0.01	-0.01	0.07	0.01	0.01
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.02	0.01	0.00	0.06	0.01	-0.01	0.05	0.01	0.01
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.01	0.01	0.00	0.04	0.00	-0.01	0.03	0.01	0.01
	$\tau_X^2 \sim \text{U}(0,100)$	0.02	0.01	0.00	0.05	0.00	-0.01	0.04	0.01	0.01
	$\tau_X^2 \sim \text{U}(0,25)$	0.02	0.01	0.00	0.05	0.00	-0.01	0.04	0.01	0.01
	$\tau_X^2 \sim \text{U}(0,4)$	0.02	0.01	0.00	0.05	0.00	-0.01	0.04	0.01	0.01
	$\tau_X \sim \text{HC}(100)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01
	$\tau_X \sim \text{HC}(25)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01
	$\tau_X \sim \text{HC}(5)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01
	$\tau_X \sim \text{U}(0,10)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01
	$\tau_X \sim \text{U}(0,5)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01
	$\tau_X \sim \text{U}(0,2)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01
<i>J</i> = 50	ML	0.01	0.01	0.00	0.02	0.01	0.00	-0.01	0.00	0.01
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.04	0.02	0.00	0.06	0.01	0.00	0.03	0.01	0.01
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.02	0.01	0.00	0.04	0.01	0.00	0.02	0.01	0.01
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.01	0.01	0.00	0.03	0.01	0.00	0.01	0.01	0.01
	$\tau_X^2 \sim \text{U}(0,100)$	0.02	0.01	0.00	0.04	0.01	0.00	0.01	0.01	0.01
	$\tau_X^2 \sim \text{U}(0,25)$	0.02	0.01	0.00	0.04	0.01	0.00	0.01	0.01	0.01
	$\tau_X^2 \sim \text{U}(0,4)$	0.02	0.01	0.00	0.04	0.01	0.00	0.01	0.01	0.01
	$\tau_X \sim \text{HC}(100)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01
	$\tau_X \sim \text{HC}(25)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01
	$\tau_X \sim \text{HC}(5)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01
	$\tau_X \sim \text{U}(0,10)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01
	$\tau_X \sim \text{U}(0,5)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01
	$\tau_X \sim \text{U}(0,2)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01

Table S9 continues

Table S9 continued

Number of groups	Estimator	Intraclass correlation of the predictor variable					
		ICC _X = .05		ICC _X = .1		ICC _X = .2	
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 100	ML	-0.01	0.00	0.00	0.00	0.00	-0.01
	$\tau_X^2 \sim \text{IG}(.001, .001)$	0.02	0.00	0.00	0.03	0.00	0.00
	$\tau_X^2 \sim \text{IG}(.01, .01)$	0.00	0.00	0.00	0.02	0.00	0.00
	$\tau_X^2 \sim \text{IG}(.1, .1)$	-0.01	0.00	0.00	0.01	0.00	0.00
	$\tau_X^2 \sim \text{U}(0, 100)$	0.00	0.00	0.00	0.01	0.00	0.00
	$\tau_X^2 \sim \text{U}(0, 25)$	0.00	0.00	0.00	0.01	0.00	0.00
	$\tau_X^2 \sim \text{U}(0, 4)$	0.00	0.00	0.00	0.01	0.00	0.00
	$\tau_X \sim \text{HC}(100)$	0.02	0.00	0.00	0.02	0.00	0.00
	$\tau_X \sim \text{HC}(25)$	0.02	0.00	0.00	0.02	0.00	0.00
	$\tau_X \sim \text{HC}(5)$	0.02	0.00	0.00	0.02	0.00	0.00
	$\tau_X \sim \text{U}(0, 10)$	0.02	0.00	0.00	0.02	0.00	0.00
	$\tau_X \sim \text{U}(0, 5)$	0.02	0.00	0.00	0.02	0.00	0.00
	$\tau_X \sim \text{U}(0, 2)$	0.02	0.00	0.00	0.02	0.00	0.00
<i>J</i> = 200	ML	0.00	0.00	0.00	0.00	0.00	0.00
	$\tau_X^2 \sim \text{IG}(.001, .001)$	0.01	0.00	0.00	0.01	0.00	0.00
	$\tau_X^2 \sim \text{IG}(.01, .01)$	0.00	0.00	0.00	0.01	0.00	0.00
	$\tau_X^2 \sim \text{IG}(.1, .1)$	0.00	0.00	0.00	0.00	0.00	0.00
	$\tau_X^2 \sim \text{U}(0, 100)$	0.00	0.00	0.00	0.01	0.00	0.00
	$\tau_X^2 \sim \text{U}(0, 25)$	0.00	0.00	0.00	0.00	0.00	0.00
	$\tau_X^2 \sim \text{U}(0, 4)$	0.00	0.00	0.00	0.01	0.00	0.00
	$\tau_X \sim \text{HC}(100)$	0.01	0.00	0.00	0.01	0.00	0.00
	$\tau_X \sim \text{HC}(25)$	0.01	0.00	0.00	0.01	0.00	0.00
	$\tau_X \sim \text{HC}(5)$	0.01	0.00	0.00	0.01	0.00	0.00
	$\tau_X \sim \text{U}(0, 10)$	0.01	0.00	0.00	0.01	0.00	0.00
	$\tau_X \sim \text{U}(0, 5)$	0.01	0.00	0.00	0.01	0.00	0.00
	$\tau_X \sim \text{U}(0, 2)$	0.01	0.00	0.00	0.01	0.00	0.00

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S10
Simulation Study Results: Relative Root Mean Squared Error in Estimating the Individual-Level Effect for the Maximum Likelihood and the Bayesian Expected a Posteriori Estimators

		Intraclass correlation of the predictor variable								
Number of groups	Estimator	ICC _X = .05			ICC _X = .1			ICC _X = .2		
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 25	ML	0.40	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.22
	$\tau^2_X \sim \text{IG}(.001, .001)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.21
	$\tau^2_X \sim \text{IG}(.01, .01)$	0.39	0.26	0.19	0.40	0.28	0.20	0.43	0.29	0.21
	$\tau^2_X \sim \text{IG}(.1, .1)$	0.40	0.26	0.19	0.40	0.28	0.20	0.43	0.29	0.22
	$\tau^2_X \sim \text{U}(0, 100)$	0.40	0.26	0.19	0.40	0.28	0.20	0.43	0.29	0.21
	$\tau^2_X \sim \text{U}(0, 25)$	0.40	0.26	0.19	0.40	0.28	0.20	0.43	0.29	0.21
	$\tau^2_X \sim \text{U}(0, 4)$	0.40	0.26	0.19	0.40	0.28	0.20	0.43	0.29	0.21
	$\tau_X \sim \text{HC}(100)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.21
	$\tau_X \sim \text{HC}(25)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.21
	$\tau_X \sim \text{HC}(5)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.22
	$\tau_X \sim \text{U}(0, 10)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.21
	$\tau_X \sim \text{U}(0, 5)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.21
	$\tau_X \sim \text{U}(0, 2)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.22
<i>J</i> = 50	ML	0.28	0.19	0.13	0.28	0.20	0.13	0.32	0.21	0.14
	$\tau^2_X \sim \text{IG}(.001, .001)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau^2_X \sim \text{IG}(.01, .01)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau^2_X \sim \text{IG}(.1, .1)$	0.28	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau^2_X \sim \text{U}(0, 100)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau^2_X \sim \text{U}(0, 25)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau^2_X \sim \text{U}(0, 4)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau_X \sim \text{HC}(100)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau_X \sim \text{HC}(25)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau_X \sim \text{HC}(5)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau_X \sim \text{U}(0, 10)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau_X \sim \text{U}(0, 5)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau_X \sim \text{U}(0, 2)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14

Table S10 continues

Table S10 continued

Intraclass correlation of the predictor variable										
Number of groups	Estimator	ICC _X = .05			ICC _X = .1			ICC _X = .2		
		n = 5	n = 10	n = 20	n = 5	n = 10	n = 20	n = 5	n = 10	n = 20
J = 100	ML	0.19	0.13	0.09	0.20	0.14	0.09	0.22	0.14	0.10
	τ _X ² ~ IG (.001, .001)	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	τ _X ² ~ IG (.01, .01)	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	τ _X ² ~ IG (.1, .1)	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	τ _X ² ~ U (0, 100)	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	τ _X ² ~ U (0, 25)	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	τ _X ² ~ U (0, 4)	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	τ _X ~ HC (100)	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	τ _X ~ HC (25)	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	τ _X ~ HC (5)	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	τ _X ~ U (0, 10)	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	τ _X ~ U (0, 5)	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	τ _X ~ U (0, 2)	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
J = 200	ML	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	τ _X ² ~ IG (.001, .001)	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	τ _X ² ~ IG (.01, .01)	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	τ _X ² ~ IG (.1, .1)	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	τ _X ² ~ U (0, 100)	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	τ _X ² ~ U (0, 25)	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	τ _X ² ~ U (0, 4)	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	τ _X ~ HC (100)	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	τ _X ~ HC (25)	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	τ _X ~ HC (5)	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	τ _X ~ U (0, 10)	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	τ _X ~ U (0, 5)	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	τ _X ~ U (0, 2)	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S11
Simulation Study Results: Relative Bias in Estimating the Group-Level Effect for the Maximum Likelihood and the Bayesian Posterior Median Estimators

		Intraclass correlation of the predictor variable									
		ICC _X = .05			ICC _X = .1			ICC _X = .2			
Number of groups	Estimator	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	
<i>J</i> = 25	ML	-0.01	0.23	0.17	0.13	0.12	0.05	0.04	0.02	0.01	
	$\tau_X^2 \sim \text{IG}(.001,.001)$	-0.16	0.22	0.32	0.10	0.25	0.11	0.10	0.05	0.01	
	$\tau_X^2 \sim \text{IG}(.01,.01)$	-0.26	0.03	0.12	-0.03	0.13	0.08	0.04	0.04	0.01	
	$\tau_X^2 \sim \text{IG}(.1,.1)$	-0.37	-0.19	-0.08	-0.18	-0.04	0.00	-0.06	0.00	0.00	
	$\tau_X^2 \sim \text{U}(0,100)$	-0.34	-0.08	0.05	-0.16	0.01	0.02	-0.07	-0.01	0.00	
	$\tau_X^2 \sim \text{U}(0,25)$	-0.34	-0.08	0.05	-0.16	0.01	0.02	-0.07	-0.01	0.00	
	$\tau_X^2 \sim \text{U}(0,4)$	-0.34	-0.08	0.04	-0.16	0.01	0.03	-0.07	-0.01	0.00	
	$\tau_X \sim \text{HC}(100)$	-0.28	0.08	0.17	-0.06	0.12	0.06	0.00	0.02	0.01	
	$\tau_X \sim \text{HC}(25)$	-0.25	0.07	0.16	-0.04	0.13	0.06	0.00	0.02	0.01	
	$\tau_X \sim \text{HC}(5)$	-0.26	0.07	0.18	-0.06	0.12	0.07	0.00	0.02	0.01	
	$\tau_X \sim \text{U}(0,10)$	-0.25	0.07	0.20	-0.06	0.12	0.06	0.00	0.01	0.01	
	$\tau_X \sim \text{U}(0,5)$	-0.25	0.07	0.17	-0.05	0.11	0.06	0.00	0.02	0.01	
	$\tau_X \sim \text{U}(0,2)$	-0.25	0.07	0.19	-0.06	0.12	0.06	0.00	0.02	0.01	
<i>J</i> = 50	ML	0.12	0.18	0.08	0.10	0.07	0.02	0.04	0.01	0.01	
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.13	0.46	0.22	0.27	0.20	0.04	0.10	0.02	0.01	
	$\tau_X^2 \sim \text{IG}(.01,.01)$	-0.05	0.17	0.12	0.11	0.13	0.04	0.07	0.02	0.01	
	$\tau_X^2 \sim \text{IG}(.1,.1)$	-0.26	-0.10	-0.03	-0.09	0.02	0.01	0.01	0.01	0.01	
	$\tau_X^2 \sim \text{U}(0,100)$	-0.16	0.08	0.07	-0.03	0.06	0.01	0.00	0.00	0.01	
	$\tau_X^2 \sim \text{U}(0,25)$	-0.16	0.07	0.07	-0.03	0.06	0.01	0.00	0.00	0.01	
	$\tau_X^2 \sim \text{U}(0,4)$	-0.16	0.08	0.07	-0.03	0.06	0.01	0.00	0.00	0.01	
	$\tau_X \sim \text{HC}(100)$	-0.01	0.28	0.15	0.10	0.12	0.02	0.05	0.01	0.01	
	$\tau_X \sim \text{HC}(25)$	0.00	0.26	0.14	0.10	0.13	0.03	0.05	0.01	0.01	
	$\tau_X \sim \text{HC}(5)$	-0.02	0.26	0.15	0.09	0.12	0.03	0.04	0.01	0.01	
	$\tau_X \sim \text{U}(0,10)$	-0.04	0.29	0.13	0.10	0.12	0.03	0.04	0.01	0.01	
	$\tau_X \sim \text{U}(0,5)$	-0.03	0.24	0.15	0.09	0.12	0.03	0.05	0.01	0.01	
	$\tau_X \sim \text{U}(0,2)$	-0.04	0.26	0.13	0.11	0.12	0.03	0.05	0.01	0.01	

Table S11 continues

Table S11 continued

Number of groups	Estimator	Intraclass correlation of the predictor variable							
		ICC _X = .05				ICC _X = .1			
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	
<i>J</i> = 100	ML	0.24	0.09	0.01	0.07	0.01	0.00	0.02	0.01
	$\tau_X^2 \sim \text{IG}(.001, .001)$	0.53	0.43	0.05	0.34	0.05	0.00	0.04	0.02
	$\tau_X^2 \sim \text{IG}(.01, .01)$	0.17	0.20	0.03	0.18	0.04	0.00	0.03	0.01
	$\tau_X^2 \sim \text{IG}(.1, .1)$	-0.15	-0.05	-0.03	0.00	0.00	-0.01	0.02	0.01
	$\tau_X^2 \sim \text{U}(0, 100)$	0.05	0.12	0.01	0.06	0.01	-0.01	0.00	0.01
	$\tau_X^2 \sim \text{U}(0, 25)$	0.04	0.12	0.01	0.06	0.01	-0.01	0.01	0.00
	$\tau_X^2 \sim \text{U}(0, 4)$	0.05	0.12	0.01	0.06	0.01	-0.01	0.01	0.00
	$\tau_X \sim \text{HC}(100)$	0.27	0.27	0.03	0.19	0.03	0.00	0.02	0.01
	$\tau_X \sim \text{HC}(25)$	0.28	0.29	0.03	0.17	0.03	0.00	0.02	0.01
	$\tau_X \sim \text{HC}(5)$	0.28	0.29	0.03	0.19	0.03	0.00	0.02	0.01
	$\tau_X \sim \text{U}(0, 10)$	0.31	0.30	0.03	0.19	0.03	0.00	0.02	0.01
	$\tau_X \sim \text{U}(0, 5)$	0.26	0.30	0.03	0.18	0.03	0.00	0.02	0.01
	$\tau_X \sim \text{U}(0, 2)$	0.27	0.28	0.03	0.19	0.03	0.00	0.02	0.01
<i>J</i> = 200	ML	0.16	0.06	0.01	0.03	0.02	0.00	0.01	0.01
	$\tau_X^2 \sim \text{IG}(.001, .001)$	0.82	0.23	0.03	0.18	0.04	0.01	0.02	0.01
	$\tau_X^2 \sim \text{IG}(.01, .01)$	0.32	0.14	0.02	0.13	0.03	0.01	0.02	0.01
	$\tau_X^2 \sim \text{IG}(.1, .1)$	-0.06	0.00	-0.01	0.03	0.02	0.00	0.02	0.01
	$\tau_X^2 \sim \text{U}(0, 100)$	0.20	0.09	0.01	0.06	0.02	0.00	0.01	0.00
	$\tau_X^2 \sim \text{U}(0, 25)$	0.19	0.09	0.01	0.06	0.02	0.00	0.01	0.00
	$\tau_X^2 \sim \text{U}(0, 4)$	0.19	0.09	0.01	0.06	0.02	0.00	0.01	0.00
	$\tau_X \sim \text{HC}(100)$	0.50	0.15	0.01	0.11	0.03	0.00	0.02	0.01
	$\tau_X \sim \text{HC}(25)$	0.49	0.16	0.02	0.11	0.03	0.00	0.02	0.01
	$\tau_X \sim \text{HC}(5)$	0.53	0.15	0.02	0.11	0.03	0.00	0.02	0.01
	$\tau_X \sim \text{U}(0, 10)$	0.50	0.16	0.02	0.10	0.03	0.01	0.02	0.01
	$\tau_X \sim \text{U}(0, 5)$	0.56	0.16	0.02	0.11	0.03	0.01	0.02	0.01
	$\tau_X \sim \text{U}(0, 2)$	0.50	0.16	0.02	0.11	0.03	0.01	0.02	0.01

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S12
Simulation Study Results: Relative Root Mean Squared Error in Estimating the Group-Level Effect for the Maximum Likelihood and the Bayesian Posterior Median Estimators

Intraclass correlation of the predictor variable											
Number of groups	Estimator	ICC _X = .05			ICC _X = .1			ICC _X = .2			
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	
<i>J</i> = 25	ML	1.95	1.68	1.15	1.17	0.79	0.54	0.55	0.36	0.27	
	$\tau_X^2 \sim \text{IG}(.001,.001)$	1.24	1.42	1.29	0.97	0.91	0.59	0.58	0.37	0.28	
	$\tau_X^2 \sim \text{IG}(.01,.01)$	1.02	1.06	0.96	0.78	0.73	0.55	0.51	0.36	0.28	
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.79	0.75	0.70	0.61	0.56	0.48	0.43	0.33	0.27	
	$\tau_X^2 \sim \text{U}(0,100)$	0.87	0.92	0.87	0.65	0.62	0.51	0.43	0.33	0.27	
	$\tau_X^2 \sim \text{U}(0,25)$	0.87	0.92	0.88	0.65	0.62	0.51	0.43	0.33	0.27	
	$\tau_X^2 \sim \text{U}(0,4)$	0.87	0.91	0.88	0.65	0.62	0.50	0.43	0.33	0.27	
	$\tau_X \sim \text{HC}(100)$	1.06	1.20	1.15	0.80	0.74	0.54	0.48	0.35	0.27	
	$\tau_X \sim \text{HC}(25)$	1.06	1.20	1.14	0.79	0.74	0.54	0.49	0.35	0.27	
	$\tau_X \sim \text{HC}(5)$	1.06	1.22	1.12	0.79	0.75	0.55	0.49	0.35	0.27	
	$\tau_X \sim \text{U}(0,10)$	1.04	1.21	1.17	0.80	0.75	0.55	0.48	0.35	0.27	
	$\tau_X \sim \text{U}(0,5)$	1.05	1.22	1.15	0.78	0.73	0.54	0.49	0.35	0.27	
	$\tau_X \sim \text{U}(0,2)$	1.05	1.19	1.14	0.77	0.74	0.55	0.48	0.35	0.27	
<i>J</i> = 50	ML	1.54	1.11	0.67	0.76	0.48	0.34	0.35	0.23	0.18	
	$\tau_X^2 \sim \text{IG}(.001,.001)$	1.39	1.37	0.86	0.89	0.61	0.35	0.39	0.23	0.18	
	$\tau_X^2 \sim \text{IG}(.01,.01)$	1.03	0.96	0.71	0.69	0.53	0.35	0.36	0.23	0.18	
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.72	0.64	0.55	0.51	0.43	0.33	0.31	0.22	0.17	
	$\tau_X^2 \sim \text{U}(0,100)$	0.87	0.85	0.66	0.57	0.46	0.34	0.31	0.22	0.17	
	$\tau_X^2 \sim \text{U}(0,25)$	0.88	0.86	0.66	0.56	0.46	0.34	0.31	0.22	0.17	
	$\tau_X^2 \sim \text{U}(0,4)$	0.87	0.86	0.66	0.56	0.46	0.34	0.31	0.22	0.17	
	$\tau_X \sim \text{HC}(100)$	1.17	1.17	0.77	0.72	0.52	0.34	0.34	0.22	0.17	
	$\tau_X \sim \text{HC}(25)$	1.15	1.20	0.77	0.71	0.52	0.34	0.34	0.23	0.17	
	$\tau_X \sim \text{HC}(5)$	1.16	1.16	0.77	0.72	0.53	0.34	0.34	0.22	0.17	
	$\tau_X \sim \text{U}(0,10)$	1.21	1.22	0.75	0.73	0.53	0.34	0.34	0.22	0.17	
	$\tau_X \sim \text{U}(0,5)$	1.18	1.18	0.78	0.74	0.53	0.34	0.34	0.22	0.17	
	$\tau_X \sim \text{U}(0,2)$	1.18	1.20	0.77	0.72	0.53	0.34	0.34	0.22	0.17	

Table S12 continues

Table S12 continued

Intraclass correlation of the predictor variable										
Number of groups	Estimator	ICC _X = .05			ICC _X = .1			ICC _X = .2		
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 100	ML	1.27	0.64	0.40	0.54	0.32	0.23	0.24	0.16	0.13
	$\tau_X^2 \sim \text{IG}(.001,.001)$	1.57	1.05	0.44	0.81	0.35	0.23	0.25	0.17	0.13
	$\tau_X^2 \sim \text{IG}(.01,.01)$	1.02	0.73	0.42	0.61	0.34	0.23	0.25	0.17	0.13
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.64	0.48	0.38	0.43	0.31	0.22	0.24	0.16	0.13
	$\tau_X^2 \sim \text{U}(0,100)$	0.90	0.66	0.40	0.50	0.32	0.22	0.23	0.16	0.13
	$\tau_X^2 \sim \text{U}(0,25)$	0.89	0.66	0.40	0.50	0.32	0.22	0.23	0.16	0.13
	$\tau_X^2 \sim \text{U}(0,4)$	0.90	0.66	0.41	0.50	0.32	0.22	0.23	0.16	0.13
	$\tau_X \sim \text{HC}(100)$	1.29	0.90	0.42	0.64	0.33	0.23	0.24	0.16	0.13
	$\tau_X \sim \text{HC}(25)$	1.34	0.92	0.42	0.64	0.33	0.23	0.24	0.16	0.13
	$\tau_X \sim \text{HC}(5)$	1.36	0.89	0.43	0.65	0.33	0.23	0.24	0.16	0.13
	$\tau_X \sim \text{U}(0,10)$	1.46	0.94	0.42	0.66	0.33	0.23	0.24	0.16	0.13
	$\tau_X \sim \text{U}(0,5)$	1.45	0.97	0.42	0.66	0.33	0.23	0.24	0.16	0.13
	$\tau_X \sim \text{U}(0,2)$	1.43	0.94	0.42	0.64	0.33	0.23	0.24	0.16	0.13
<i>J</i> = 200	ML	0.83	0.43	0.28	0.33	0.21	0.16	0.16	0.11	0.09
	$\tau_X^2 \sim \text{IG}(.001,.001)$	1.65	0.64	0.28	0.47	0.22	0.16	0.17	0.11	0.09
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.91	0.50	0.28	0.40	0.22	0.16	0.17	0.11	0.09
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.52	0.38	0.27	0.32	0.21	0.16	0.16	0.11	0.09
	$\tau_X^2 \sim \text{U}(0,100)$	0.82	0.46	0.28	0.35	0.21	0.16	0.16	0.11	0.09
	$\tau_X^2 \sim \text{U}(0,25)$	0.81	0.46	0.28	0.35	0.21	0.16	0.16	0.11	0.09
	$\tau_X^2 \sim \text{U}(0,4)$	0.82	0.46	0.28	0.35	0.21	0.16	0.16	0.11	0.09
	$\tau_X \sim \text{HC}(100)$	1.31	0.54	0.28	0.39	0.21	0.16	0.17	0.11	0.09
	$\tau_X \sim \text{HC}(25)$	1.35	0.54	0.28	0.40	0.21	0.16	0.16	0.11	0.09
	$\tau_X \sim \text{HC}(5)$	1.37	0.53	0.29	0.40	0.21	0.16	0.16	0.11	0.09
	$\tau_X \sim \text{U}(0,10)$	1.49	0.57	0.28	0.40	0.22	0.16	0.17	0.11	0.09
	$\tau_X \sim \text{U}(0,5)$	1.52	0.54	0.28	0.40	0.21	0.16	0.16	0.11	0.09
	$\tau_X \sim \text{U}(0,2)$	1.46	0.56	0.28	0.40	0.21	0.16	0.17	0.11	0.09

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S13
Simulation Study Results: Relative Bias in Estimating the Individual-Level Effect for the Maximum Likelihood and the Bayesian Posterior Median Estimators

Intraclass correlation of the predictor variable											
Number of groups	Estimator	ICC _X = .05			ICC _X = .1			ICC _X = .2			
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	
<i>J</i> = 25	ML	0.00	0.00	0.00	0.02	0.00	-0.01	0.01	0.00	0.01	
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.03	0.02	0.00	0.08	0.01	-0.01	0.07	0.01	0.01	
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.02	0.01	0.00	0.06	0.01	-0.01	0.05	0.01	0.01	
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.01	0.01	0.00	0.04	0.00	-0.01	0.03	0.01	0.01	
	$\tau_X^2 \sim \text{U}(0,100)$	0.02	0.01	0.00	0.05	0.00	-0.01	0.04	0.01	0.01	
	$\tau_X^2 \sim \text{U}(0,25)$	0.02	0.01	0.00	0.05	0.00	-0.01	0.04	0.01	0.01	
	$\tau_X^2 \sim \text{U}(0,4)$	0.02	0.01	0.00	0.05	0.00	-0.01	0.04	0.01	0.01	
	$\tau_X \sim \text{HC}(100)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01	
	$\tau_X \sim \text{HC}(25)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01	
	$\tau_X \sim \text{HC}(5)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01	
	$\tau_X \sim \text{U}(0,10)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01	
	$\tau_X \sim \text{U}(0,5)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01	
	$\tau_X \sim \text{U}(0,2)$	0.03	0.02	0.00	0.07	0.01	-0.01	0.06	0.01	0.01	
<i>J</i> = 50	ML	0.01	0.01	0.00	0.02	0.01	0.00	-0.01	0.00	0.01	
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.04	0.02	0.00	0.06	0.01	0.00	0.03	0.01	0.01	
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.02	0.01	0.00	0.04	0.01	0.00	0.02	0.01	0.01	
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.01	0.01	0.00	0.03	0.01	0.00	0.01	0.01	0.01	
	$\tau_X^2 \sim \text{U}(0,100)$	0.02	0.01	0.00	0.04	0.01	0.00	0.01	0.01	0.01	
	$\tau_X^2 \sim \text{U}(0,25)$	0.02	0.01	0.00	0.04	0.01	0.00	0.01	0.01	0.01	
	$\tau_X^2 \sim \text{U}(0,4)$	0.02	0.01	0.00	0.04	0.01	0.00	0.01	0.01	0.01	
	$\tau_X \sim \text{HC}(100)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01	
	$\tau_X \sim \text{HC}(25)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01	
	$\tau_X \sim \text{HC}(5)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01	
	$\tau_X \sim \text{U}(0,10)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01	
	$\tau_X \sim \text{U}(0,5)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01	
	$\tau_X \sim \text{U}(0,2)$	0.03	0.02	0.00	0.06	0.01	0.00	0.02	0.01	0.01	

Table S13 continues

Table S13 continued

Number of groups	Estimator	Intraclass correlation of the predictor variable					
		ICC _X = .05		ICC _X = .1		ICC _X = .2	
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 100	ML	−0.01	0.00	0.00	0.00	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.001, .001)$	0.02	0.00	0.00	0.03	0.00	0.01
	$\tau_X^2 \sim \text{IG}(.01, .01)$	0.00	0.00	0.00	0.02	0.00	0.01
	$\tau_X^2 \sim \text{IG}(.1, .1)$	−0.01	0.00	0.00	0.01	0.00	0.01
	$\tau_X^2 \sim \text{U}(0, 100)$	0.00	0.00	0.00	0.01	0.00	0.01
	$\tau_X^2 \sim \text{U}(0, 25)$	0.00	0.00	0.00	0.01	0.00	0.01
	$\tau_X^2 \sim \text{U}(0, 4)$	0.00	0.00	0.00	0.01	0.00	0.01
	$\tau_X \sim \text{HC}(100)$	0.02	0.00	0.00	0.02	0.00	0.01
	$\tau_X \sim \text{HC}(25)$	0.02	0.00	0.00	0.02	0.00	0.01
	$\tau_X \sim \text{HC}(5)$	0.02	0.00	0.00	0.02	0.00	0.01
	$\tau_X \sim \text{U}(0, 10)$	0.02	0.00	0.00	0.02	0.00	0.01
	$\tau_X \sim \text{U}(0, 5)$	0.02	0.00	0.00	0.02	0.00	0.01
	$\tau_X \sim \text{U}(0, 2)$	0.02	0.00	0.00	0.02	0.00	0.01
<i>J</i> = 200	ML	0.00	0.00	0.00	0.00	0.01	0.00
	$\tau_X^2 \sim \text{IG}(.001, .001)$	0.01	0.00	0.00	0.01	0.00	0.01
	$\tau_X^2 \sim \text{IG}(.01, .01)$	0.00	0.00	0.00	0.01	0.00	0.01
	$\tau_X^2 \sim \text{IG}(.1, .1)$	0.00	0.00	0.00	0.00	0.00	0.01
	$\tau_X^2 \sim \text{U}(0, 100)$	0.00	0.00	0.00	0.01	0.00	0.01
	$\tau_X^2 \sim \text{U}(0, 25)$	0.00	0.00	0.00	0.00	0.00	0.01
	$\tau_X^2 \sim \text{U}(0, 4)$	0.00	0.00	0.00	0.00	0.00	0.01
	$\tau_X \sim \text{HC}(100)$	0.01	0.00	0.00	0.01	0.00	0.01
	$\tau_X \sim \text{HC}(25)$	0.01	0.00	0.00	0.01	0.00	0.01
	$\tau_X \sim \text{HC}(5)$	0.01	0.00	0.00	0.01	0.00	0.01
	$\tau_X \sim \text{U}(0, 10)$	0.01	0.00	0.00	0.01	0.00	0.0002
	$\tau_X \sim \text{U}(0, 5)$	0.01	0.00	0.00	0.01	0.00	0.01
	$\tau_X \sim \text{U}(0, 2)$	0.01	0.00	0.00	0.01	0.00	0.01

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S14
Simulation Study Results: Relative Root Mean Squared Error in Estimating the Individual-Level Effect for the Maximum Likelihood and the Bayesian Posterior Median Estimators

		Intraclass correlation of the predictor variable								
Number of groups	Estimator	ICC _X = .05			ICC _X = .1			ICC _X = .2		
		<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 25	ML	0.40	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.22
	$\tau^2_X \sim \text{IG}(.001, .001)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.21
	$\tau^2_X \sim \text{IG}(.01, .01)$	0.39	0.26	0.19	0.40	0.28	0.20	0.43	0.29	0.21
	$\tau^2_X \sim \text{IG}(.1, .1)$	0.40	0.26	0.19	0.40	0.28	0.20	0.43	0.29	0.22
	$\tau^2_X \sim \text{U}(0, 100)$	0.40	0.26	0.19	0.40	0.28	0.20	0.43	0.29	0.21
	$\tau^2_X \sim \text{U}(0, 25)$	0.40	0.26	0.19	0.40	0.28	0.20	0.43	0.29	0.21
	$\tau^2_X \sim \text{U}(0, 4)$	0.40	0.26	0.19	0.40	0.28	0.20	0.43	0.29	0.21
	$\tau_X \sim \text{HC}(100)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.21
	$\tau_X \sim \text{HC}(25)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.22
	$\tau_X \sim \text{HC}(5)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.22
	$\tau_X \sim \text{U}(0, 10)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.21
	$\tau_X \sim \text{U}(0, 5)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.21
	$\tau_X \sim \text{U}(0, 2)$	0.39	0.26	0.19	0.40	0.28	0.20	0.44	0.29	0.22
<i>J</i> = 50	ML	0.28	0.19	0.13	0.28	0.20	0.13	0.32	0.21	0.14
	$\tau^2_X \sim \text{IG}(.001, .001)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau^2_X \sim \text{IG}(.01, .01)$	0.27	0.19	0.13	0.28	0.20	0.13	0.31	0.20	0.14
	$\tau^2_X \sim \text{IG}(.1, .1)$	0.28	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau^2_X \sim \text{U}(0, 100)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau^2_X \sim \text{U}(0, 25)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau^2_X \sim \text{U}(0, 4)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau_X \sim \text{HC}(100)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau_X \sim \text{HC}(25)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau_X \sim \text{HC}(5)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau_X \sim \text{U}(0, 10)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau_X \sim \text{U}(0, 5)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.20	0.14
	$\tau_X \sim \text{U}(0, 2)$	0.27	0.19	0.13	0.28	0.19	0.13	0.31	0.21	0.14

Table S14 continues

Table S14 continued

		Intraclass correlation of the predictor variable								
		ICC _X = .05			ICC _X = .1			ICC _X = .2		
Number of groups	Estimator	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20	<i>n</i> = 5	<i>n</i> = 10	<i>n</i> = 20
<i>J</i> = 100	ML	0.19	0.13	0.09	0.20	0.14	0.09	0.22	0.14	0.10
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X^2 \sim \text{U}(0,100)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X^2 \sim \text{U}(0,25)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X^2 \sim \text{U}(0,4)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X \sim \text{HC}(100)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X \sim \text{HC}(25)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X \sim \text{HC}(5)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X \sim \text{U}(0,10)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X \sim \text{U}(0,5)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
	$\tau_X \sim \text{U}(0,2)$	0.19	0.13	0.09	0.20	0.14	0.09	0.21	0.14	0.10
<i>J</i> = 200	ML	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X^2 \sim \text{IG}(.001,.001)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X^2 \sim \text{IG}(.01,.01)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X^2 \sim \text{IG}(.1,.1)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X^2 \sim \text{U}(0,100)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X^2 \sim \text{U}(0,25)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X^2 \sim \text{U}(0,4)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X \sim \text{HC}(100)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X \sim \text{HC}(25)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X \sim \text{HC}(5)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X \sim \text{U}(0,10)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X \sim \text{U}(0,5)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07
	$\tau_X \sim \text{U}(0,2)$	0.14	0.09	0.07	0.15	0.10	0.07	0.16	0.10	0.07

Note. ML = maximum likelihood estimation; IG = inverse gamma distribution; U = uniform distribution; HC = half-Cauchy distribution; *J* = number of groups; *n* = number of persons within each group; ICC_X = intraclass correlation of the predictor variable; τ_X^2 (τ_X) = group-level variance (standard deviation) of the predictor variable.

Table S15

Further Results of the Additional Simulation Study: Characteristics of the Sampling Distributions for the Maximum Likelihood and the Bayesian Maximum a Posteriori Estimators of the Group-Level Effect, the Adjustment Factor, and the Group-Level Variance of the Predictor Variable

	RMSE	M	SD	Percentile				
				5th	25th	50th	75th	95th
Group-level effect ($\beta_b = 0.7$)								
ML	0.766	0.781	0.530	−0.007	0.419	0.707	1.076	2.159
IG (.001, .001)	0.813	0.801	0.560	−0.090	0.428	0.744	1.103	2.171
IG (.01, .01)	0.577	0.693	0.404	0.021	0.400	0.651	0.959	1.607
IG (.1, .1)	0.457	0.583	0.298	0.074	0.367	0.574	0.786	1.175
IG (1, 1)	0.441	0.459	0.193	0.116	0.306	0.459	0.610	0.818
IG (10, 10)	0.501	0.371	0.121	0.148	0.275	0.372	0.462	0.584
IG (100, 100)	0.545	0.330	0.092	0.164	0.257	0.332	0.401	0.496
IG (1,000, 1,000)	0.555	0.321	0.086	0.166	0.254	0.321	0.391	0.476
Adjustment factor ($\frac{1}{Rel} = 4.8$)								
ML	0.655	5.927	2.936	3.022	3.826	4.980	7.070	16.751
IG (.001, .001)	1.843	10.257	6.961	2.961	4.443	8.108	15.626	31.538
IG (.01, .01)	0.413	5.369	1.901	2.936	3.752	4.995	6.721	10.647
IG (.1, .1)	0.241	3.900	0.724	2.785	3.308	3.841	4.443	5.427
IG (1, 1)	0.463	2.584	0.186	2.254	2.432	2.578	2.729	2.921
IG (10, 10)	0.651	1.676	0.039	1.604	1.645	1.676	1.706	1.747
IG (100, 100)	0.733	1.282	0.012	1.261	1.273	1.282	1.291	1.305
IG (1,000, 1,000)	0.751	1.196	0.009	1.181	1.189	1.195	1.202	1.212
Group-level variance of the predictor variable ($\tau_X^2 = .05$)								
ML	0.990	0.048	0.022	0.012	0.032	0.047	0.066	0.091
IG (.001, .001)	0.998	0.012	0.020	0.001	0.002	0.003	0.008	0.073
IG (.01, .01)	0.995	0.025	0.020	0.007	0.009	0.015	0.044	0.075
IG (.1, .1)	0.989	0.053	0.015	0.031	0.041	0.050	0.064	0.088
IG (1, 1)	0.978	0.108	0.012	0.089	0.099	0.107	0.117	0.133
IG (10, 10)	0.946	0.261	0.012	0.241	0.252	0.261	0.269	0.284
IG (100, 100)	0.866	0.641	0.008	0.627	0.634	0.641	0.647	0.656
IG (1,000, 1,000)	0.805	0.938	0.003	0.932	0.935	0.937	0.940	0.943

Note. In addition to the relative root mean squared error (RMSE), the mean (M), and the standard deviation (SD), the table shows the 5th, 25th, 50th, 75th, and 95th percentiles. ML = maximum likelihood estimation; IG = inverse gamma distribution; ICC_X = intraclass correlation of the predictor variable; β_b = group-level effect; $\frac{1}{Rel}$ = adjustment factor; τ_X^2 = group-level variance of the predictor variable.

Example JAGS/WinBUGS Code

```

model{
# N... total number of students
# group... indicator of class membership
# J... number of classes
# Y... mathematics achievement
# X... perceived teacher distractibility

# Likelihood
for(i in 1:N){
  Y[i] ~ dnorm(expr[i], invSigmaSqr.Y)
  expr[i] <- alpha + beta.w * (X[i] - X.b[group[i]])
               + beta.b * X.b[group[i]] + delta[group[i]]
  X[i] ~ dnorm(X.b[group[i]], invSigmaSqr.X)
}
for(j in 1:J){
  delta[j] ~ dnorm(0, invTauSqr.Y) #... between-class residual
  X.b[j] ~ dnorm(mu.X, invTauSqr.X) #... latent class mean
}

# Prior distributions
alpha ~ dnorm(0, 0.001) #... intercept
beta.w ~ dnorm(0, 0.001) #... within-class coefficient
beta.b ~ dnorm(0, 0.001) #... between-class coefficient
mu.X ~ dnorm(0, 0.001) # grand mean
sigmaSqr.Y ~ dunif(0, 100) #... within-class residual variance
invSigmaSqr.Y <- 1 / sigmaSqr.Y
sigmaSqr.X ~ dunif(0, 100) #... within-class variance of X
invSigmaSqr.X <- 1 / sigmaSqr.X
tauSqr.Y ~ dunif(0, 100) #... between-class residual variance
invTauSqr.Y <- 1 / tauSqr.Y
invTauSqr.X ~ dgamma( 0.001, 0.001 )
tauSqr.X <- 1 / tauSqr.X #... between-class variance of X
}

```