Multiple Imputation of Missing Data in Multilevel Designs: A Comparison of Different Strategies

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Supplemental Online Material

Enclosed in this document are the supplemental materials for our article entitled "Multiple Imputation of Missing Data in Multilevel Designs: A Comparison of Different Strategies". Supplement A contains the results of an additional simulation study that featured a multilevel model with random slopes as the data generating model. Supplement B contains the results of an additional simulation study that compared the procedures discussed in the main article under a data generating model with either manifest or latent group means. Supplement C contains the computer code that was used to calculate the data analysis example using the different missing data methods. Supplement D contains additional tables to the results reported in the article.

Supplement A: Simulation Results for Multilevel Model with Random Slopes

We conducted an additional simulation study in which we investigated the performance of the PAN approach for a multilevel model with random slopes:

$$Y_{ij} = \mu_Y + \beta_{W,YX} X_{W,ij} + \beta_{B,YX} X_{B,j} + \nu_{0j} + \nu_{1j} X_{W,ij} + \varepsilon_{ij} , \qquad (1)$$

where $\beta_{W,YX}$ and $\beta_{B,YX}$ are the within- and between-group regression coefficients; ν_{0j} and ν_{1j} are normally distributed random effects with mean zero and variances τ_0^2 and τ_1^2, and covariance τ_{01}. Note that the between part of the level-1 predictor is treated as a latent variable (see also model in Equation 6 in the main article). Preacher, Zhang, and Zyphur (in press) provide a detailed discussion of random slope models with latent between parts of level-1 variables.

We used selected conditions of the simulation in the main article and simulated $K = 150$ groups of medium size ($n = 15$), where the ICCs for X and Y were constrained to be equal and set to .10 or .30. The correlation within groups (ρ_W) was set to .35, and the correlation between groups (ρ_B) to .60. For simplicity's sake, the random effects were assumed to be independent of one another ($\tau_{01} = 0$), and the slope variance (τ_1^2) was varied with values

of .01, .05, .10, and .20. Missing data (deleting 25%) in either Y or X were induced by an MCAR or MAR mechanism by setting λ to 0 or .8 (see Equation 29 in the main article).

In addition to the PAN approach, which is based on a joint modeling approach, we also used a conditional model for imputing the missing data. In the case of missing values on Y, for instance, a multilevel model with random slopes is used in which Y is the dependent and X is the predictor variable. This approach was suggested for handling incomplete variables in models with random slopes (see Enders, Mistler, & Keller, in press). It was implemented in a chained equations framework (also known as "fully conditional specification", FCS) using the function `mice.impute.2l.pan` in the R package `mice` (van Buuren & Groothuis-Oudshoorn, 2011). To accommodate group-level effects of level-1 predictors in the imputation model, the observed group means were also included as additional predictors in the FCS approach (see Enders et al., in press). We used M*plus* 7.3 to estimate the multilevel model with random slopes. Note that M*plus* uses full information maximum likelihood estimation, which may result in slightly biased estimates of variance components. Thus, we included the results obtained from complete data sets as a benchmark.

The main questions were (a) whether the PAN approach provides valid estimators of $\beta_{W,YX}$ and $\beta_{B,YX}$ despite ignoring the slope variation, and (b) whether the FCS approach provides an improved estimation of the slope variance (τ_1^2) compared to the PAN approach. Table 1 presents the main results for the bias and the coverage rates of the 95% confidence intervals when the slope variance is large ($\tau_1^2 = .20$).

First, in the case where the dependent variable is incomplete ($Y \sim X$), both the PAN approach and the FCS approach produced approximately unbiased estimates of the within-group and between-group regression coefficient. For the variance components, the estimators provided by the FCS approach were very close to those obtained from the complete data sets, whereas the PAN approach underestimated the slope variance. It is also worth noting that the coverage rates produced by the PAN approach were lower than the nominal

Table 1

Bias and Coverage of the 95% Confidence Interval for the Estimators of the Fixed Effects and Variance Components in the Random Slope Model (Y on X) for Large Intraclass Correlations ($\rho_{I,X} = \rho_{I,Y} = .30$)

	MCAR ($\lambda = 0$)						MAR ($\lambda = 0.8$)					
	Bias			Coverage (95%)			Bias			Coverage (95%)		
	CD	PAN	FCS	CD	PAN	FCS	CD	PAN	FCS	CD	PAN	FCS
	Missing $Y \sim X$ (25%)											
$\beta_{W,YX}$ (.350)	.001	.000	.001	.935	**.879**	.940	.001	.000	.001	.943	**.851**	.943
$\beta_{B,YX}$ (.600)	−.005	−.005	−.005	.952	.951	.951	.000	−.001	.001	.950	.949	.950
τ_0^2 (.192)	**.025**	.005	**.028**				**.025**	**.016**	**.026**			
τ_1^2 (.200)	**−.021**	**−.100**	**−.019**				**−.022**	**−.130**	**−.023**			
	Missing $X \sim Y$ (25%)											
$\beta_{W,YX}$ (.350)	−.003	−.005	**−.018**	.945	**.897**	.912	.002	.002	**−.020**	.952	.902	.918
$\beta_{B,YX}$ (.600)	−.000	−.001	.001	.938	.942	.939	.010	.010	.022	.946	.953	.949
τ_0^2 (.192)	**.025**	.006	**.016**				**.024**	.005	**.011**			
τ_1^2 (.200)	**−.023**	**−.089**	**−.052**				**−.022**	**−.106**	**−.062**			

Note. Biases larger than 5% and coverage values lower than 90% are written in bold. True values are given in parentheses. $\beta_{W,YX}$ = within-group regression coefficient; $\beta_{B,YX}$ = between-group regression coefficient; τ_0^2 = intercept variance; τ_1^2 = slope variance; CD = complete data; PAN = two-level joint model; FCS = two-level conditional model.

95%. This could be explained by the fact that the slope variance is ignored in the imputation model of the PAN approach and that this in turn results in standard errors that are too small because this extra uncertainty is not taken into account when the imputations are generated (see Carpenter & Kenward, 2013).

In the more challenging condition where the predictor variable is incomplete ($X \sim Y$), the results for the PAN approach were almost identical, and the PAN approach continued to provide approximately unbiased estimates for the regression coefficients. However, as we see, the FCS approach underestimated the slope variance. The estimated relative bias (-29% for $\tau_1^2 = .10$) matches the relative bias that is reported by Enders et al. (in press; see Table 2) under similar conditions. Furthermore, the FCS approach led to a small positive bias for the between-group regression coefficient (under MAR) and a small negative bias
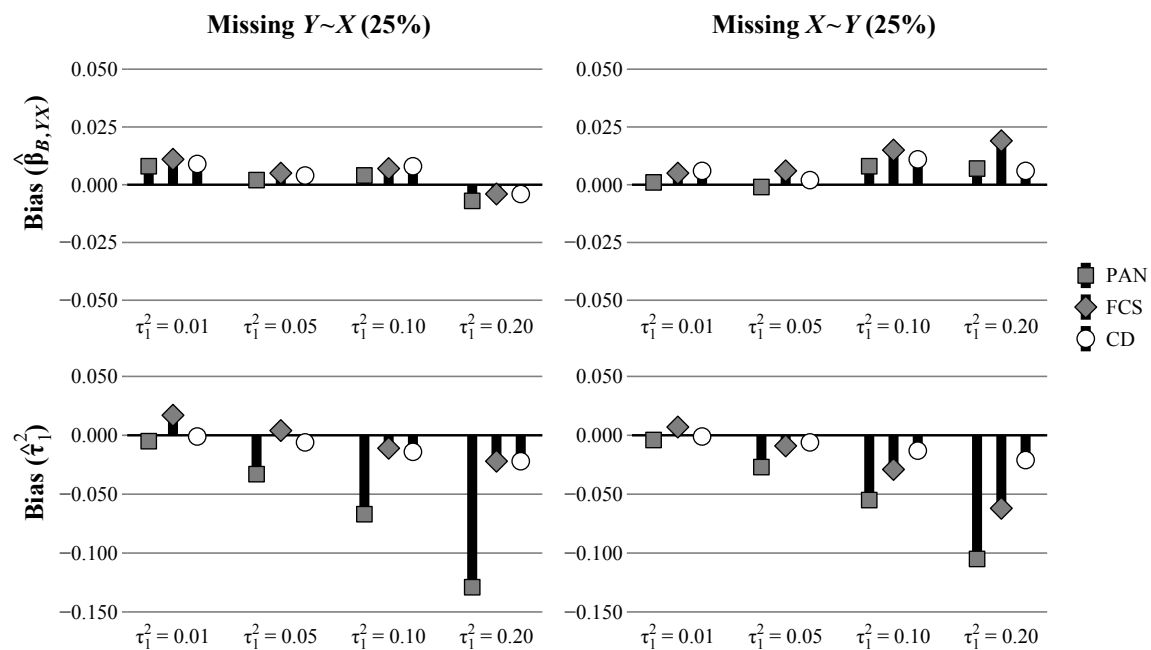
Figure 1. Bias for the between-group regression coefficient and the slope variance for different values of the (true) slope variance (τ_1^2). PAN = two-level joint model; FCS = two-level conditional model; CD = complete data.

for the within-group regression coefficient (under both MAR and MCAR). As shown in Figure 1, the magnitude of the biases depended on the size of the true slope variance.

For very small values of the slope variance, neither the PAN nor the FCS approach produced biased estimates. However, as the true slope variance increased ($\tau_1^2 = .05$ or larger), both the PAN and the FCS approach provided negatively biased estimates of the slope variance. We also see that the bias for the estimator of the between-group coefficient in the FCS approach was relatively low but increased in size as the true slope grew larger.

In conclusion, the additional simulation suggested that the PAN approach also seems to provide approximately unbiased estimators of the within-group and between-group regression coefficients in models with random slopes. As expected, the estimates of the slope variance provided by the PAN approach were negatively biased. When the predictor variable is incomplete (i.e., the variable with a random slope), also the FCS approach

produced biased estimates of the slope variance. These results suggest that estimates of slope variation in multilevel models with random slopes and incomplete predictor variables should be interpreted with caution (see also Grund, Lüdtke, & Robitzsch, in press).

Supplement B: Equivalence of Multilevel Imputation Models with Latent and Manifest Group Means

There are two main approaches to estimating multilevel models with contextual effects. In the first approach, the group mean of the level-1 predictor variable is treated as an observed or manifest variable (see Raudenbush & Bryk, 2002). This approach has traditionally been used in multilevel modeling and can result in biased estimates of group-level effects (especially when the ICC of the predictor X is low and/or the group sizes are small). In the second approach, the group mean of the level-1 predictor is treated as latent (multilevel latent covariate model; see Lüdtke et al., 2008), and the group-level effect (i.e., the between-group effect) is controlled for error that is due to measuring a latent mean through the mean of a sample of finite size. This approach is currently the default in the software Mplus, and it is the one we use in our study.

The simulation results of our study show that if a researcher is interested in using the second approach (with latent means), the PAN approach is appropriate under most of the included conditions—problems were mainly observed with small groups and low ICC. This finding is consistent with the imputation model of the PAN approach ("empty model"; see Equation 24), which preserves the relations at the group level by treating the group means (or between parts of the level-1 variables) as latent variables. It is an important question, whether the PAN approach can also be used when the model of interest is a multilevel model with manifest group means. To answer this question, we conducted an additional simulation in which the multilevel random-intercept model with manifest means was the analysis model (and also the data-generating model). More specifically, for the model with manifest means we used the observed group mean of the predictor X by calculating $\bar{X}_{\bullet j} = \sum_{i=1}^{n_j} X_{ij}$ and treat

it as a manifest variable (see Raudenbush & Bryk, 2002):

$$Y_{ij} = \beta_0 + \beta_{W,YX}^{man}(X_{ij} - \bar{X}_{\bullet j}) + \beta_{B,YX}^{man}\bar{X}_{\bullet j} + \varepsilon_{ij} , \qquad (2)$$

where β_0 is the regression intercept, $\beta_{W,YX}^{man}$ is the within-group regression coefficient describing the relationship between Y and X within groups, and $\beta_{B,YX}^{man}$ is the between-group regression coefficient that indicates the relationship between group means. The crucial question is whether the PAN approach is also appropriate if the multilevel model with manifest group means is the model of interest.

First, we assumed that the multilevel random-intercept model with manifest group means holds in the population (see Study 3 in Lüdtke et al., 2008, for a description of the data-generating procedure). We used selected conditions of the simulation in the main article and varied the group size (n = 5 and 15), the ICC of X and Y (.10 and .30), and the missing mechanism (MCAR and MAR). The other conditions were held constant: number of groups (K = 150), within-group correlation (ρ_W = .35), between-group correlation (ρ_B = .60), and missing data rate (25%). For each data set, missing data were imputed using the PAN approach. After imputing the missing values on Y, data sets were analyzed with a multilevel random-intercept model with manifest group means for the level-1 predictor using M*plus* 7.3. We focused on the scenario when missing values occur on the predictor variable.

Table 2 shows that the PAN approach produces approximately unbiased estimates of the between-group regression coefficient (i.e., constellation with an incomplete predictor variable Y and a fully observed dependent variable X) with coverage rates near the nominal value in most conditions. In conditions with a small intraclass correlation and a small group size, the estimator provided by the PAN approach was slightly negatively biased (-14.5% in relative terms). However, the magnitude of this bias was comparable to the bias of the PAN approach when the analysis model (and data-generating model) was the multilevel

Table 2

Bias and Coverage of the 95% Confidence Interval for the Estimators of the Between-Group Regression Coefficient in a Multilevel Model with Manifest Group Means ($\beta_{B,YX}^{man}$) for a Large Number of Groups (K = 150)

| | | MCAR ($\lambda = 0$) | | | | MAR ($\lambda = 0.8$) | | | |
| | | Bias | | Coverage (95%) | | Bias | | Coverage (95%) | |
ρ_I	n	PAN	CD	PAN	CD	PAN	CD	PAN	CD
0.1	5	$-.087$	.003	94.3	93.9	$-.086$	.003	95.2	93.9
0.1	15	$-.024$	$-.002$	95.3	92.5	$-.030$	$-.002$	95.5	92.5
0.3	5	$-.010$	.003	95.6	94.6	$-.013$	.003	96.2	94.6
0.3	15	.001	$-.001$	94.6	93.9	$-.004$	$-.001$	94.5	93.3

Note. Biases larger than 10% and coverage values lower than 90% are written in bold. True value $\beta_{B,YX} = .600$. ρ_I = intraclass correlation of X and Y; n = group size; CD = complete data; PAN = two-level joint model.

random-intercept model with latent group means (-15.2%; see Table 2 in the main article).

In the following, we provide a formal argument explaining why the PAN approach is also appropriate for the imputation of missing data, when the multilevel model with manifest group means holds in the population. Vice versa, this argument also suggests that a multilevel model with manifest group means can be used when the population model is the one with latent group means, thus making both models suitable for MI in either case.

The main idea is that the covariance structure of the empty model of the PAN approach (see Equation 24 in the main article) can be equivalently represented by a multilevel model with manifest group means (see Carpenter & Kenward, 2013, p. 221). Consider a two-level structure in which two individual-level variables X_{ij} and Y_{ij} are decomposed into latent within- and between-group components (see Equation 3 in the main article). Then, the covariance matrices of X and Y within and between groups can be written as follows:

$$\Sigma_W = \begin{pmatrix} \sigma_X^2 & \rho_W \sigma_X \sigma_Y \\ \rho_W \sigma_X \sigma_Y & \sigma_Y^2 \end{pmatrix} \quad \text{and} \quad \Sigma_B = \begin{pmatrix} \tau_X^2 & \rho_B \tau_X \tau_Y \\ \rho_B \tau_X \tau_Y & \tau_Y^2 \end{pmatrix}, \quad (3)$$

where $\mathbf{\Sigma}_W$ is a within-group covariance matrix and $\mathbf{\Sigma}_B$ a between-group covariance matrix. Let us further assume that the within and between components are normally distributed and the group sizes are balanced (with size n). It has been shown in the literature that the bivariate multilevel random-intercept model can also be represented as a multivariate single level model with $2 \cdot n$ variables (Mehta & Neale, 2005, pp. 265). Let $\mathbf{X}_j = (X_{1j}, \ldots, X_{nj})$ and $\mathbf{Y}_j = (Y_{1j}, \ldots, Y_{nj})$ denote the vectors for X and Y variables of the persons i in a specific group j. Carpenter and Kenward (2013, p. 221; see also Mehta & Neale, 2005) show that the vector $(\mathbf{X}_j, \mathbf{Y}_j)$ for a group j is multivariate normally distributed with a mean vector including $2 \cdot n$ means of X and Y, and a covariance matrix

$$\mathbf{\Sigma} = \begin{pmatrix} \tau_X^2 \mathbf{J} + \sigma_X^2 \mathbf{I} & \rho_B \tau_X \tau_Y \mathbf{J} + \rho_W \sigma_X \sigma_Y \mathbf{I} \\ \rho_B \tau_X \tau_Y \mathbf{J} + \rho_W \sigma_X \sigma_Y \mathbf{I} & \tau_Y^2 \mathbf{J} + \sigma_Y^2 \mathbf{I} \end{pmatrix} \tag{4}$$

where $\mathbf{J}$ is $n \times n$ matrix in which all entries are equal to one, and $\mathbf{I}$ is the $n \times n$ identity matrix which has ones in the diagonal and zeros as all other entries. Generating imputations from the bivariate multilevel normal model (i.e., the PAN approach) when only some of the $\mathbf{Y}_j$ values are missing basically means drawing imputations from the conditional distribution $P(\mathbf{Y}_j | \mathbf{X}_j)$. Note that the joint distribution $P(\mathbf{X}_j, \mathbf{Y}_j)$ is also given by the product of the conditional distribution $P(\mathbf{Y}_j | \mathbf{X}_j)$ and the marginal distribution $P(\mathbf{X}_j)$, i.e. $P(\mathbf{X}_j, \mathbf{Y}_j) = P(\mathbf{X}_j) \cdot P(\mathbf{Y}_j | \mathbf{X}_j)$. As the joint distribution $P(\mathbf{X}_j, \mathbf{Y}_j)$ is multivariate normal, the conditional distribution $P(\mathbf{Y}_j | \mathbf{X}_j)$ is also multivariate normal. Using a formula for the inversion of a structured covariance matrix (Magnus & Neudecker, 1988), it can be shown that the conditional mean of the distribution $P(\mathbf{Y}_j | \mathbf{X}_j)$ is a function of the vector $\mathbf{X}_j$ and the manifest group mean (Carpenter & Kenward, 2013, p. 221). The conditional mean of each component $E(Y_{ij} | \mathbf{X}_j)$ is then given by

$$E(Y_{ij} | \mathbf{X}_j) = \beta_0 + \beta_{W,YX}^{man}(X_{ij} - \bar{X}_{\bullet j}) + \beta_{B,YX}^{man} \bar{X}_{\bullet j}, \tag{5}$$

where the coefficients $\beta_{W,YX}^{man} = \rho_W \sigma_Y / \sigma_X$ and $\beta_{B,YX}^{man} = (\rho_B \tau_X \tau_Y + \rho_W \sigma_X \sigma_Y / n)/(\tau_X^2 + \sigma_X^2/n)$ can be directly calculated from the entries of the covariance matrices $\boldsymbol{\Sigma}_W$ and $\boldsymbol{\Sigma}_B$ (Carpenter & Kenward, 2013, p. 221). Furthermore, the conditional covariance of the distribution $P(\mathbf{Y}_j|\mathbf{X}_j)$ can be written as $\tau_e^2 \mathbf{J} + \sigma_e^2 \mathbf{I}$ with variance components $\tau_e^2 = \tau_Y^2 - (\rho_B \tau_X \tau_Y + \rho_W \sigma_X \sigma_Y / n)^2/(\tau_X^2 + \sigma_X^2/n)$ and $\sigma_e^2 = \sigma_Y^2(1 - \rho_W^2)$. These findings show that the conditional distribution $P(\mathbf{Y}_j|\mathbf{X}_j)$ is consistent with a multilevel random-intercept model with manifest group means with a level-2 variance τ_e^2 and level-1 variance σ_e^2. Therefore, drawing imputations from the model with manifest group means is an appropriate imputation strategy when the multilevel model with latent group means holds in the population.

A similar argument can be used in the opposite case, if the PAN approach is used as an imputation model and the analysis model is a multilevel model with manifest group means. In this scenario, one has to show that the multivariate distribution $P(\mathbf{X}_j, \mathbf{Y}_j)$ of the PAN approach (Equation 4) follows, if the multilevel model with manifest group means holds in the population. Let us again assume that X_{ij} is decomposed into normally distributed between-group and within-group components (with corresponding variances τ_X^2 and σ_X^2, respectively), and that group sizes are balanced. If the multilevel model with manifest group means holds, the conditional mean of the conditional distribution $P(\mathbf{Y}_j|\mathbf{X}_j)$ has the form given in Equation 5, and the conditional covariance matrix is given by $\tau_e^2 \mathbf{J} + \sigma_e^2 \mathbf{I}$. Using the relation $P(\mathbf{X}_j, \mathbf{Y}_j) = P(\mathbf{X}_j) \cdot P(\mathbf{Y}_j|\mathbf{X}_j)$, the joint distribution $P(\mathbf{X}_j, \mathbf{Y}_j)$ is then multivariate normal with covariance matrix

$$\boldsymbol{\Sigma} = \begin{pmatrix} \tau_X^2 \mathbf{J} + \sigma_X^2 \mathbf{I} & \psi_{YX} \mathbf{J} + \sigma_{YX} \mathbf{I} \\ \psi_{YX} \mathbf{J} + \sigma_{YX} \mathbf{I} & \tau_Y^2 \mathbf{J} + \sigma_Y^2 \mathbf{I} \end{pmatrix} \tag{6}$$

where all parameters in this matrix can be calculated as functions from the marginal distribution $P(\mathbf{X}_j)$ and the parameters from the model with manifest group means $P(\mathbf{Y}_j|\mathbf{X}_j)$. More specifically, it holds that $\psi_{YX} = -\beta_{W,YX}^{man} \cdot 1/n \cdot \sigma_X^2 + \beta_{B,YX}^{man}(\tau_X^2 + \sigma_X^2/n)$, $\sigma_{YX} = \beta_{W,YX}^{man} \sigma_X^2$, $\tau_Y^2 = -(\beta_{W,YX}^{man})^2 \cdot 1/n \cdot \sigma_X^2 + (\beta_{B,YX}^{man})^2(\tau_X^2 + \sigma_X^2/n) + \tau_e^2$, and $\sigma_Y^2 = (\beta_{W,YX}^{man})^2 \sigma_X^2 + \sigma_e^2$. Hence,

the covariance structure implied by the model with manifest group means is identical to the covariance structure of the empty model of the PAN approach. This result shows that the PAN approach can be used as an imputation model, even when the multilevel model with manifest group means is the model of interest.

Based on the finding of the equivalence of the imputation models with latent group means and manifest group means (for normally distributed multilevel data with balanced group sizes), we expect that imputations generated by a joint imputation approach (i.e., the PAN approach) and a fully conditional approach (using multilevel models with manifest group means as conditional distributions) perform similarly and will imply the same covariance structure among the variables (see Enders et al., in press). A similar argument was also made by Mistler (2015).

Supplement C: R Code for the Data Analysis Example

This section contains the R code used for the analysis example in which the different missing data methods have been applied to a large empirical dataset from educational research (students nested within classes). The example dataset included the class indicator variable, and five partially observed variables that were measured at the student level.

```
library(pan)
library(mice)
library(foreign)

dat0 <- read.spss("", to.data.frame=TRUE)
dat <- dat0[dat0$itpart2=="PARTICIPATED ", c("idclass_FDZ","sfm_10","sfm_13","scrlmle",
  "sfk_6_1","sfk_4_1")]
colnames(dat) <- c("ID","MathDis","MathAnx","ReadAch","GermDis","SchClimate")


# *** .............................................
# structure of the dataset
#
# ---------------------------------------------------
#   Variable  Description
# ---------------------------------------------------
```

```
#        ID  class indicator variable
#    MathDis  disciplinary problems in mathematics
#    MathAnx  teacher-related anxiety in mathematics
#    ReadAch  reading achievement scores
#    GermDis  disciplinary problems in German
# SchClimate  perceived school climate
# --------------------------------------------------



# *** ............................................
# 1) NORM approach
# multilevel structure of the data is ignored in the imputation model

predMatrix <- 1 + 0 * diag(ncol(dat))
rownames(predMatrix) <- colnames(predMatrix) <- colnames(dat)
predMatrix[,"ID"] <- 0
diag(predMatrix) <- 0

# run imputation
imp0 <- mice( data = as.matrix(dat), m=10, maxit=100, seed=1234,
              imputationMethod=c( "", rep("norm", ncol(dat)-1) ),
              predictorMatrix=predMatrix )

imp <- as.list(1:10)
for(ii in 1:10){ imp[[ii]] <- complete( imp0, action=ii) }


# *** ............................................
# 2) DI approach
# multilevel structure is represented by dummy indicator variables

predMatrix <- 1 + 0 * diag(ncol(dat))
rownames(predMatrix) <- colnames(predMatrix) <- colnames(dat)
predMatrix[,"ID"] <- 1
diag(predMatrix) <- 0

cdat <- dat
cdat$ID <- as.factor(cdat$ID)

# run imputation
imp0 <- mice( data=cdat, m=10, maxit=100, seed=1234,
              imputationMethod=c( "", rep("norm", ncol(cdat)-1) ),
              predictorMatrix=predMatrix )

imp <- as.list(1:10)
for(ii in 1:10){ imp[[ii]] <- complete( imp0, action=ii) }
```

```
# *** ..........................................
# 3) PAN approach
# two-level imputation model

subj <- dat[,1]
y <- as.matrix(dat[,-1])
pred <- matrix(1,nrow(dat),1)

xcol <- 1
zcol <- 1

prior <- list( a=ncol(y),
               Binv=diag(1,ncol(y)),
               c=ncol(y)*length(zcol),
               Dinv=diag(1,ncol(y)*length(zcol)) )

n.burn <- 2000
n.each <- 100

# run burn-in
burnin <- pan(y, subj, pred, xcol, zcol, prior, seed=1234, iter=n.burn)

current <- burnin
imp <- as.list(1:10)

# run imputation
for(ii in 1:10){
  current <- pan(y, subj, pred, xcol, zcol, prior, seed=1234+ii, iter=n.each,
    start=current$last)
  imp[[ii]] <- data.frame(ID=subj, current$y)
}


# *** ..........................................
# 4) listwise deletion (LD)

datLD <- na.omit(dat[,c("ID","MathDis","MathAnx")])
```

Supplement D: Additional Tables

The following pages contain the complete simulation results for the intraclass correlation of Y, and the between-group and within-group regression coefficients in the multilevel regression models of X on Y and Y on X, respectively. We included the results for bias, RMSE, and (where possible) the coverage rates of the 95% CI. The results for the intraclass correlation of Y are presented in Table A1 to A16. The results for the between- and within-group regression coefficients with X regressed on Y are presented in Table B1 to B24 and Table C1 to C24, respectively. Table D1 to D24 and Table E1 to E24 contain the results for the between- and within-group regression coefficients for Y regressed on X, respectively.

Table A1

Bias of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y}$ = .10, Given $\rho_{I,X}$ = .10 and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35)															
K = 50															
n = 5	−.038	.109	.020	−.004	−.003	−.039	.109	.019	−.005	−.003	−.041	.108	.015	−.008	−.007
n = 15	−.041	.029	.002	−.003	−.004	−.041	.029	.003	−.005	−.007	−.041	.031	.003	−.003	−.006
n = 30	−.040	.013	.000	−.002	−.002	−.040	.014	.001	−.002	−.003	−.039	.015	.001	−.002	−.004
K = 150															
n = 5	−.041	.112	.009	−.003	−.003	−.039	.115	.012	−.003	−.004	−.040	.118	.010	−.003	−.005
n = 15	−.039	.032	.002	−.001	−.001	−.039	.033	.002	−.001	−.002	−.039	.033	.001	−.001	−.004
n = 30	−.038	.017	.001	−.001	−.001	−.039	.015	.000	−.001	−.002	−.039	.016	.000	−.001	−.003
Large correlation at level 2 (ρ_B = .60)															
K = 50															
n = 5	−.038	.103	.017	−.007	−.007	−.036	.106	.018	−.004	−.006	−.035	.112	.020	−.004	−.009
n = 15	−.038	.027	.002	−.004	−.005	−.036	.031	.006	−.004	−.006	−.036	.032	.005	−.003	−.011
n = 30	−.037	.013	.000	−.003	−.004	−.036	.013	.001	−.003	−.004	−.036	.015	.002	−.003	−.010
K = 150															
n = 5	−.034	.115	.014	.000	.000	−.036	.113	.012	−.002	−.006	−.036	.118	.011	−.001	−.010
n = 15	−.035	.032	.003	−.001	−.001	−.036	.033	.003	−.001	−.004	−.035	.034	.002	−.001	−.009
n = 30	−.035	.015	.001	−.001	−.001	−.035	.015	.001	−.001	−.003	−.035	.016	.001	−.001	−.009

Note. *K* = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A2

Bias of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y} = .10$, Given $\rho_{I,X} = .30$ and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
$K = 50$															
$n = 5$	−.036	.109	.018	−.004	−.004	−.034	.112	.021	−.004	−.003	−.034	.118	.016	−.005	−.008
$n = 15$	−.037	.029	.003	−.005	−.005	−.036	.030	.003	−.004	−.007	−.035	.037	.003	−.004	−.010
$n = 30$	−.036	.012	−.001	−.003	−.003	−.034	.015	.002	−.002	−.004	−.033	.017	.001	−.002	−.008
$K = 150$															
$n = 5$	−.035	.114	.012	−.001	−.002	−.034	.119	.012	−.001	−.003	−.033	.129	.011	−.001	−.007
$n = 15$	−.034	.033	.002	−.001	−.001	−.034	.033	.002	−.001	−.003	−.033	.040	.002	−.001	−.007
$n = 30$	−.034	.016	.001	−.001	.000	−.034	.015	.000	−.001	−.003	−.032	.019	.001	−.001	−.007
Large correlation at level 2 ($\rho_B = .60$)															
$K = 50$															
$n = 5$	−.029	.106	.021	−.004	−.004	−.028	.110	.021	−.005	−.008	−.024	.127	.026	−.005	−.017
$n = 15$	−.029	.029	.005	−.003	−.003	−.028	.031	.005	−.002	−.007	−.026	.038	.007	−.004	−.018
$n = 30$	−.028	.013	.001	−.002	−.003	−.029	.013	.000	−.003	−.007	−.026	.017	.002	−.003	−.018
$K = 150$															
$n = 5$	−.027	.115	.015	−.001	−.002	−.027	.117	.014	−.002	−.007	−.026	.128	.014	−.001	−.017
$n = 15$	−.027	.032	.003	−.002	−.002	−.027	.033	.002	−.002	−.006	−.026	.040	.003	−.001	−.016
$n = 30$	−.027	.015	.001	−.001	−.001	−.027	.016	.001	−.001	−.005	−.026	.017	.000	−.001	−.015

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A3

Bias of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y} = .30$, Given $\rho_{I,X} = .10$ and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	–.131	.057	–.011	–.011	–.014	–.127	.065	–.003	–.008	–.007	–.130	.061	–.009	–.012	–.012
n = 15	–.130	.010	–.009	–.008	–.008	–.128	.011	–.009	–.009	–.010	–.126	.014	–.007	–.007	–.008
n = 30	–.128	.000	–.009	–.008	–.008	–.127	.003	–.007	–.008	–.008	–.127	.001	–.009	–.007	–.007
K = 150															
n = 5	–.124	.070	–.001	–.002	–.002	–.127	.068	–.005	–.005	–.006	–.124	.070	–.004	–.004	–.005
n = 15	–.124	.018	–.002	–.002	–.003	–.124	.018	–.002	–.002	–.002	–.123	.019	–.003	–.003	–.003
n = 30	–.124	.008	–.002	–.002	–.002	–.124	.007	–.003	–.003	–.002	–.123	.008	–.002	–.003	–.002
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	–.120	.064	–.003	–.010	–.010	–.123	.061	–.006	–.008	–.012	–.124	.059	–.011	–.012	–.020
n = 15	–.120	.013	–.006	–.007	–.008	–.121	.012	–.008	–.007	–.010	–.119	.014	–.006	–.008	–.015
n = 30	–.122	.000	–.009	–.010	–.010	–.120	.003	–.006	–.006	–.008	–.119	.003	–.007	–.007	–.012
K = 150															
n = 5	–.118	.069	–.001	–.001	–.001	–.117	.069	–.001	–.002	–.005	–.117	.070	–.004	–.003	–.011
n = 15	–.116	.019	–.001	–.003	–.003	–.116	.019	–.001	–.002	–.004	–.116	.019	–.002	–.002	–.009
n = 30	–.116	.009	–.001	–.002	–.002	–.117	.007	–.003	–.002	–.003	–.116	.007	–.003	–.004	–.009

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A4

Bias of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y} = .30$, Given $\rho_{I,X} = .30$ and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
						Moderate correlation at level 2 ($\rho_B = .35$)									
K = 50															
n = 5	−.125	.060	−.009	−.009	−.012	−.119	.064	−.005	−.008	−.011	−.119	.069	−.010	−.010	−.018
n = 15	−.118	.015	−.004	−.005	−.005	−.120	.013	−.007	−.007	−.009	−.114	.018	−.005	−.007	−.012
n = 30	−.119	.003	−.007	−.007	−.007	−.116	.004	−.005	−.008	−.009	−.115	.003	−.009	−.008	−.013
K = 150															
n = 5	−.120	.064	−.007	−.004	−.006	−.120	.067	−.008	−.006	−.010	−.111	.081	.000	.000	−.006
n = 15	−.117	.017	−.003	−.004	−.004	−.114	.021	−.001	−.002	−.003	−.111	.023	−.001	−.003	−.009
n = 30	−.118	.006	−.004	−.003	−.003	−.115	.008	−.002	−.003	−.005	−.112	.009	−.003	−.003	−.008
						Large correlation at level 2 ($\rho_B = .60$)									
K = 50															
n = 5	−.108	.058	−.006	−.010	−.011	−.106	.065	−.003	−.009	−.015	−.104	.069	−.005	−.010	−.031
n = 15	−.103	.014	−.005	−.007	−.007	−.104	.013	−.007	−.009	−.013	−.102	.016	−.008	−.009	−.026
n = 30	−.107	−.001	−.011	−.009	−.009	−.102	.004	−.006	−.008	−.011	−.100	.003	−.008	−.008	−.024
K = 150															
n = 5	−.099	.071	.003	−.002	−.002	−.100	.069	−.002	−.004	−.009	−.098	.076	−.003	−.004	−.024
n = 15	−.100	.019	−.001	−.002	−.002	−.100	.019	−.002	−.003	−.007	−.096	.023	−.001	−.002	−.019
n = 30	−.101	.008	−.002	−.003	−.003	−.100	.007	−.003	−.003	−.007	−.097	.010	−.002	−.003	−.020

Note. *K* = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A5

Bias of the Estimator of the Intraclass Correlation of Y for a True Value of ρ_{I,Y} = .10, Given ρ_{I,X} = .10 and 50% Missing Data

Moderate correlation at level 2 ($\rho_B = .35$)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
$n = 5$	–.061	.263	.055	–.006	.000	–.059	.264	.056	–.005	.001	–.060	.266	.057	–.004	–.002
$n = 15$	–.067	.094	.015	–.003	–.004	–.067	.096	.016	–.004	–.006	–.066	.102	.016	–.002	–.007
$n = 30$	–.067	.045	.007	–.002	–.003	–.067	.046	.006	–.003	–.005	–.067	.048	.005	–.003	–.008
K = 150															
$n = 5$	–.064	.273	.035	–.002	–.001	–.064	.275	.035	–.002	–.001	–.064	.276	.034	–.003	–.003
$n = 15$	–.067	.097	.007	–.002	–.002	–.066	.101	.009	–.001	–.001	–.065	.107	.008	–.001	–.005
$n = 30$	–.066	.047	.003	–.001	–.002	–.066	.047	.002	–.002	–.003	–.065	.052	.003	–.001	–.004

Large correlation at level 2 ($\rho_B = .60$)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
$n = 5$	–.057	.261	.056	–.007	.000	–.059	.262	.055	–.006	–.003	–.056	.262	.056	–.004	–.006
$n = 15$	–.062	.093	.018	–.002	–.004	–.062	.095	.018	–.004	–.007	–.061	.104	.019	–.002	–.013
$n = 30$	–.062	.044	.007	–.003	–.004	–.062	.045	.006	–.003	–.006	–.061	.050	.009	–.002	–.013
K = 150															
$n = 5$	–.061	.273	.036	–.001	–.003	–.059	.273	.037	–.002	–.004	–.060	.274	.035	.000	–.011
$n = 15$	–.061	.097	.010	–.001	–.002	–.061	.099	.010	–.001	–.004	–.061	.107	.009	–.001	–.013
$n = 30$	–.061	.047	.004	–.001	–.001	–.060	.049	.006	.000	–.003	–.060	.052	.004	.000	–.011

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A6

Bias of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y}$ = .10, Given $\rho_{I,X}$ = .30 and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35)															
K = 50															
n = 5	−.053	.265	.060	−.004	.006	−.049	.269	.062	−.004	.004	−.048	.271	.062	−.003	.000
n = 15	−.057	.092	.016	−.003	−.004	−.057	.099	.016	−.004	−.007	−.055	.126	.017	−.002	−.011
n = 30	−.057	.043	.005	−.003	−.004	−.056	.049	.007	−.004	−.007	−.054	.063	.008	−.003	−.010
K = 150															
n = 5	−.056	.275	.035	−.002	.000	−.055	.275	.033	−.003	−.006	−.052	.281	.035	−.001	−.007
n = 15	−.057	.096	.007	−.001	−.002	−.056	.105	.008	−.001	−.004	−.054	.133	.008	−.001	−.008
n = 30	−.056	.048	.004	−.001	−.001	−.055	.051	.004	−.001	−.003	−.053	.067	.004	−.001	−.008
Large correlation at level 2 (ρ_B = .60)															
K = 50															
n = 5	−.043	.263	.062	−.004	.001	−.043	.264	.063	−.005	−.002	−.041	.268	.061	−.006	−.014
n = 15	−.046	.094	.020	−.003	−.004	−.046	.101	.020	−.004	−.010	−.045	.127	.021	−.003	−.023
n = 30	−.046	.045	.009	−.002	−.003	−.044	.049	.010	−.002	−.007	−.044	.062	.009	−.002	−.022
K = 150															
n = 5	−.044	.272	.042	−.002	−.001	−.045	.273	.040	−.001	−.005	−.043	.275	.039	−.002	−.018
n = 15	−.045	.096	.011	−.001	−.002	−.044	.105	.012	−.001	−.007	−.042	.134	.013	−.001	−.019
n = 30	−.044	.048	.006	.000	.000	−.044	.050	.004	−.001	−.007	−.043	.066	.005	−.001	−.021

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A7

Bias of the Estimator of the Intraclass Correlation of Y for a True Value of ρ_{I,y} = .30, Given ρ_{I,x} = .10 and 50% Missing Data

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
						Moderate correlation at level 2 (ρ_B = .35)									
K = 50															
n = 5	–.218	.166	.001	–.009	–.013	–.218	.163	–.002	–.009	–.017	–.213	.159	–.005	–.013	–.017
n = 15	–.215	.051	–.006	–.009	–.009	–.215	.050	–.010	–.010	–.012	–.212	.059	–.007	–.008	–.010
n = 30	–.214	.021	–.008	–.009	–.009	–.213	.023	–.006	–.006	–.007	–.211	.026	–.005	–.007	–.008
K = 150															
n = 5	–.214	.176	–.001	–.002	–.003	–.214	.173	–.004	–.005	–.008	–.211	.177	.001	–.004	–.005
n = 15	–.213	.057	–.004	–.002	–.002	–.213	.059	–.003	–.003	–.004	–.210	.063	–.005	–.004	–.004
n = 30	–.213	.026	–.003	–.003	–.003	–.213	.026	–.004	–.003	–.003	–.210	.029	–.003	–.002	–.002
						Large correlation at level 2 (ρ_B = .60)									
K = 50															
n = 5	–.208	.160	–.002	–.011	–.015	–.208	.164	.002	–.008	–.016	–.206	.159	–.003	–.009	–.024
n = 15	–.205	.054	–.003	–.007	–.008	–.204	.053	–.005	–.005	–.009	–.203	.058	–.006	–.008	–.018
n = 30	–.204	.023	–.005	–.007	–.007	–.203	.023	–.006	–.006	–.009	–.202	.024	–.006	–.006	–.016
K = 150															
n = 5	–.204	.174	.002	–.004	–.006	–.203	.176	.001	–.001	–.006	–.202	.170	–.004	–.004	–.017
n = 15	–.204	.057	–.004	–.003	–.004	–.202	.060	–.001	–.003	–.006	–.200	.064	–.003	–.002	–.012
n = 30	–.201	.030	.001	–.001	.000	–.201	.028	–.002	–.002	–.004	–.200	.029	–.003	–.003	–.012

Note. *K* = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A8

Bias of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y}$ = .30, Given $\rho_{I,X}$ = .30 and 50% Missing Data

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35)															
K = 50															
n = 5	−.203	.165	.001	−.010	−.014	−.199	.166	.004	−.011	−.018	−.195	.164	.001	−.010	−.024
n = 15	−.203	.049	−.011	−.010	−.012	−.198	.057	−.005	−.006	−.010	−.194	.075	−.006	−.008	−.018
n = 30	−.199	.021	−.007	−.005	−.007	−.197	.026	−.004	−.005	−.008	−.191	.033	−.007	−.007	−.015
K = 150															
n = 5	−.200	.174	−.004	−.006	−.010	−.196	.180	.002	−.003	−.006	−.190	.177	.002	−.001	−.011
n = 15	−.198	.059	−.001	−.002	−.003	−.196	.065	.000	−.001	−.004	−.191	.079	−.003	−.004	−.012
n = 30	−.198	.027	−.002	−.002	−.002	−.197	.029	−.003	−.002	−.005	−.190	.040	−.002	−.002	−.009
Large correlation at level 2 (ρ_B = .60)															
K = 50															
n = 5	−.180	.163	.008	−.010	−.013	−.179	.164	.004	−.011	−.025	−.172	.156	.002	−.013	−.045
n = 15	−.176	.054	−.002	−.007	−.009	−.174	.057	−.003	−.009	−.017	−.174	.073	−.006	−.011	−.037
n = 30	−.176	.023	−.004	−.005	−.005	−.175	.026	−.003	−.005	−.011	−.172	.031	−.008	−.009	−.034
K = 150															
n = 5	−.175	.175	.006	−.002	−.004	−.175	.171	.002	−.002	−.013	−.170	.171	.002	−.004	−.032
n = 15	−.174	.059	−.001	−.003	−.003	−.174	.062	−.003	−.003	−.010	−.167	.079	−.001	−.002	−.028
n = 30	−.175	.025	−.004	−.004	−.004	−.173	.028	−.003	−.002	−.009	−.168	.038	−.002	−.002	−.027

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A9

RMSE of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y}=.10$, Given $\rho_{I,X}=.10$ and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.054	0.125	0.062	0.055	0.065	0.055	0.126	0.061	0.055	0.064	0.055	0.125	0.058	0.054	0.065
n = 15	0.046	0.043	0.031	0.030	0.034	0.046	0.043	0.031	0.029	0.034	0.046	0.044	0.032	0.030	0.034
n = 30	0.044	0.029	0.025	0.024	0.026	0.043	0.028	0.024	0.023	0.025	0.042	0.029	0.025	0.023	0.025
K = 150															
n = 5	0.046	0.117	0.033	0.031	0.038	0.046	0.121	0.037	0.033	0.041	0.047	0.124	0.036	0.033	0.040
n = 15	0.041	0.037	0.019	0.017	0.020	0.041	0.038	0.019	0.017	0.020	0.041	0.038	0.020	0.017	0.020
n = 30	0.040	0.022	0.015	0.014	0.015	0.040	0.021	0.015	0.014	0.015	0.040	0.021	0.015	0.014	0.015
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.054	0.119	0.059	0.054	0.064	0.053	0.121	0.059	0.053	0.064	0.053	0.129	0.061	0.055	0.066
n = 15	0.044	0.042	0.031	0.030	0.034	0.042	0.045	0.031	0.029	0.033	0.043	0.046	0.033	0.031	0.036
n = 30	0.040	0.027	0.024	0.023	0.025	0.040	0.029	0.025	0.024	0.026	0.039	0.029	0.025	0.025	0.027
K = 150															
n = 5	0.042	0.120	0.038	0.032	0.040	0.043	0.119	0.036	0.032	0.041	0.044	0.123	0.037	0.033	0.041
n = 15	0.037	0.037	0.019	0.017	0.020	0.038	0.037	0.019	0.017	0.020	0.037	0.038	0.018	0.018	0.021
n = 30	0.036	0.021	0.015	0.014	0.015	0.036	0.021	0.015	0.014	0.015	0.036	0.022	0.015	0.014	0.017

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A10

RMSE of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y}=.10$, Given $\rho_{I,X}=.30$ and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.052	0.123	0.056	0.054	0.065	0.052	0.128	0.062	0.055	0.066	0.053	0.135	0.059	0.055	0.065
n = 15	0.044	0.043	0.032	0.030	0.035	0.043	0.044	0.032	0.030	0.035	0.041	0.049	0.030	0.029	0.033
n = 30	0.040	0.027	0.024	0.023	0.025	0.039	0.030	0.025	0.024	0.026	0.038	0.030	0.024	0.023	0.025
K = 150															
n = 5	0.043	0.120	0.037	0.033	0.041	0.042	0.124	0.037	0.032	0.040	0.042	0.134	0.036	0.033	0.040
n = 15	0.037	0.037	0.019	0.017	0.020	0.036	0.037	0.018	0.017	0.019	0.035	0.044	0.018	0.017	0.021
n = 30	0.035	0.022	0.015	0.014	0.015	0.036	0.021	0.015	0.014	0.015	0.034	0.024	0.015	0.014	0.016
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.051	0.123	0.061	0.054	0.065	0.051	0.127	0.063	0.054	0.065	0.050	0.144	0.064	0.054	0.065
n = 15	0.038	0.044	0.033	0.030	0.034	0.037	0.045	0.032	0.030	0.033	0.036	0.052	0.033	0.030	0.036
n = 30	0.034	0.028	0.025	0.024	0.026	0.035	0.029	0.026	0.024	0.027	0.033	0.031	0.025	0.024	0.030
K = 150															
n = 5	0.038	0.120	0.038	0.033	0.041	0.038	0.123	0.038	0.032	0.041	0.037	0.133	0.037	0.033	0.042
n = 15	0.030	0.037	0.018	0.017	0.019	0.031	0.038	0.019	0.018	0.020	0.029	0.045	0.018	0.017	0.024
n = 30	0.029	0.021	0.014	0.014	0.015	0.029	0.021	0.014	0.013	0.015	0.028	0.023	0.014	0.014	0.021

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A11

RMSE of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y}=.30$, Given $\rho_{I,X}=.10$ and 25% Missing Data

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.142	0.088	0.076	0.069	0.082	0.138	0.093	0.074	0.071	0.084	0.141	0.091	0.078	0.070	0.082
n = 15	0.134	0.052	0.054	0.051	0.054	0.133	0.051	0.052	0.051	0.055	0.131	0.054	0.055	0.051	0.055
n = 30	0.132	0.045	0.047	0.047	0.048	0.130	0.044	0.046	0.046	0.047	0.130	0.044	0.046	0.047	0.048
K = 150															
n = 5	0.127	0.081	0.047	0.039	0.046	0.130	0.078	0.045	0.039	0.046	0.128	0.080	0.043	0.038	0.045
n = 15	0.126	0.035	0.031	0.030	0.032	0.125	0.033	0.030	0.028	0.030	0.124	0.035	0.031	0.029	0.031
n = 30	0.125	0.029	0.029	0.027	0.027	0.126	0.028	0.029	0.027	0.028	0.124	0.029	0.028	0.027	0.028
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.131	0.092	0.074	0.070	0.081	0.134	0.093	0.078	0.069	0.082	0.136	0.092	0.078	0.070	0.084
n = 15	0.125	0.051	0.052	0.050	0.053	0.126	0.051	0.052	0.051	0.055	0.124	0.051	0.052	0.050	0.054
n = 30	0.125	0.045	0.047	0.046	0.048	0.124	0.047	0.048	0.048	0.050	0.123	0.046	0.047	0.046	0.048
K = 150															
n = 5	0.122	0.079	0.046	0.041	0.046	0.121	0.079	0.044	0.040	0.046	0.121	0.081	0.048	0.040	0.048
n = 15	0.118	0.035	0.031	0.029	0.030	0.118	0.035	0.031	0.030	0.031	0.117	0.033	0.029	0.028	0.031
n = 30	0.118	0.028	0.027	0.027	0.027	0.118	0.027	0.027	0.026	0.027	0.117	0.029	0.029	0.028	0.029

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A12

RMSE of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y}$ = .30, Given $\rho_{I,X}$ = .30 and 25% Missing Data

Moderate correlation at level 2 (ρ_B = .35)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
n = 5	0.136	0.091	0.078	0.070	0.083	0.131	0.093	0.077	0.069	0.081	0.130	0.096	0.073	0.067	0.080
n = 15	0.123	0.052	0.053	0.050	0.054	0.125	0.053	0.053	0.051	0.054	0.120	0.052	0.051	0.050	0.054
n = 30	0.123	0.046	0.048	0.047	0.049	0.121	0.046	0.047	0.047	0.049	0.120	0.044	0.046	0.047	0.049
K = 150															
n = 5	0.124	0.076	0.046	0.040	0.046	0.124	0.078	0.046	0.040	0.047	0.116	0.091	0.047	0.040	0.047
n = 15	0.119	0.033	0.030	0.030	0.031	0.116	0.036	0.031	0.029	0.031	0.113	0.037	0.031	0.030	0.032
n = 30	0.119	0.027	0.027	0.026	0.027	0.117	0.027	0.027	0.026	0.027	0.120	0.027	0.026	0.027	0.029

Large correlation at level 2 (ρ_B = .60)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
n = 5	0.122	0.091	0.076	0.069	0.080	0.120	0.095	0.078	0.069	0.082	0.118	0.099	0.076	0.070	0.087
n = 15	0.110	0.053	0.054	0.051	0.053	0.111	0.051	0.052	0.051	0.055	0.110	0.054	0.054	0.051	0.059
n = 30	0.113	0.047	0.049	0.047	0.049	0.108	0.046	0.047	0.047	0.049	0.107	0.049	0.050	0.047	0.053
K = 150															
n = 5	0.104	0.082	0.047	0.041	0.049	0.106	0.079	0.045	0.039	0.047	0.104	0.086	0.045	0.041	0.053
n = 15	0.103	0.035	0.031	0.029	0.031	0.102	0.034	0.030	0.029	0.031	0.099	0.038	0.031	0.029	0.036
n = 30	0.103	0.028	0.027	0.026	0.027	0.102	0.028	0.028	0.027	0.028	0.099	0.029	0.028	0.027	0.033

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A13

RMSE of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y}= .10$, Given $\rho_{I,X}= .10$ and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.066	0.271	0.083	0.055	0.085	0.064	0.271	0.085	0.053	0.083	0.065	0.275	0.086	0.053	0.081
n = 15	0.069	0.101	0.037	0.030	0.042	0.069	0.103	0.038	0.030	0.042	0.068	0.110	0.039	0.030	0.043
n = 30	0.067	0.053	0.028	0.024	0.031	0.068	0.053	0.027	0.024	0.030	0.068	0.055	0.027	0.023	0.031
K = 150															
n = 5	0.066	0.276	0.052	0.032	0.053	0.066	0.278	0.053	0.032	0.055	0.066	0.279	0.052	0.032	0.054
n = 15	0.067	0.099	0.022	0.017	0.025	0.066	0.103	0.024	0.017	0.025	0.066	0.109	0.022	0.017	0.025
n = 30	0.066	0.049	0.017	0.014	0.018	0.067	0.050	0.017	0.014	0.018	0.066	0.055	0.017	0.014	0.018
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.063	0.269	0.083	0.055	0.083	0.064	0.270	0.083	0.055	0.082	0.063	0.270	0.085	0.054	0.081
n = 15	0.064	0.100	0.039	0.030	0.044	0.064	0.102	0.038	0.029	0.042	0.063	0.110	0.038	0.029	0.042
n = 30	0.064	0.052	0.028	0.024	0.030	0.063	0.051	0.025	0.024	0.029	0.062	0.057	0.028	0.023	0.031
K = 150															
n = 5	0.063	0.275	0.055	0.033	0.056	0.061	0.275	0.055	0.033	0.054	0.062	0.277	0.053	0.032	0.054
n = 15	0.062	0.099	0.023	0.017	0.025	0.061	0.101	0.023	0.017	0.025	0.061	0.110	0.024	0.017	0.027
n = 30	0.061	0.049	0.016	0.014	0.017	0.060	0.052	0.017	0.014	0.018	0.060	0.054	0.017	0.014	0.020

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A14

RMSE of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y} = .10$, Given $\rho_{I,X} = .30$ and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.060	0.273	0.088	0.055	0.086	0.058	0.278	0.090	0.053	0.083	0.057	0.279	0.090	0.054	0.082
n = 15	0.060	0.098	0.036	0.029	0.042	0.060	0.107	0.039	0.030	0.043	0.058	0.134	0.039	0.044	0.044
n = 30	0.059	0.050	0.026	0.023	0.029	0.058	0.057	0.028	0.024	0.030	0.056	0.070	0.027	0.023	0.030
K = 150															
n = 5	0.059	0.278	0.054	0.032	0.054	0.058	0.277	0.052	0.031	0.054	0.056	0.284	0.053	0.032	0.053
n = 15	0.058	0.098	0.022	0.017	0.024	0.057	0.107	0.023	0.017	0.025	0.055	0.135	0.023	0.017	0.025
n = 30	0.057	0.050	0.016	0.014	0.017	0.056	0.054	0.016	0.013	0.017	0.054	0.070	0.017	0.014	0.019
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.054	0.271	0.091	0.053	0.085	0.053	0.272	0.090	0.055	0.082	0.054	0.275	0.086	0.054	0.078
n = 15	0.050	0.101	0.040	0.029	0.042	0.050	0.108	0.040	0.029	0.042	0.050	0.135	0.042	0.029	0.046
n = 30	0.048	0.051	0.027	0.023	0.030	0.047	0.057	0.029	0.024	0.031	0.048	0.070	0.029	0.024	0.034
K = 150															
n = 5	0.049	0.275	0.057	0.032	0.055	0.050	0.277	0.058	0.033	0.056	0.049	0.279	0.057	0.033	0.054
n = 15	0.046	0.098	0.024	0.017	0.025	0.046	0.107	0.025	0.017	0.025	0.044	0.137	0.027	0.018	0.031
n = 30	0.045	0.050	0.017	0.014	0.017	0.045	0.052	0.016	0.013	0.018	0.045	0.069	0.018	0.014	0.026

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A15

RMSE of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y}=.30$, Given $\rho_{I,X}=.10$ and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.221	0.179	0.086	0.068	0.107	0.220	0.176	0.081	0.071	0.104	0.216	0.174	0.084	0.071	0.105
n = 15	0.216	0.072	0.057	0.050	0.060	0.217	0.073	0.061	0.053	0.063	0.214	0.078	0.056	0.049	0.060
n = 30	0.215	0.051	0.050	0.047	0.051	0.214	0.053	0.051	0.046	0.051	0.212	0.055	0.052	0.047	0.052
K = 150															
n = 5	0.215	0.181	0.057	0.040	0.061	0.215	0.178	0.054	0.040	0.060	0.212	0.182	0.056	0.040	0.061
n = 15	0.214	0.064	0.034	0.029	0.035	0.213	0.066	0.034	0.030	0.035	0.211	0.070	0.036	0.029	0.035
n = 30	0.213	0.038	0.029	0.027	0.030	0.213	0.037	0.029	0.026	0.029	0.211	0.040	0.030	0.027	0.029
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.211	0.173	0.085	0.071	0.107	0.211	0.177	0.085	0.071	0.107	0.209	0.173	0.089	0.068	0.110
n = 15	0.206	0.075	0.059	0.051	0.062	0.206	0.074	0.057	0.050	0.061	0.205	0.078	0.057	0.051	0.063
n = 30	0.205	0.052	0.049	0.047	0.051	0.204	0.052	0.050	0.047	0.050	0.204	0.051	0.048	0.046	0.051
K = 150															
n = 5	0.205	0.179	0.057	0.040	0.061	0.205	0.180	0.055	0.040	0.063	0.204	0.175	0.055	0.039	0.061
n = 15	0.204	0.064	0.034	0.029	0.034	0.202	0.068	0.036	0.030	0.036	0.201	0.071	0.034	0.029	0.035
n = 30	0.201	0.040	0.029	0.027	0.030	0.202	0.038	0.028	0.027	0.030	0.201	0.040	0.030	0.027	0.032

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table A16

RMSE of the Estimator of the Intraclass Correlation of Y for a True Value of $\rho_{I,Y}= .30$, Given $\rho_{I,X}=.30$ and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.206	0.179	0.085	0.067	0.105	0.203	0.179	0.085	0.069	0.109	0.200	0.178	0.088	0.072	0.115
n = 15	0.205	0.071	0.057	0.050	0.058	0.200	0.077	0.058	0.052	0.062	0.196	0.091	0.059	0.050	0.070
n = 30	0.200	0.049	0.048	0.045	0.049	0.199	0.053	0.050	0.046	0.052	0.193	0.057	0.051	0.047	0.053
K = 150															
n = 5	0.201	0.178	0.057	0.041	0.063	0.198	0.184	0.056	0.038	0.060	0.192	0.183	0.054	0.039	0.060
n = 15	0.198	0.065	0.033	0.028	0.033	0.197	0.072	0.034	0.029	0.035	0.192	0.085	0.034	0.029	0.036
n = 30	0.199	0.040	0.031	0.026	0.030	0.197	0.039	0.028	0.025	0.028	0.190	0.048	0.029	0.026	0.031
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.185	0.177	0.088	0.069	0.106	0.185	0.177	0.084	0.068	0.106	0.179	0.171	0.085	0.072	0.115
n = 15	0.179	0.075	0.058	0.051	0.061	0.177	0.077	0.057	0.050	0.062	0.177	0.090	0.058	0.053	0.070
n = 30	0.178	0.051	0.048	0.048	0.051	0.177	0.054	0.051	0.046	0.052	0.175	0.058	0.052	0.048	0.061
K = 150															
n = 5	0.178	0.180	0.057	0.040	0.062	0.177	0.176	0.055	0.041	0.062	0.173	0.176	0.054	0.039	0.068
n = 15	0.175	0.066	0.033	0.028	0.035	0.174	0.068	0.032	0.029	0.035	0.169	0.085	0.035	0.029	0.044
n = 30	0.176	0.037	0.028	0.027	0.029	0.174	0.039	0.029	0.027	0.030	0.169	0.048	0.030	0.027	0.040

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B1

Bias of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .10$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)															
K = 50															
n = 5	.203	−.217	−.113	.001	−.012	.215	−.224	−.105	−.009	−.040	.252	−.233	−.108	.010	−.143
n = 15	.270	−.091	−.017	.004	.009	.260	−.097	−.029	.011	−.044	.218	−.121	−.054	−.015	−.178
n = 30	.236	−.049	−.008	.007	.006	.217	−.062	−.022	−.001	−.046	.230	−.052	−.009	.005	−.161
K = 150															
n = 5	.279	−.209	−.043	−.007	−.009	.264	−.210	−.052	.000	−.050	.241	−.223	−.067	−.008	−.174
n = 15	.231	−.094	−.010	.003	.004	.200	−.110	−.030	−.009	−.050	.211	−.109	−.023	−.006	−.171
n = 30	.216	−.056	−.009	.000	.001	.214	−.058	−.009	−.003	−.046	.214	−.057	−.007	−.006	−.166
Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)															
K = 50															
n = 5	.286	−.347	−.112	.050	.037	.253	−.354	−.116	.015	−.036	.243	−.365	−.150	.030	−.191
n = 15	.306	−.158	−.037	.019	.038	.258	−.172	−.064	.008	−.046	.284	−.165	−.044	.017	−.185
n = 30	.252	−.089	−.023	.010	.014	.259	−.082	−.016	.009	−.035	.240	−.094	−.029	.008	−.199
K = 150															
n = 5	.261	−.354	−.090	.012	.020	.287	−.354	−.079	.033	−.021	.275	−.366	−.091	.026	−.188
n = 15	.233	−.171	−.037	−.001	−.002	.245	−.169	−.030	.004	−.042	.241	−.171	−.028	.010	−.193
n = 30	.232	−.094	−.016	.003	.004	.237	−.091	−.011	.003	−.046	.229	−.096	−.014	.005	−.198

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B2

Bias of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .10$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.606)															
K = 50															
n = 5	.669	−.359	−.060	.121	.128	.649	−.375	−.074	.076	−.039	.625	−.387	−.099	.070	−.382
n = 15	.538	−.177	−.044	.006	.018	.550	−.167	−.027	.019	−.067	.483	−.213	−.058	.013	−.356
n = 30	.470	−.100	−.028	.006	.008	.461	−.100	−.025	.001	−.085	.451	−.104	−.018	.008	−.345
K = 150															
n = 5	.587	−.361	−.051	.021	.052	.577	−.367	−.047	.028	−.047	.528	−.379	−.059	.014	−.361
n = 15	.498	−.157	−.001	.018	.017	.468	−.175	−.018	.003	−.085	.445	−.199	−.021	.000	−.356
n = 30	.459	−.096	−.010	.001	.000	.456	−.099	−.009	.002	−.081	.434	−.112	−.013	−.002	−.351
Large correlation at level 2 ($\rho_B = .60$, true value = 1.039)															
K = 50															
n = 5	.555	−.608	−.134	.160	.164	.588	−.595	−.107	.213	.092	.498	−.635	−.144	.180	−.296
n = 15	.532	−.267	−.042	.033	.058	.515	−.284	−.051	.047	−.014	.444	−.329	−.079	.024	−.339
n = 30	.446	−.147	−.027	.013	.022	.416	−.174	−.049	−.001	−.073	.405	−.182	−.041	.027	−.341
K = 150															
n = 5	.520	−.617	−.109	.060	.095	.549	−.620	−.084	.073	.027	.485	−.649	−.107	.067	−.311
n = 15	.427	−.287	−.040	.004	.009	.437	−.290	−.029	.024	−.058	.405	−.331	−.040	.013	−.364
n = 30	.412	−.160	−.016	.003	.004	.407	−.165	−.017	.001	−.077	.379	−.191	−.025	.005	−.362

Note. *K* = number of groups; *n* = group size; *λ* = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B3

Bias of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of ρ$_{I,X}$= .10 and ρ$_{I,Y}$= .30, and 25% Missing Data

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ$_B$ = .35, true value = 0.202)															
K = 50															
n = 5	.105	–.060	–.018	–.003	–.011	.109	–.055	–.012	–.004	–.028	.061	–.080	–.042	–.016	–.092
n = 15	.101	–.021	–.005	–.003	–.001	.106	–.017	–.001	.000	–.022	.101	–.020	–.003	–.001	–.078
n = 30	.107	–.006	.002	.001	.003	.103	–.008	.001	.000	–.019	.103	–.008	.000	.002	–.075
K = 150															
n = 5	.094	–.060	–.013	–.003	–.005	.097	–.062	–.012	–.004	–.025	.093	–.063	–.012	–.003	–.080
n = 15	.103	–.019	–.001	–.001	–.002	.103	–.018	.000	.001	–.020	.099	–.019	–.001	.001	–.076
n = 30	.102	–.009	–.001	.000	.000	.102	–.010	–.001	–.001	–.020	.099	–.010	–.001	.000	–.075
Large correlation at level 2 (ρ$_B$ = .60, true value = 0.346)															
K = 50															
n = 5	.134	–.095	–.022	.002	.003	.143	–.094	–.018	.001	–.025	.119	–.113	–.038	–.007	–.113
n = 15	.131	–.031	–.005	–.002	–.001	.123	–.037	–.011	–.003	–.030	.130	–.031	–.003	.000	–.107
n = 30	.129	–.016	–.002	–.003	–.002	.124	–.019	–.006	–.004	–.030	.120	–.021	–.007	.002	–.106
K = 150															
n = 5	.126	–.100	–.018	–.001	–.001	.132	–.096	–.010	–.001	–.030	.121	–.104	–.016	.000	–.110
n = 15	.131	–.030	–.001	–.001	–.001	.127	–.031	–.002	.000	–.027	.123	–.034	–.004	–.001	–.109
n = 30	.127	–.016	–.001	.001	.001	.125	–.018	–.003	–.002	–.028	.120	–.019	–.004	–.002	–.108

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B4

Bias of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}$ = .30 and $\rho_{I,Y}$ = .30, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
	Moderate correlation at level 2 (ρ_B = .35, true value = 0.350)														
K = 50															
n = 5	.249	–.104	–.010	–.010	–.007	.243	–.099	–.005	.005	–.034	.204	–.123	–.029	–.003	–.156
n = 15	.233	–.020	.011	.005	.005	.202	–.042	–.011	–.002	–.039	.210	–.034	.002	.013	–.139
n = 30	.228	–.007	.009	.004	.006	.220	–.011	.005	.000	–.035	.208	–.014	.004	–.002	–.145
K = 150															
n = 5	.231	–.097	.001	.001	.002	.217	–.105	–.008	–.001	–.040	.198	–.110	–.008	–.004	–.156
n = 15	.221	–.030	.002	.001	.001	.220	–.030	.004	.004	–.033	.204	–.038	.000	.002	–.147
n = 30	.215	–.019	–.003	–.002	–.002	.214	–.017	–.001	.000	–.034	.209	–.014	.005	.004	–.139
	Large correlation at level 2 (ρ_B = .60, true value = 0.600)														
K = 50															
n = 5	.288	–.160	–.006	.013	.021	.310	–.155	.008	.013	–.029	.261	–.188	–.015	.011	–.185
n = 15	.239	–.051	.000	.000	.000	.229	–.061	–.009	.005	–.037	.223	–.067	–.006	.003	–.181
n = 30	.236	–.024	.002	–.001	–.001	.234	–.024	.003	.002	–.038	.209	–.036	–.007	–.001	–.180
K = 150															
n = 5	.245	–.161	–.001	.005	.007	.247	–.162	.003	.006	–.038	.223	–.189	–.009	.005	–.190
n = 15	.231	–.056	–.003	.000	.000	.229	–.057	–.001	.001	–.038	.212	–.068	–.003	–.002	–.185
n = 30	.230	–.028	–.001	.001	.001	.227	–.029	–.001	.002	–.038	.212	–.034	–.002	.000	–.178

Note. *K* = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B5

Bias of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}= .10$ and $\rho_{I,Y}= .10$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)															
K = 50															
n = 5	.506	−.291	−.205	.014	.024	.532	−.281	−.172	.012	−.018	.490	−.295	−.197	.006	−.201
n = 15	.821	−.196	−.084	.007	.025	.801	−.201	−.089	−.007	−.059	.779	−.206	−.090	−.002	−.223
n = 30	.738	−.122	−.037	.005	.006	.748	−.130	−.044	.001	−.061	.736	−.139	−.048	.003	−.223
K = 150															
n = 5	.718	−.282	−.111	.009	.004	.688	−.286	−.127	−.005	−.053	.647	−.292	−.142	−.001	−.211
n = 15	.735	−.195	−.044	−.001	−.001	.725	−.198	−.044	.001	−.061	.707	−.203	−.045	.001	−.215
n = 30	.699	−.123	−.014	.001	.002	.685	−.131	−.021	−.002	−.063	.648	−.139	−.027	−.006	−.217
Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)															
K = 50															
n = 5	.459	−.494	−.308	.041	−.017	.420	−.499	−.324	.014	−.126	.369	−.507	−.344	.010	−.307
n = 15	.749	−.332	−.144	.014	.023	.732	−.341	−.158	.017	−.048	.691	−.351	−.158	.010	−.262
n = 30	.709	−.223	−.088	−.001	.016	.712	−.217	−.076	.007	−.047	.673	−.230	−.090	.005	−.273
K = 150															
n = 5	.608	−.491	−.216	.023	.029	.592	−.492	−.233	.030	−.078	.575	−.501	−.237	.008	−.279
n = 15	.685	−.333	−.091	.006	.015	.668	−.336	−.091	.002	−.061	.670	−.349	−.086	.004	−.275
n = 30	.645	−.218	−.046	.001	.005	.641	−.215	−.041	.002	−.060	.625	−.230	−.044	.005	−.273

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B6

Bias of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .10$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.606)															
K = 50															
n = 5	1.178	−.501	−.273	.098	.004	1.107	−.485	−.255	.091	−.088	.977	−.490	−.298	.067	−.501
n = 15	1.477	−.323	−.080	.020	.072	1.427	−.353	−.115	.003	−.096	1.298	−.381	−.149	.010	−.484
n = 30	1.388	−.209	−.035	.001	.018	1.319	−.217	−.045	.009	−.108	1.176	−.283	−.089	−.001	−.488
K = 150															
n = 5	1.328	−.497	−.175	.008	.058	1.353	−.486	−.135	.030	−.069	1.228	−.486	−.165	.034	−.481
n = 15	1.322	−.338	−.052	.002	.006	1.274	−.349	−.054	.003	−.109	1.172	−.382	−.062	.008	−.464
n = 30	1.250	−.214	−.018	.003	.002	1.223	−.227	−.021	.003	−.116	1.131	−.270	−.025	.007	−.472
Large correlation at level 2 ($\rho_B = .60$, true value = 1.039)															
K = 50															
n = 5	.866	−.848	−.423	.170	.061	.836	−.853	−.429	.159	−.056	.737	−.854	−.457	.175	−.515
n = 15	1.058	−.575	−.206	.037	.115	1.054	−.598	−.217	.046	−.009	.994	−.660	−.247	.029	−.495
n = 30	.987	−.378	−.122	.013	.040	.988	−.374	−.099	.023	−.058	.929	−.468	−.152	.005	−.534
K = 150															
n = 5	.932	−.845	−.299	.053	.094	.940	−.851	−.287	.053	−.020	.906	−.851	−.305	.062	−.489
n = 15	.990	−.564	−.100	.016	.038	.955	−.598	−.134	.005	−.097	.895	−.661	−.138	.009	−.531
n = 30	.944	−.373	−.059	.007	.009	.930	−.395	−.057	.009	−.109	.876	−.474	−.075	.003	−.533

Note. *K* = number of groups; *n* = group size; λ = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B7

Bias of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}= .10$ and $\rho_{I,Y}= .30$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.202)															
K = 50															
n = 5	.393	–.112	–.038	.001	.002	.383	–.107	–.031	–.009	–.033	.345	–.113	–.041	–.011	–.110
n = 15	.347	–.051	–.009	–.002	–.007	.354	–.051	–.009	–.005	–.037	.341	–.053	–.008	.001	–.103
n = 30	.348	–.023	.001	.004	.003	.331	–.026	.001	.001	–.029	.309	–.033	–.010	–.001	–.107
K = 150															
n = 5	.358	–.110	–.018	–.001	–.008	.361	–.114	–.021	–.003	–.033	.337	–.116	–.019	.003	–.102
n = 15	.337	–.051	–.005	–.001	–.002	.326	–.053	–.007	–.003	–.032	.319	–.056	–.006	–.001	–.103
n = 30	.337	–.026	–.001	–.001	–.002	.329	–.028	–.003	–.002	–.028	.316	–.029	–.002	.002	–.100
Large correlation at level 2 ($\rho_B = .60$, true value = 0.346)															
K = 50															
n = 5	.415	–.191	–.065	.001	.006	.356	–.200	–.081	–.012	–.056	.371	–.203	–.075	–.004	–.140
n = 15	.398	–.086	–.019	.003	–.002	.402	–.084	–.015	.000	–.036	.374	–.094	–.022	.004	–.148
n = 30	.385	–.044	–.007	–.001	–.001	.379	–.043	–.005	.003	–.033	.360	–.052	–.013	–.003	–.151
K = 150															
n = 5	.407	–.188	–.033	.000	.001	.404	–.189	–.032	–.001	–.035	.380	–.200	–.038	–.002	–.146
n = 15	.382	–.085	–.009	–.001	–.002	.371	–.088	–.011	.000	–.038	.358	–.094	–.011	–.001	–.148
n = 30	.375	–.044	–.003	–.001	–.001	.370	–.045	–.003	.000	–.037	.357	–.049	–.005	–.001	–.150

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B8

Bias of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}$= .30 and $\rho_{I,Y}$= .30, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35, true value = 0.350)															
K = 50															
n = 5	.820	−.189	−.030	−.006	−.015	.774	−.191	−.034	.001	−.077	.702	−.193	−.047	.003	−.225
n = 15	.681	−.098	−.019	−.008	−.009	.675	−.093	−.005	.001	−.050	.629	−.109	−.009	.000	−.206
n = 30	.676	−.042	.001	.004	.005	.649	−.049	−.005	−.002	−.056	.596	−.062	−.007	.000	−.199
K = 150															
n = 5	.753	−.187	.001	.001	.004	.704	−.187	−.005	.001	−.057	.615	−.189	−.016	.004	−.205
n = 15	.681	−.082	.002	.000	.001	.658	−.091	−.004	.004	−.051	.600	−.113	−.005	.004	−.205
n = 30	.669	−.046	−.003	.003	.003	.659	−.046	.002	.000	−.051	.603	−.059	.002	.002	−.199
Large correlation at level 2 (ρ_B = .60, true value = 0.600)															
K = 50															
n = 5	.750	−.323	−.048	.012	.040	.724	−.325	−.056	.017	−.037	.667	−.339	−.065	.018	−.246
n = 15	.632	−.150	−.022	−.001	−.001	.646	−.148	−.006	.012	−.048	.589	−.199	−.032	.006	−.263
n = 30	.620	−.079	−.008	.001	.002	.603	−.089	−.015	−.005	−.063	.563	−.112	−.017	−.004	−.263
K = 150															
n = 5	.661	−.324	−.022	.004	.015	.650	−.329	−.024	.001	−.057	.589	−.355	−.044	.000	−.268
n = 15	.619	−.146	−.006	.002	.003	.606	−.157	−.006	.001	−.063	.555	−.192	−.011	.000	−.265
n = 30	.614	−.078	−.004	.001	.002	.599	−.084	−.004	.000	−.058	.553	−.107	−.004	.001	−.258

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B9

RMSE of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .10$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)															
K = 50															
n = 5	0.761	0.321	0.495	0.659	0.758	0.779	0.317	0.500	0.651	0.755	0.840	0.325	0.502	0.644	0.634
n = 15	0.490	0.208	0.257	0.260	0.340	0.450	0.204	0.234	0.255	0.301	0.436	0.212	0.238	0.247	0.309
n = 30	0.341	0.170	0.184	0.185	0.202	0.319	0.170	0.180	0.183	0.194	0.332	0.177	0.182	0.182	0.227
K = 150															
n = 5	0.505	0.237	0.245	0.263	0.378	0.501	0.242	0.266	0.270	0.378	0.500	0.249	0.263	0.285	0.355
n = 15	0.289	0.136	0.129	0.127	0.147	0.269	0.148	0.135	0.127	0.150	0.274	0.146	0.133	0.130	0.214
n = 30	0.254	0.106	0.104	0.101	0.109	0.251	0.105	0.103	0.101	0.115	0.255	0.109	0.109	0.104	0.189
Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)															
K = 50															
n = 5	0.744	0.419	0.468	0.570	0.716	0.685	0.411	0.461	0.524	0.635	0.619	0.413	0.451	0.568	0.611
n = 15	0.459	0.233	0.229	0.235	0.315	0.402	0.243	0.225	0.236	0.281	0.434	0.236	0.225	0.232	0.316
n = 30	0.336	0.177	0.172	0.171	0.195	0.338	0.169	0.167	0.173	0.189	0.316	0.169	0.162	0.166	0.258
K = 150															
n = 5	0.437	0.371	0.249	0.272	0.341	0.448	0.371	0.252	0.268	0.351	0.442	0.382	0.249	0.262	0.368
n = 15	0.279	0.193	0.122	0.118	0.139	0.289	0.191	0.121	0.116	0.141	0.290	0.193	0.125	0.120	0.227
n = 30	0.256	0.122	0.092	0.091	0.099	0.264	0.122	0.095	0.093	0.109	0.258	0.127	0.098	0.094	0.216

Note. *K* = number of groups; *n* = group size; λ = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B10

RMSE of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .10$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.606)															
K = 50															
n = 5	1.215	0.454	0.685	0.967	1.258	1.292	0.471	0.749	0.965	1.225	1.244	0.472	0.775	0.959	1.144
n = 15	0.772	0.326	0.367	0.384	0.447	0.812	0.328	0.381	0.383	0.471	0.735	0.335	0.372	0.373	0.523
n = 30	0.595	0.269	0.286	0.290	0.309	0.592	0.270	0.291	0.289	0.311	0.585	0.277	0.297	0.294	0.433
K = 150															
n = 5	0.804	0.387	0.326	0.378	0.506	0.819	0.391	0.327	0.359	0.485	0.776	0.398	0.326	0.361	0.551
n = 15	0.562	0.215	0.198	0.191	0.214	0.533	0.226	0.199	0.193	0.222	0.515	0.242	0.197	0.185	0.398
n = 30	0.506	0.177	0.175	0.162	0.172	0.502	0.176	0.172	0.167	0.190	0.477	0.173	0.159	0.154	0.376
Large correlation at level 2 ($\rho_B = .60$, true value = 1.039)															
K = 50															
n = 5	0.916	0.664	0.617	0.868	0.958	1.024	0.659	0.655	0.878	1.060	0.963	0.684	0.655	0.840	1.077
n = 15	0.692	0.356	0.320	0.348	0.436	0.687	0.369	0.328	0.355	0.432	0.610	0.401	0.326	0.342	0.555
n = 30	0.542	0.274	0.262	0.266	0.301	0.530	0.298	0.286	0.271	0.314	0.513	0.288	0.265	0.274	0.445
K = 150															
n = 5	0.707	0.630	0.327	0.412	0.550	0.727	0.633	0.333	0.413	0.542	0.678	0.661	0.342	0.403	0.605
n = 15	0.476	0.317	0.184	0.182	0.212	0.490	0.321	0.190	0.185	0.214	0.464	0.353	0.186	0.182	0.412
n = 30	0.445	0.206	0.152	0.143	0.158	0.440	0.208	0.152	0.148	0.175	0.414	0.232	0.158	0.148	0.391

Note. *K* = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B11

RMSE of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}=.10$ and $\rho_{I,Y}=.30$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.202)															
K = 50															
n = 5	0.310	0.152	0.192	0.184	0.231	0.286	0.140	0.175	0.173	0.211	0.311	0.165	0.204	0.182	0.209
n = 15	0.181	0.105	0.112	0.110	0.119	0.188	0.108	0.116	0.113	0.120	0.184	0.104	0.113	0.111	0.126
n = 30	0.166	0.093	0.097	0.096	0.101	0.164	0.094	0.098	0.095	0.096	0.163	0.093	0.097	0.095	0.110
K = 150															
n = 5	0.165	0.096	0.100	0.094	0.115	0.167	0.098	0.102	0.098	0.117	0.163	0.096	0.100	0.096	0.124
n = 15	0.128	0.056	0.058	0.060	0.066	0.132	0.062	0.064	0.063	0.068	0.127	0.058	0.060	0.061	0.093
n = 30	0.126	0.054	0.056	0.054	0.057	0.125	0.052	0.054	0.053	0.057	0.122	0.052	0.054	0.054	0.087
Large correlation at level 2 ($\rho_B = .60$, true value = 0.346)															
K = 50															
n = 5	0.285	0.165	0.178	0.173	0.213	0.280	0.159	0.170	0.166	0.202	0.276	0.171	0.179	0.170	0.217
n = 15	0.185	0.098	0.101	0.100	0.113	0.184	0.103	0.106	0.100	0.111	0.186	0.101	0.106	0.106	0.146
n = 30	0.167	0.082	0.084	0.083	0.089	0.161	0.082	0.084	0.084	0.090	0.160	0.083	0.084	0.085	0.130
K = 150															
n = 5	0.174	0.121	0.092	0.090	0.109	0.186	0.121	0.098	0.093	0.112	0.172	0.127	0.096	0.091	0.147
n = 15	0.150	0.060	0.057	0.056	0.063	0.144	0.058	0.053	0.053	0.062	0.143	0.062	0.057	0.056	0.120
n = 30	0.141	0.050	0.049	0.047	0.050	0.138	0.050	0.048	0.047	0.056	0.134	0.049	0.047	0.047	0.116

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B12

RMSE of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,x} = .30$ and $\rho_{I,y} = .30$, and 25% Missing Data

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)															
K = 50															
n = 5	0.466	0.199	0.244	0.222	0.280	0.428	0.191	0.230	0.218	0.268	0.408	0.200	0.233	0.220	0.276
n = 15	0.312	0.147	0.159	0.158	0.167	0.293	0.152	0.161	0.158	0.168	0.302	0.151	0.164	0.158	0.196
n = 30	0.301	0.146	0.153	0.155	0.157	0.297	0.146	0.152	0.153	0.157	0.297	0.152	0.160	0.151	0.191
K = 150															
n = 5	0.284	0.132	0.122	0.116	0.134	0.271	0.139	0.125	0.114	0.138	0.260	0.141	0.127	0.118	0.194
n = 15	0.248	0.084	0.088	0.089	0.094	0.249	0.087	0.090	0.086	0.094	0.236	0.090	0.091	0.089	0.166
n = 30	0.239	0.081	0.083	0.082	0.084	0.239	0.081	0.083	0.083	0.089	0.236	0.080	0.084	0.081	0.155
Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)															
K = 50															
n = 5	0.411	0.226	0.216	0.202	0.272	0.445	0.221	0.225	0.211	0.266	0.404	0.243	0.220	0.203	0.299
n = 15	0.294	0.141	0.143	0.145	0.155	0.290	0.147	0.147	0.145	0.153	0.287	0.143	0.145	0.141	0.224
n = 30	0.284	0.136	0.140	0.131	0.135	0.277	0.125	0.128	0.131	0.135	0.263	0.127	0.130	0.129	0.213
K = 150															
n = 5	0.282	0.181	0.115	0.108	0.126	0.284	0.183	0.115	0.110	0.133	0.266	0.208	0.120	0.111	0.223
n = 15	0.249	0.094	0.082	0.081	0.087	0.248	0.094	0.082	0.079	0.090	0.233	0.101	0.083	0.080	0.200
n = 30	0.245	0.078	0.076	0.076	0.078	0.242	0.077	0.075	0.075	0.083	0.229	0.076	0.072	0.071	0.189

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B13

RMSE of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .10$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)															
K = 50															
n = 5	0.919	0.313	0.421	0.644	0.892	1.047	0.303	0.402	0.640	0.804	0.930	0.317	0.389	0.614	0.667
n = 15	0.989	0.235	0.244	0.243	0.471	0.995	0.233	0.233	0.254	0.411	0.955	0.241	0.241	0.241	0.396
n = 30	0.824	0.177	0.181	0.180	0.251	0.840	0.184	0.184	0.183	0.244	0.846	0.189	0.189	0.183	0.301
K = 150															
n = 5	0.894	0.289	0.250	0.277	0.493	0.870	0.293	0.255	0.287	0.494	0.834	0.300	0.261	0.254	0.442
n = 15	0.782	0.206	0.136	0.128	0.192	0.779	0.209	0.137	0.129	0.189	0.759	0.214	0.138	0.128	0.263
n = 30	0.724	0.144	0.110	0.105	0.133	0.711	0.150	0.112	0.102	0.138	0.674	0.158	0.115	0.103	0.237
Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)															
K = 50															
n = 5	0.825	0.507	0.455	0.591	0.814	0.781	0.512	0.475	0.551	0.787	0.810	0.521	0.484	0.553	0.672
n = 15	0.850	0.354	0.247	0.236	0.395	0.836	0.360	0.250	0.235	0.381	0.805	0.369	0.254	0.232	0.420
n = 30	0.768	0.254	0.181	0.169	0.233	0.767	0.247	0.172	0.169	0.227	0.738	0.259	0.183	0.169	0.337
K = 150															
n = 5	0.715	0.495	0.292	0.266	0.497	0.710	0.496	0.303	0.261	0.472	0.694	0.505	0.311	0.253	0.488
n = 15	0.723	0.340	0.147	0.117	0.185	0.702	0.344	0.151	0.123	0.189	0.708	0.355	0.146	0.120	0.317
n = 30	0.661	0.227	0.101	0.091	0.119	0.658	0.226	0.104	0.093	0.131	0.642	0.239	0.106	0.089	0.289

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B14

RMSE of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,x}=.30$ and $\rho_{I,y}=.10$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.606)															
K = 50															
n = 5	1.573	0.518	0.582	0.991	1.409	1.409	0.505	0.685	0.989	1.272	1.462	0.512	0.600	0.966	1.110
n = 15	1.625	0.373	0.346	0.370	0.640	1.586	0.397	0.364	0.372	0.598	1.490	0.419	0.375	0.347	0.744
n = 30	1.469	0.292	0.293	0.292	0.390	1.405	0.299	0.299	0.292	0.381	1.263	0.338	0.288	0.280	0.560
K = 150															
n = 5	1.462	0.503	0.334	0.345	0.787	1.487	0.492	0.327	0.348	0.765	1.418	0.496	0.346	0.393	0.731
n = 15	1.368	0.352	0.209	0.191	0.248	1.318	0.362	0.213	0.188	0.273	1.224	0.395	0.192	0.192	0.506
n = 30	1.271	0.243	0.174	0.164	0.192	1.248	0.254	0.179	0.165	0.219	1.159	0.291	0.180	0.156	0.494
Large correlation at level 2 ($\rho_B = .60$, true value = 1.039)															
K = 50															
n = 5	1.165	0.859	0.669	0.824	1.290	1.174	0.864	0.612	0.852	1.123	1.139	0.868	0.894	0.810	1.149
n = 15	1.154	0.599	0.353	0.363	0.606	1.157	0.623	0.368	0.363	0.640	1.125	0.679	0.384	0.356	0.766
n = 30	1.044	0.423	0.277	0.262	0.351	1.052	0.415	0.264	0.272	0.378	0.990	0.501	0.297	0.258	0.623
K = 150															
n = 5	1.022	0.848	0.391	0.403	0.655	1.051	0.855	0.392	0.390	0.661	1.026	0.857	0.413	0.409	0.780
n = 15	1.022	0.572	0.210	0.181	0.273	0.992	0.605	0.223	0.186	0.298	0.934	0.666	0.230	0.186	0.583
n = 30	0.961	0.387	0.157	0.145	0.180	0.947	0.408	0.160	0.144	0.209	0.896	0.485	0.172	0.141	0.558

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B15

RMSE of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of ρ_{I,X} = .10 and ρ_{I,Y} = .30, and 50% Missing Data

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35, true value = 0.202)															
K = 50															
n = 5	0.631	0.148	0.190	0.177	0.330	0.604	0.144	0.186	0.182	0.389	0.577	0.151	0.194	0.198	0.254
n = 15	0.417	0.106	0.119	0.112	0.147	0.428	0.104	0.116	0.115	0.144	0.454	0.103	0.114	0.111	0.151
n = 30	0.393	0.089	0.097	0.096	0.112	0.378	0.089	0.097	0.093	0.108	0.360	0.090	0.097	0.095	0.134
K = 150															
n = 5	0.430	0.123	0.108	0.096	0.153	0.431	0.127	0.107	0.095	0.152	0.409	0.131	0.109	0.094	0.156
n = 15	0.360	0.072	0.067	0.063	0.081	0.349	0.074	0.066	0.061	0.080	0.344	0.077	0.069	0.063	0.119
n = 30	0.352	0.055	0.056	0.054	0.064	0.345	0.057	0.057	0.053	0.065	0.332	0.055	0.055	0.054	0.109
Large correlation at level 2 (ρ_B = .60, true value = 0.346)															
K = 50															
n = 5	0.580	0.215	0.189	0.168	0.309	0.533	0.223	0.197	0.170	0.313	0.528	0.226	0.203	0.163	0.293
n = 15	0.446	0.122	0.111	0.104	0.138	0.445	0.118	0.104	0.099	0.132	0.419	0.124	0.105	0.096	0.181
n = 30	0.410	0.088	0.086	0.084	0.099	0.404	0.088	0.087	0.083	0.102	0.388	0.093	0.087	0.085	0.169
K = 150															
n = 5	0.453	0.196	0.105	0.090	0.149	0.455	0.197	0.109	0.091	0.147	0.425	0.209	0.107	0.090	0.189
n = 15	0.395	0.096	0.059	0.056	0.075	0.384	0.098	0.058	0.054	0.078	0.372	0.104	0.060	0.055	0.159
n = 30	0.383	0.061	0.048	0.046	0.055	0.379	0.062	0.049	0.047	0.065	0.366	0.065	0.049	0.046	0.155

Note. *K* = number of groups; *n* = group size; *λ* = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B16

RMSE of the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{1,X}$ = .30 and $\rho_{1,Y}$ = .30, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35, true value = 0.350)															
$K = 50$															
$n = 5$	1.032	0.225	0.256	0.220	0.418	0.979	0.227	0.242	0.211	0.414	0.921	0.237	0.259	0.227	0.438
$n = 15$	0.744	0.162	0.169	0.157	0.185	0.743	0.158	0.174	0.163	0.188	0.716	0.166	0.176	0.159	0.252
$n = 30$	0.717	0.141	0.154	0.149	0.161	0.693	0.140	0.150	0.149	0.161	0.659	0.150	0.163	0.152	0.232
$K = 150$															
$n = 5$	0.805	0.198	0.142	0.116	0.169	0.759	0.200	0.141	0.120	0.178	0.669	0.208	0.146	0.117	0.244
$n = 15$	0.700	0.111	0.097	0.090	0.109	0.678	0.118	0.099	0.089	0.111	0.624	0.134	0.091	0.091	0.220
$n = 30$	0.683	0.089	0.087	0.084	0.090	0.676	0.089	0.089	0.085	0.100	0.621	0.094	0.084	0.084	0.210
Large correlation at level 2 (ρ_B = .60, true value = 0.600)															
$K = 50$															
$n = 5$	0.845	0.343	0.221	0.204	0.398	0.824	0.345	0.223	0.213	0.399	0.793	0.363	0.242	0.217	0.448
$n = 15$	0.667	0.189	0.143	0.138	0.170	0.683	0.193	0.162	0.147	0.183	0.638	0.230	0.159	0.145	0.304
$n = 30$	0.643	0.140	0.133	0.125	0.136	0.630	0.147	0.133	0.128	0.151	0.596	0.159	0.135	0.129	0.286
$K = 150$															
$n = 5$	0.694	0.330	0.130	0.108	0.179	0.684	0.336	0.133	0.108	0.178	0.627	0.366	0.138	0.106	0.302
$n = 15$	0.630	0.161	0.087	0.080	0.093	0.617	0.168	0.081	0.076	0.108	0.569	0.202	0.089	0.077	0.275
$n = 30$	0.622	0.103	0.077	0.073	0.080	0.607	0.107	0.078	0.073	0.096	0.562	0.124	0.078	0.072	0.266

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B17

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .10$, and 25% Missing Data

Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
n = 5	97.7	86.6	96.9	94.2	93.5	97.6	88.6	96.5	94.0	93.9	97.4	87.2	96.9	92.9	90.5
n = 15	92.8	92.4	95.3	91.5	92.6	93.0	93.0	96.1	92.8	92.0	93.8	93.1	96.1	92.2	83.7
n = 30	84.6	92.8	93.6	92.2	92.3	93.9	93.9	94.1	92.9	92.0	84.0	94.0	94.5	92.7	78.3
K = 150															
n = 5	97.2	65.0	96.3	94.8	93.7	96.4	65.6	95.3	93.6	93.7	96.8	65.0	95.9	95.1	88.3
n = 15	81.2	86.6	95.0	94.3	94.4	84.7	84.2	93.5	94.2	91.9	84.9	85.8	95.7	93.3	68.1
n = 30	66.4	90.8	94.3	94.5	94.2	67.9	93.0	96.1	94.8	93.0	66.2	91.4	93.2	92.5	52.0

Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
n = 5	98.8	68.0	96.1	92.7	92.1	98.7	66.9	94.9	93.4	93.0	98.2	66.2	95.6	93.2	87.4
n = 15	92.3	83.9	94.9	92.9	91.0	92.2	81.7	93.4	92.1	90.6	91.8	83.7	93.6	92.2	78.2
n = 30	80.1	89.2	93.5	92.0	91.2	81.5	89.6	94.6	92.6	91.5	84.1	90.5	94.2	91.9	66.9
K = 150															
n = 5	98.1	18.9	94.0	93.1	94.2	96.2	18.0	95.0	93.4	93.1	97.3	15.1	95.6	94.9	85.5
n = 15	79.0	60.5	95.2	94.0	93.9	77.3	59.7	96.5	95.0	92.7	77.0	61.4	94.6	93.4	58.3
n = 30	53.6	81.2	95.3	94.7	94.3	55.3	83.7	94.8	93.5	90.4	54.1	79.1	93.7	93.2	36.1

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B18

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,x} = .30$ and $\rho_{I,y} = .10$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.606)															
K = 50															
n = 5	97.3	76.7	97.0	92.9	93.0	96.7	75.6	95.1	92.2	91.0	97.0	75.8	95.6	93.0	83.9
n = 15	86.8	89.8	94.0	91.7	92.3	85.2	89.8	94.6	90.6	89.2	87.0	90.4	94.9	91.4	74.8
n = 30	76.3	92.7	94.7	92.6	92.8	92.8	92.8	93.9	93.1	91.8	76.0	94.2	93.0	91.6	67.0
K = 150															
n = 5	94.5	37.8	95.3	93.8	93.0	94.0	35.8	94.5	93.5	92.1	95.4	33.1	95.8	93.3	70.8
n = 15	53.8	82.5	94.0	94.3	92.9	61.4	81.3	94.3	93.9	90.7	62.9	79.3	95.4	95.5	45.1
n = 30	40.7	88.8	92.8	93.9	94.0	42.0	90.3	93.3	93.6	90.4	45.0	91.6	95.7	95.3	29.2
Large correlation at level 2 ($\rho_B = .60$, true value = 1.039)															
K = 50															
n = 5	98.6	42.7	91.8	89.8	92.0	98.3	43.7	92.6	90.4	90.8	98.2	38.3	90.4	90.7	79.6
n = 15	85.9	81.3	94.7	90.6	91.1	88.6	80.8	95.0	92.1	89.0	90.5	75.9	94.9	92.9	70.1
n = 30	71.1	88.4	93.8	92.2	91.2	77.5	86.4	92.1	90.8	88.5	75.8	87.5	94.2	92.2	64.0
K = 150															
n = 5	92.7	2.0	89.5	89.6	89.1	93.3	3.8	93.0	90.4	87.4	93.4	2.2	91.4	89.8	66.0
n = 15	59.3	49.0	95.2	93.4	91.8	56.7	49.9	93.6	93.0	90.0	62.1	41.5	93.5	92.7	42.1
n = 30	33.3	79.3	94.1	93.7	92.6	34.5	77.8	94.8	93.9	89.4	42.3	71.3	93.7	93.3	28.0

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B19

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .30$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.202)															
K = 50															
n = 5	95.0	94.4	95.0	92.5	93.0	96.2	95.4	93.0	93.0	92.3	95.8	91.9	93.0	92.8	89.6
n = 15	89.0	93.5	93.2	92.8	92.9	86.7	92.8	92.5	92.0	91.7	87.8	94.6	93.5	92.3	84.3
n = 30	83.6	92.2	91.5	91.6	91.6	85.4	93.2	92.9	93.1	91.7	82.6	93.3	92.9	92.8	79.1
K = 150															
n = 5	92.1	91.1	94.6	94.4	94.2	93.1	90.7	95.3	93.4	92.7	93.3	92.9	96.0	94.0	85.9
n = 15	79.8	96.1	96.0	95.4	94.2	77.1	93.9	94.1	94.0	92.4	78.9	95.7	95.5	94.6	68.3
n = 30	68.4	93.2	92.8	94.0	94.0	68.4	94.0	94.0	93.2	92.5	69.7	95.1	94.1	93.6	58.2
Large correlation at level 2 ($\rho_B = .60$, true value = 0.346)															
K = 50															
n = 5	94.4	88.8	93.5	92.8	91.8	95.2	90.2	93.6	92.2	92.4	96.0	88.1	95.0	92.8	85.3
n = 15	82.1	92.2	92.5	92.2	92.6	83.4	92.7	93.1	92.2	91.9	81.3	92.1	92.9	91.5	72.9
n = 30	75.7	92.7	93.4	93.3	92.8	77.3	92.5	93.0	92.3	90.4	77.4	92.3	92.7	91.7	62.5
K = 150															
n = 5	89.6	80.4	95.1	93.5	94.1	89.0	80.2	95.1	92.6	92.8	89.6	76.3	95.8	93.8	76.8
n = 15	62.1	92.2	94.3	93.8	92.9	61.7	93.5	95.8	95.4	92.7	65.0	90.2	94.3	93.5	42.4
n = 30	43.6	93.8	93.3	94.0	94.6	46.9	93.0	93.8	93.7	90.0	49.0	92.5	94.1	94.3	22.6

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B20

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .30$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)															
K = 50															
n = 5	92.3	91.1	95.0	92.6	92.0	93.2	93.1	95.1	93.2	92.9	91.9	94.4	92.4	92.7	84.4
n = 15	76.6	93.9	94.2	93.4	93.2	82.1	93.9	93.3	92.8	92.1	78.1	94.2	93.5	92.4	79.1
n = 30	73.8	92.8	93.2	91.9	92.5	93.2	93.5	92.9	92.0	92.0	74.4	92.9	92.5	92.1	71.9
K = 150															
n = 5	80.0	87.1	95.8	94.6	94.2	81.5	84.9	95.4	94.9	92.8	79.1	84.3	94.2	93.1	69.3
n = 15	54.6	95.7	95.1	94.2	94.1	55.1	93.6	94.9	94.4	92.6	59.0	93.8	95.1	95.1	52.2
n = 30	47.3	93.4	93.8	94.4	93.9	47.9	95.1	94.3	93.9	93.2	48.5	95.3	95.1	94.5	48.2
Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)															
K = 50															
n = 5	91.3	82.2	95.0	92.9	90.8	89.1	84.2	94.0	91.8	90.4	91.9	81.9	95.3	92.7	77.6
n = 15	72.3	93.1	93.5	92.2	91.9	74.5	92.8	93.9	92.4	92.6	74.1	93.1	95.0	93.0	65.4
n = 30	60.7	90.3	90.1	91.2	90.6	64.9	93.8	92.5	91.5	90.8	68.9	92.9	92.4	92.1	58.3
K = 150															
n = 5	70.8	63.1	95.0	93.7	94.7	71.2	63.3	95.7	93.3	91.2	75.2	53.2	94.4	93.4	56.3
n = 15	37.3	89.0	94.6	93.0	92.2	37.7	88.6	95.0	94.2	90.7	41.5	87.0	93.8	93.9	26.2
n = 30	25.9	91.3	94.5	93.6	93.4	27.3	92.3	94.5	93.4	90.5	30.7	93.1	95.0	94.5	20.0

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B21

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .10$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)															
K = 50															
n = 5	98.4	47.0	96.1	92.9	93.2	98.8	50.9	97.2	94.3	94.5	99.0	45.5	97.0	92.7	89.5
n = 15	90.1	73.5	96.2	93.4	92.1	91.1	75.7	95.6	92.0	92.0	90.7	77.5	96.3	92.5	79.7
n = 30	70.1	87.0	94.6	92.8	93.0	68.8	90.2	96.4	93.1	91.5	86.9	86.9	95.5	93.2	69.3
K = 150															
n = 5	95.2	3.5	96.7	94.2	94.4	97.0	2.4	95.8	93.1	93.9	97.0	5.4	95.1	95.4	86.4
n = 15	62.7	31.4	95.6	94.0	94.8	58.7	32.7	95.1	93.9	92.6	59.9	32.0	95.7	94.8	63.3
n = 30	12.5	70.8	94.2	93.6	93.0	14.1	68.6	95.0	93.8	90.8	17.0	65.8	93.4	93.4	35.9
Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)															
K = 50															
n = 5	99.6	6.2	90.4	93.6	93.8	99.5	6.1	92.1	93.4	92.9	99.6	6.2	89.1	94.1	83.7
n = 15	88.7	35.2	91.0	92.3	91.1	91.4	32.6	89.5	92.4	90.5	89.2	30.1	89.9	92.5	72.3
n = 30	61.5	64.8	91.7	91.9	92.4	57.5	66.5	93.3	92.0	90.9	60.6	64.5	92.6	92.7	55.3
K = 150															
n = 5	96.2	0.0	86.1	94.2	95.5	97.4	0.0	87.1	94.3	92.7	97.7	0.0	87.0	94.4	78.1
n = 15	49.2	0.9	90.9	93.7	94.6	46.5	0.6	91.0	93.3	91.7	50.2	0.1	92.6	92.8	47.6
n = 30	3.9	17.0	94.8	93.5	94.0	4.7	20.3	93.6	94.0	89.1	4.7	15.6	94.0	94.9	17.5

Note. *K* = number of groups; *n* = group size; *λ* = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B22

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,x} = .30$ and $\rho_{I,y} = .10$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.606)															
K = 50															
n = 5	97.0	16.1	95.9	93.4	92.3	95.7	17.9	95.9	91.8	90.1	98.0	25.4	93.7	91.8	77.9
n = 15	68.9	69.8	95.4	92.4	92.5	72.5	67.3	94.2	89.7	89.7	73.8	58.9	95.3	92.8	62.6
n = 30	32.7	86.9	95.0	91.8	91.4	33.6	85.9	92.5	92.4	92.2	40.9	85.4	92.8	92.8	44.6
K = 150															
n = 5	85.2	0.0	92.7	94.2	92.3	0.0	0.0	93.8	95.6	91.5	85.6	0.4	93.1	93.8	68.4
n = 15	15.9	19.4	94.7	93.3	94.0	14.7	15.5	94.6	94.1	89.8	18.5	9.6	94.5	93.6	27.6
n = 30	0.1	63.2	95.3	92.9	94.4	62.5	62.5	93.8	92.7	88.0	1.8	53.1	95.4	94.9	11.0
Large correlation at level 2 ($\rho_B = .60$, true value = 1.039)															
K = 50															
n = 5	99.0	0.4	85.4	91.4	90.9	99.3	0.5	85.1	91.2	88.1	99.9	1.1	84.8	90.9	72.6
n = 15	72.6	20.0	90.5	90.5	89.8	70.5	18.2	89.1	89.6	86.4	80.6	10.9	88.6	91.6	58.2
n = 30	32.5	57.2	92.5	91.8	89.9	28.3	60.2	94.7	92.2	88.8	39.3	45.6	93.5	93.8	43.0
K = 150															
n = 5	86.7	0.0	80.3	89.9	90.6	85.3	0.0	80.3	88.9	85.1	89.8	0.0	82.6	91.0	60.8
n = 15	10.4	0.0	92.0	92.0	91.6	13.9	0.0	90.9	92.3	86.1	16.0	0.0	89.8	92.0	26.1
n = 30	0.0	12.8	94.9	94.5	92.6	0.1	8.3	94.5	94.5	85.8	0.4	3.0	92.8	93.5	9.7

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B23

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,x} = .10$ and $\rho_{I,y} = .30$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.202)															
K = 50															
n = 5	96.1	89.2	97.5	93.4	92.3	98.0	89.4	96.9	92.6	91.5	97.1	86.6	98.3	91.5	89.1
n = 15	79.1	90.5	92.8	91.6	91.8	76.8	93.1	94.3	92.0	91.6	77.7	93.7	95.3	92.6	79.6
n = 30	56.6	93.7	93.5	92.0	92.0	57.6	93.3	94.0	92.4	90.8	65.0	93.0	94.1	92.1	66.9
K = 150															
n = 5	91.2	63.4	96.1	94.2	94.3	92.1	62.2	96.0	94.3	93.2	91.9	65.2	97.3	94.7	83.1
n = 15	39.0	86.7	94.5	92.7	93.6	39.2	86.6	95.0	94.3	93.1	42.0	86.2	93.9	93.7	55.4
n = 30	15.0	93.3	94.4	93.1	93.4	15.6	92.1	94.0	95.3	91.0	18.7	93.0	95.1	93.8	35.6
Large correlation at level 2 ($\rho_B = .60$, true value = 0.346)															
K = 50															
n = 5	95.8	64.0	95.5	93.0	93.6	96.5	60.2	94.3	92.8	91.5	94.8	59.5	97.6	93.7	83.8
n = 15	60.9	82.6	93.5	91.7	91.7	62.3	85.9	95.3	92.4	91.7	65.4	84.8	94.6	93.0	64.5
n = 30	33.1	91.6	93.7	93.1	92.4	32.6	89.9	93.8	91.7	89.1	38.8	91.2	93.7	92.4	42.7
K = 150															
n = 5	79.6	15.3	95.8	93.5	94.4	82.0	16.0	95.2	94.0	93.0	83.5	15.7	95.8	94.8	72.9
n = 15	11.7	66.1	95.0	94.7	93.0	11.5	62.4	95.7	94.6	90.8	15.9	58.0	95.2	94.4	25.2
n = 30	1.2	86.1	96.2	94.8	94.6	0.8	84.9	95.1	94.6	87.1	1.4	84.0	94.4	94.1	5.7

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table B24

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}= .30$ and $\rho_{I,Y}= .30$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)															
K = 50															
n = 5	89.7	76.4	96.5	93.0	91.9	89.7	75.2	95.4	93.6	92.5	89.1	78.0	96.0	92.9	79.0
n = 15	52.4	89.9	94.7	93.4	93.3	47.4	90.2	93.2	92.2	91.4	51.7	91.5	94.2	92.4	61.9
n = 30	28.2	94.2	92.8	91.4	92.3	29.8	94.9	93.9	91.9	90.1	33.9	91.6	90.8	91.6	54.7
K = 150															
n = 5	55.8	34.6	96.0	95.2	94.8	59.4	35.7	94.6	93.9	92.9	59.1	52.2	96.0	94.9	63.8
n = 15	4.9	84.0	95.0	94.4	92.3	6.5	83.3	94.2	94.5	91.5	12.1	78.2	94.2	94.2	24.6
n = 30	1.1	91.7	93.8	93.9	94.3	1.8	92.4	94.2	93.2	89.9	3.5	92.8	94.6	93.7	14.0
Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)															
K = 50															
n = 5	85.1	38.7	96.4	91.7	90.5	88.2	34.7	97.2	91.9	91.0	87.1	39.4	96.7	91.4	73.7
n = 15	30.4	80.3	95.1	93.4	92.0	28.7	80.2	92.5	92.0	88.8	36.5	70.8	95.3	91.6	45.5
n = 30	10.7	89.7	93.3	93.0	93.0	10.7	86.7	94.2	92.9	89.7	17.7	87.3	94.5	92.7	31.7
K = 150															
n = 5	38.2	1.1	94.3	94.4	92.7	41.2	1.5	94.0	93.5	90.7	47.0	2.7	94.1	94.3	44.9
n = 15	0.3	49.9	94.4	94.1	93.8	0.0	45.5	95.9	94.8	88.4	1.4	28.8	95.5	94.8	7.8
n = 30	0.0	80.1	93.8	93.8	93.1	0.0	78.6	94.1	94.1	85.3	0.1	69.5	94.7	94.8	2.4

Note. K = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C1

Bias of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}$= .10 and $\rho_{I,Y}$= .10, and 25% Missing Data (True Value = 0.350)

Moderate correlation at level 2 (ρ_B = .35)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
n = 5	−.014	−.003	.006	−.001	−.001	−.010	.000	.008	.001	−.019	−.021	−.015	−.008	.000	−.092
n = 15	−.015	−.001	.000	.000	−.001	−.014	.001	.001	−.001	−.022	−.012	.002	.002	.001	−.086
n = 30	−.014	.000	.000	.000	.000	−.014	.000	.000	.001	−.020	−.015	−.001	−.002	.000	−.088
K = 150															
n = 5	−.017	−.003	.001	−.001	.000	−.013	.000	.005	.000	−.020	−.014	−.002	.001	.000	−.088
n = 15	−.015	−.001	.000	.000	.000	−.014	.001	.001	.000	−.020	−.015	−.001	.000	.000	−.088
n = 30	−.015	.000	.000	.000	.000	−.014	.000	.000	.000	−.021	−.014	.000	.000	.000	−.088

Large correlation at level 2 (ρ_B = .60)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
n = 5	−.005	−.004	.006	.002	.004	−.004	−.004	.006	.003	−.016	−.009	−.012	−.002	.002	−.085
n = 15	−.007	−.001	.002	−.001	.000	−.007	.000	.002	.000	−.021	−.007	−.001	−.001	.000	−.088
n = 30	−.007	−.001	.000	−.001	−.001	−.007	−.001	−.001	−.001	−.022	−.008	−.001	−.002	−.001	−.089
K = 150															
n = 5	−.007	−.002	.005	.001	.000	−.007	−.001	.004	−.001	−.020	−.008	−.003	.002	−.001	−.088
n = 15	−.007	.000	.002	.000	.000	−.008	−.001	.000	.000	−.022	−.007	−.001	.000	.000	−.087
n = 30	−.007	.000	.000	.000	.000	−.006	.001	.001	.000	−.020	−.007	.000	−.001	.000	−.087

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C2

Bias of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of ρ_{I,X}= .30 and ρ_{I,Y}= .10, and 25% Missing Data (True Value = 0.309)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35)															
K = 50															
n = 5	–.023	–.003	.002	.001	–.001	–.020	–.002	.004	–.002	–.015	–.020	–.001	.003	.001	–.064
n = 15	–.021	.000	.001	.001	.001	–.021	.000	.001	.000	–.015	–.020	.002	.002	.000	–.063
n = 30	–.021	.000	.001	.000	.000	–.022	–.001	–.001	–.001	–.014	–.021	.000	.000	.000	–.064
K = 150															
n = 5	–.022	–.001	.002	.000	–.001	–.023	–.002	.001	–.001	–.015	–.022	–.001	.000	–.001	–.064
n = 15	–.022	.000	.001	.000	–.001	–.021	.001	.002	.000	–.014	–.022	–.001	–.001	.000	–.063
n = 30	–.022	.000	.000	.000	.000	–.022	.000	.000	.000	–.014	–.021	.000	.000	.000	–.063
Large correlation at level 2 (ρ_B = .60)															
K = 50															
n = 5	–.010	–.002	.006	.001	.000	–.012	–.004	.002	.000	–.012	–.015	–.009	–.004	–.003	–.065
n = 15	–.012	–.001	.000	.000	.000	–.012	–.001	–.001	.000	–.015	–.010	.000	.001	.000	–.063
n = 30	–.012	–.001	–.001	–.001	–.002	–.012	–.001	–.001	.000	–.014	–.013	–.003	–.004	.000	–.064
K = 150															
n = 5	–.012	.000	.004	–.001	–.001	–.013	–.003	.002	.000	–.014	–.012	–.002	.002	.001	–.062
n = 15	–.012	.000	.001	.000	–.001	–.011	.000	.001	.000	–.015	–.013	–.002	–.002	–.001	–.065
n = 30	–.011	.000	.000	.000	.000	–.011	.000	.000	.000	–.015	–.011	.000	–.001	.000	–.064

Note. *K* = number of groups; *n* = group size; λ = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C3

Bias of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}= .10$ and $\rho_{I,Y}= .30$, and 25% Missing Data (True Value = 0.397)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
						Moderate correlation at level 2 ($\rho_B = .35$)									
K = 50															
n = 5	–.057	–.009	–.007	–.004	–.005	–.053	–.003	.000	.001	–.023	–.054	–.007	–.006	–.001	–.102
n = 15	–.051	–.001	.000	.000	–.001	–.049	–.001	.000	–.001	–.024	–.054	–.005	–.005	–.001	–.100
n = 30	–.049	–.001	.000	.000	–.001	–.050	–.001	.000	.001	–.023	–.050	.000	–.001	.000	–.099
K = 150															
n = 5	–.049	.003	.005	.000	.000	–.049	.000	.002	.003	–.021	–.051	–.002	–.001	.000	–.100
n = 15	–.052	–.001	–.001	–.001	–.001	–.050	.001	.000	.001	–.023	–.051	–.001	–.001	.000	–.099
n = 30	–.051	.000	.000	.000	.000	–.050	–.001	.000	.000	–.024	–.050	.000	–.001	.000	–.100
						Large correlation at level 2 ($\rho_B = .60$)									
K = 50															
n = 5	–.042	–.011	–.005	–.007	–.009	–.042	–.010	–.005	–.003	–.028	–.042	–.012	–.007	–.002	–.102
n = 15	–.034	.001	.002	.002	.001	–.035	.000	.001	–.001	–.024	–.036	–.001	–.002	.000	–.099
n = 30	–.036	–.001	.000	.000	.000	–.037	–.002	–.001	.000	–.024	–.036	.000	–.001	.000	–.099
K = 150															
n = 5	–.038	–.003	.001	–.001	–.001	–.037	–.003	.001	–.001	–.024	–.037	–.002	–.001	–.001	–.100
n = 15	–.037	–.001	.000	.000	.000	–.035	.000	.001	.000	–.023	–.036	.000	–.001	.001	–.098
n = 30	–.036	.000	.000	.000	.000	–.035	.001	.001	.000	–.023	–.035	–.001	–.001	.001	–.099

Note. *K* = number of groups; *n* = group size; λ = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C4

Bias of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,x}$= .30 and $\rho_{I,y}$= .30, and 25% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	–.049	–.001	.001	.001	.000	–.052	–.005	–.005	–.002	–.015	–.049	–.007	–.006	–.001	–.073
n = 15	–.047	.001	.001	.001	.001	–.047	.001	.001	.000	–.017	–.046	.000	.000	.000	–.071
n = 30	–.048	.000	.000	.000	.000	–.048	–.001	–.001	.000	–.017	–.047	–.002	–.003	–.001	–.073
K = 150															
n = 5	–.051	–.003	–.002	.000	.001	–.050	–.002	–.002	–.001	–.017	–.047	.001	.001	.001	–.070
n = 15	–.049	.000	.000	.000	.000	–.048	.001	.001	.000	–.017	–.047	.000	.000	.001	–.071
n = 30	–.050	–.001	–.002	–.001	–.001	–.049	.001	.000	.000	–.016	–.047	–.003	.000	.000	–.072
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	–.027	–.003	.002	.001	.000	–.028	–.005	.000	–.001	–.014	–.029	–.005	–.003	.001	–.069
n = 15	–.026	.001	.002	.001	.001	–.026	.000	.000	.000	–.015	–.026	–.001	.000	.000	–.073
n = 30	–.026	.000	.000	.000	–.001	–.025	.001	.001	.000	–.016	–.026	–.001	–.002	.000	–.073
K = 150															
n = 5	–.027	.000	.002	–.001	–.001	–.026	–.001	.002	.000	–.014	–.025	.000	.000	.001	–.070
n = 15	–.027	–.001	–.001	.000	.000	–.028	–.001	–.001	–.001	–.018	–.025	.000	.000	–.001	–.072
n = 30	–.027	.000	.000	.000	.000	–.026	.000	.000	.001	–.016	–.026	.000	–.001	.000	–.072

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; PAN = two-level imputation; CD = complete data; LD = listwise deletion. DI = dummy-indicator approach;

Table C5

Bias of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}$ = .10 and $\rho_{I,Y}$ = .10, and 50% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35)															
K = 50															
n = 5	−.028	−.013	.010	.000	.000	−.025	−.014	.009	.000	−.029	−.032	−.019	−.002	.000	−.124
n = 15	−.024	−.003	.002	−.001	.000	−.028	−.005	−.001	−.001	−.030	−.030	−.010	−.008	−.002	−.125
n = 30	−.024	−.001	.000	.000	−.001	−.023	.000	.001	−.001	−.029	−.026	−.002	−.003	−.001	−.124
K = 150															
n = 5	−.023	−.002	.012	.000	.000	−.022	−.002	.013	.000	−.028	−.025	−.005	.006	−.001	−.123
n = 15	−.024	−.001	.001	.000	.000	−.022	.002	.004	.001	−.028	−.024	−.002	−.001	.000	−.123
n = 30	−.023	.000	.001	.000	.000	−.024	.000	.000	.000	−.028	−.025	−.001	−.002	.000	−.124
Large correlation at level 2 (ρ_B = .60)															
K = 50															
n = 5	−.013	−.015	.013	.002	.006	−.011	−.016	.012	.000	−.025	−.017	−.020	.002	.003	−.124
n = 15	−.010	−.001	.004	.000	.000	−.012	−.003	.002	.001	−.029	−.012	−.005	−.003	.000	−.124
n = 30	−.011	−.001	.001	.000	−.001	−.012	−.003	−.001	−.001	−.030	−.011	−.001	−.001	−.001	−.124
K = 150															
n = 5	−.011	−.006	.013	−.001	.001	−.009	−.003	.016	−.001	−.027	−.014	−.012	.006	.000	−.123
n = 15	−.012	−.002	.003	.000	−.001	−.011	−.002	.002	.000	−.029	−.014	−.004	−.002	.000	−.124
n = 30	−.011	−.001	.001	.000	.000	−.009	.001	.002	.000	−.029	−.010	.000	.000	.000	−.123

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C6

Bias of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .10$, and 50% Missing Data (True Value = 0.309)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	−.039	−.006	.012	.001	.003	−.036	−.009	.010	.001	−.016	−.046	−.018	−.004	.001	−.094
n = 15	−.040	−.003	.001	.000	.000	−.041	−.002	−.001	−.002	−.023	−.041	−.004	−.003	.000	−.091
n = 30	−.038	.001	.001	.000	.001	−.038	.000	.001	.001	−.018	−.039	−.002	−.002	.000	−.092
K = 150															
n = 5	−.043	−.006	.004	−.002	−.003	−.037	−.003	.007	.001	−.018	−.041	−.007	.000	.000	−.093
n = 15	−.040	.000	.001	.000	.000	−.039	.000	.001	.000	−.020	−.039	−.002	−.001	−.001	−.092
n = 30	−.039	.000	.000	.000	.001	−.040	−.001	.000	.000	−.020	−.039	−.001	−.001	.000	−.092
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	−.021	−.010	.009	−.002	.004	−.023	−.013	.008	.000	−.018	−.029	−.022	−.005	.001	−.089
n = 15	−.021	−.002	.001	−.001	.000	−.017	.002	.005	.002	−.017	−.026	−.008	−.007	−.001	−.092
n = 30	−.020	−.001	.000	.000	.000	−.019	−.001	.000	.000	−.020	−.022	−.004	−.003	.000	−.091
K = 150															
n = 5	−.017	−.001	.012	.000	.002	−.020	−.004	.008	−.001	−.020	−.019	−.004	.007	.001	−.091
n = 15	−.021	−.001	.001	.000	.001	−.021	−.001	.001	.000	−.020	−.021	−.002	−.001	.000	−.092
n = 30	−.021	−.001	.000	.000	.000	−.020	.000	.001	.000	−.019	−.020	−.001	−.001	.000	−.092

Note. *K* = number of groups; *n* = group size; λ = effect of *X* on missingness; NORM = normal model imputation; PAN = two-level imputation; CD = complete data; LD = listwise deletion. DI = dummy-indicator approach;

Table C7

Bias of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}= .10$ and $\rho_{I,Y}= .30$, and 50% Missing Data (True Value = 0.397)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	−.082	−.017	−.004	−.003	−.008	−.074	−.012	.003	.004	−.035	−.080	−.019	−.007	.000	−.142
n = 15	−.076	.000	.002	.002	.001	−.073	.002	.002	.001	−.031	−.079	−.007	−.008	.000	−.140
n = 30	−.074	.001	.001	.000	.001	−.076	−.001	−.001	.000	−.032	−.080	−.002	−.003	−.002	−.140
K = 150															
n = 5	−.080	−.005	.001	−.002	−.001	−.075	.000	.005	.000	−.032	−.080	−.013	−.006	−.002	−.142
n = 15	−.078	−.001	−.001	.000	.000	−.078	−.001	.000	.000	−.032	−.077	−.002	−.002	−.001	−.140
n = 30	−.078	−.001	−.001	.000	−.001	−.077	.000	.000	.000	−.033	−.076	−.001	−.001	.000	−.140
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	−.054	−.015	.005	.000	−.001	−.059	−.018	.001	.000	−.034	−.055	−.022	−.008	.003	−.140
n = 15	−.052	.001	.003	.000	.003	−.053	−.003	−.002	.000	−.033	−.060	−.013	−.013	−.003	−.142
n = 30	−.050	.001	.002	.001	.001	−.051	−.001	.000	.000	−.033	−.054	−.003	−.004	.000	−.140
K = 150															
n = 5	−.056	−.009	.005	.000	−.002	−.056	−.009	.003	−.002	−.037	−.054	−.009	−.001	.000	−.140
n = 15	−.051	.000	.002	.001	.002	−.051	.000	.002	.000	−.032	−.054	−.004	−.005	.000	−.139
n = 30	−.052	.000	.000	.000	−.001	−.052	.000	.000	.000	−.033	−.053	−.001	−.002	−.001	−.140

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C8

Bias of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}$= .30 and $\rho_{I,Y}$= .30, and 50% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	−.081	−.011	−.003	−.002	−.001	−.077	−.008	.000	−.001	−.019	−.082	−.012	−.008	.000	−.103
n = 15	−.078	−.002	−.002	.000	−.001	−.075	−.003	−.003	−.001	−.023	−.075	−.002	−.003	.001	−.102
n = 30	−.074	.001	.001	.000	.001	−.078	−.003	−.003	.000	−.023	−.072	−.002	−.002	−.001	−.103
K = 150															
n = 5	−.076	−.002	.001	.001	.000	−.079	−.004	−.003	−.001	−.022	−.078	−.008	−.008	.000	−.103
n = 15	−.076	−.001	.000	.001	.001	−.076	.001	.001	.000	−.023	−.076	−.002	−.002	.000	−.103
n = 30	−.076	.000	.000	.001	.001	−.077	−.002	−.002	.000	−.023	−.075	−.002	−.002	.000	−.104
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	−.040	−.009	.005	.002	.004	−.038	−.007	.007	.000	−.021	−.041	−.018	−.010	.001	−.103
n = 15	−.039	.000	.002	−.001	.000	−.041	−.003	−.003	−.001	−.024	−.039	−.002	−.004	.001	−.101
n = 30	−.038	.001	.001	.001	.000	−.039	.000	.000	.000	−.022	−.037	−.001	−.002	.001	−.104
K = 150															
n = 5	−.040	−.004	.003	.001	.000	−.040	−.003	.004	.000	−.021	−.039	−.001	.001	.001	−.102
n = 15	−.040	−.003	−.002	.000	−.001	−.038	.001	.002	.000	−.023	−.037	.000	.000	.000	−.102
n = 30	−.039	.000	−.001	.000	−.001	−.039	−.001	.000	−.001	−.023	−.037	−.001	−.001	.000	−.104

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; PAN = two-level imputation; CD = complete data; LD = listwise deletion; DI = dummy-indicator approach.

Table C9

RMSE of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,x} = .10$ and $\rho_{I,y} = .10$, and 25% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.069	0.077	0.074	0.066	0.078	0.070	0.079	0.077	0.066	0.079	0.080	0.087	0.084	0.066	0.115
n = 15	0.043	0.043	0.043	0.037	0.043	0.040	0.041	0.040	0.035	0.046	0.045	0.046	0.045	0.036	0.093
n = 30	0.031	0.028	0.028	0.024	0.029	0.032	0.029	0.029	0.025	0.035	0.034	0.032	0.031	0.024	0.091
K = 150															
n = 5	0.043	0.046	0.044	0.039	0.046	0.042	0.044	0.043	0.038	0.048	0.048	0.050	0.049	0.038	0.096
n = 15	0.027	0.024	0.024	0.021	0.024	0.027	0.024	0.024	0.020	0.031	0.029	0.026	0.025	0.021	0.090
n = 30	0.021	0.015	0.016	0.014	0.016	0.021	0.017	0.017	0.014	0.027	0.022	0.018	0.018	0.014	0.089
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.069	0.076	0.075	0.065	0.076	0.069	0.079	0.076	0.065	0.077	0.077	0.087	0.083	0.065	0.108
n = 15	0.039	0.042	0.041	0.036	0.042	0.038	0.041	0.040	0.035	0.045	0.044	0.046	0.046	0.035	0.095
n = 30	0.027	0.028	0.028	0.025	0.029	0.028	0.028	0.028	0.025	0.035	0.031	0.031	0.032	0.025	0.093
K = 150															
n = 5	0.041	0.046	0.045	0.038	0.045	0.042	0.047	0.046	0.039	0.049	0.045	0.050	0.048	0.037	0.097
n = 15	0.023	0.024	0.024	0.021	0.024	0.023	0.023	0.023	0.020	0.032	0.025	0.025	0.025	0.020	0.089
n = 30	0.017	0.016	0.016	0.014	0.016	0.017	0.018	0.017	0.015	0.026	0.019	0.018	0.018	0.014	0.089

Note. K = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C10

RMSE of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,x}=.30$ and $\rho_{I,y}=.10$, and 25% Missing Data (True Value = 0.309)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.064	0.069	0.066	0.058	0.070	0.064	0.071	0.069	0.059	0.072	0.067	0.073	0.070	0.058	0.090
n = 15	0.039	0.037	0.037	0.032	0.037	0.040	0.037	0.037	0.031	0.039	0.042	0.040	0.040	0.031	0.071
n = 30	0.031	0.024	0.024	0.022	0.025	0.032	0.025	0.025	0.022	0.028	0.034	0.027	0.027	0.022	0.068
K = 150															
n = 5	0.041	0.039	0.038	0.033	0.040	0.041	0.039	0.039	0.034	0.042	0.045	0.044	0.043	0.034	0.073
n = 15	0.029	0.021	0.021	0.018	0.021	0.029	0.021	0.021	0.018	0.025	0.031	0.023	0.023	0.018	0.066
n = 30	0.026	0.015	0.015	0.013	0.015	0.026	0.014	0.014	0.013	0.020	0.025	0.015	0.015	0.012	0.065
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.063	0.068	0.068	0.059	0.068	0.062	0.070	0.067	0.058	0.070	0.069	0.079	0.076	0.059	0.091
n = 15	0.036	0.036	0.036	0.031	0.036	0.037	0.036	0.036	0.030	0.038	0.038	0.040	0.039	0.031	0.072
n = 30	0.027	0.025	0.025	0.022	0.025	0.026	0.024	0.024	0.022	0.028	0.029	0.027	0.028	0.022	0.068
K = 150															
n = 5	0.037	0.040	0.039	0.033	0.041	0.037	0.041	0.039	0.034	0.042	0.041	0.047	0.043	0.035	0.073
n = 15	0.023	0.021	0.021	0.019	0.022	0.022	0.020	0.020	0.018	0.025	0.023	0.021	0.021	0.018	0.067
n = 30	0.017	0.014	0.014	0.013	0.015	0.018	0.014	0.014	0.012	0.020	0.019	0.016	0.016	0.013	0.066

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C11

RMSE of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}= .10$ and $\rho_{I,Y}= .30$, and 25% Missing Data (True Value = 0.397)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.093	0.092	0.087	0.077	0.091	0.091	0.089	0.087	0.076	0.091	0.101	0.101	0.096	0.074	0.130
n = 15	0.066	0.045	0.045	0.040	0.048	0.064	0.046	0.046	0.040	0.052	0.072	0.053	0.052	0.040	0.109
n = 30	0.058	0.033	0.033	0.029	0.034	0.059	0.033	0.033	0.027	0.039	0.060	0.035	0.035	0.028	0.103
K = 150															
n = 5	0.064	0.051	0.049	0.042	0.051	0.067	0.054	0.053	0.043	0.055	0.069	0.056	0.053	0.044	0.109
n = 15	0.057	0.027	0.027	0.024	0.029	0.056	0.026	0.026	0.023	0.034	0.057	0.030	0.029	0.023	0.102
n = 30	0.054	0.019	0.019	0.016	0.018	0.053	0.019	0.019	0.016	0.030	0.054	0.022	0.022	0.017	0.101
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.087	0.091	0.090	0.074	0.091	0.089	0.094	0.092	0.077	0.093	0.092	0.098	0.094	0.075	0.129
n = 15	0.053	0.047	0.047	0.040	0.046	0.055	0.047	0.048	0.041	0.052	0.060	0.054	0.053	0.040	0.108
n = 30	0.047	0.033	0.033	0.028	0.033	0.048	0.033	0.033	0.028	0.041	0.050	0.037	0.037	0.028	0.103
K = 150															
n = 5	0.057	0.051	0.050	0.044	0.052	0.056	0.052	0.050	0.044	0.057	0.061	0.058	0.057	0.045	0.110
n = 15	0.043	0.026	0.026	0.023	0.027	0.043	0.027	0.027	0.023	0.035	0.044	0.029	0.029	0.023	0.101
n = 30	0.039	0.018	0.018	0.016	0.018	0.039	0.019	0.019	0.016	0.030	0.040	0.020	0.020	0.016	0.101

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C12

RMSE of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of ρ_{I,X}= .30 and ρ_{I,Y}= .30, and 25% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.078	0.076	0.073	0.066	0.078	0.083	0.079	0.078	0.067	0.078	0.087	0.084	0.082	0.066	0.103
n = 15	0.059	0.040	0.040	0.035	0.041	0.060	0.041	0.041	0.035	0.044	0.061	0.044	0.044	0.035	0.081
n = 30	0.055	0.028	0.027	0.024	0.028	0.055	0.029	0.029	0.025	0.033	0.056	0.031	0.031	0.024	0.077
K = 150															
n = 5	0.063	0.044	0.043	0.038	0.045	0.062	0.045	0.045	0.037	0.048	0.063	0.052	0.052	0.039	0.081
n = 15	0.054	0.024	0.024	0.020	0.024	0.052	0.024	0.024	0.020	0.028	0.052	0.026	0.026	0.021	0.075
n = 30	0.053	0.016	0.016	0.014	0.017	0.051	0.016	0.016	0.014	0.023	0.050	0.017	0.017	0.014	0.074
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.075	0.083	0.082	0.067	0.079	0.073	0.081	0.079	0.067	0.082	0.077	0.085	0.084	0.067	0.100
n = 15	0.044	0.040	0.040	0.036	0.042	0.046	0.042	0.041	0.034	0.042	0.048	0.044	0.044	0.035	0.082
n = 30	0.037	0.028	0.028	0.025	0.030	0.036	0.028	0.029	0.025	0.032	0.038	0.031	0.030	0.025	0.077
K = 150															
n = 5	0.046	0.045	0.044	0.039	0.047	0.046	0.047	0.045	0.039	0.048	0.051	0.052	0.051	0.038	0.082
n = 15	0.034	0.023	0.023	0.020	0.024	0.035	0.024	0.024	0.021	0.030	0.033	0.024	0.024	0.020	0.075
n = 30	0.031	0.016	0.016	0.014	0.016	0.030	0.017	0.016	0.014	0.022	0.031	0.018	0.018	0.014	0.074

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C13

RMSE of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,x}= .10$ and $\rho_{I,y}= .10$, and 50% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35)															
$K = 50$															
$n = 5$	0.083	0.107	0.096	0.064	0.098	0.089	0.108	0.100	0.066	0.099	0.098	0.122	0.112	0.065	0.146
$n = 15$	0.051	0.051	0.049	0.035	0.053	0.056	0.054	0.053	0.036	0.059	0.064	0.061	0.062	0.035	0.132
$n = 30$	0.040	0.035	0.035	0.025	0.036	0.039	0.034	0.033	0.025	0.044	0.047	0.042	0.042	0.025	0.127
$K = 150$															
$n = 5$	0.052	0.061	0.056	0.038	0.060	0.052	0.061	0.057	0.038	0.063	0.060	0.070	0.063	0.039	0.132
$n = 15$	0.036	0.029	0.029	0.020	0.030	0.035	0.030	0.030	0.021	0.040	0.039	0.035	0.034	0.020	0.125
$n = 30$	0.030	0.020	0.020	0.015	0.021	0.030	0.021	0.020	0.014	0.034	0.034	0.024	0.025	0.014	0.125
Large correlation at level 2 (ρ_B = .60)															
$K = 50$															
$n = 5$	0.080	0.097	0.091	0.064	0.097	0.084	0.105	0.098	0.065	0.096	0.098	0.122	0.112	0.066	0.148
$n = 15$	0.046	0.050	0.050	0.037	0.052	0.048	0.052	0.051	0.035	0.058	0.055	0.059	0.058	0.035	0.131
$n = 30$	0.033	0.034	0.034	0.025	0.036	0.035	0.037	0.037	0.025	0.045	0.040	0.042	0.041	0.024	0.127
$K = 150$															
$n = 5$	0.047	0.059	0.054	0.038	0.058	0.051	0.063	0.059	0.040	0.063	0.056	0.069	0.062	0.039	0.131
$n = 15$	0.028	0.029	0.028	0.020	0.030	0.028	0.030	0.029	0.021	0.041	0.034	0.036	0.034	0.020	0.126
$n = 30$	0.021	0.020	0.020	0.014	0.021	0.021	0.020	0.020	0.014	0.035	0.024	0.024	0.024	0.014	0.124

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C14

RMSE of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,x} = .30$ and $\rho_{I,y} = .10$, and 50% Missing Data (True Value = 0.309)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
$K = 50$															
$n = 5$	0.078	0.089	0.085	0.058	0.093	0.079	0.095	0.086	0.059	0.095	0.095	0.104	0.097	0.059	0.121
$n = 15$	0.057	0.045	0.044	0.032	0.046	0.058	0.047	0.046	0.032	0.051	0.062	0.051	0.050	0.031	0.099
$n = 30$	0.047	0.030	0.030	0.022	0.031	0.048	0.031	0.031	0.022	0.035	0.050	0.034	0.033	0.022	0.096
$K = 150$															
$n = 5$	0.058	0.054	0.048	0.033	0.054	0.055	0.052	0.048	0.035	0.055	0.063	0.059	0.055	0.034	0.104
$n = 15$	0.046	0.027	0.026	0.018	0.027	0.045	0.026	0.026	0.018	0.032	0.048	0.030	0.030	0.018	0.095
$n = 30$	0.042	0.018	0.018	0.012	0.018	0.043	0.018	0.018	0.012	0.027	0.044	0.021	0.021	0.013	0.093
Large correlation at level 2 ($\rho_B = .60$)															
$K = 50$															
$n = 5$	0.074	0.095	0.088	0.058	0.094	0.073	0.098	0.088	0.057	0.088	0.088	0.109	0.098	0.059	0.118
$n = 15$	0.044	0.043	0.043	0.032	0.046	0.041	0.045	0.045	0.031	0.047	0.053	0.052	0.050	0.032	0.100
$n = 30$	0.033	0.029	0.029	0.022	0.032	0.034	0.030	0.030	0.022	0.036	0.039	0.035	0.034	0.022	0.095
$K = 150$															
$n = 5$	0.043	0.050	0.047	0.033	0.052	0.044	0.054	0.050	0.034	0.056	0.048	0.056	0.050	0.033	0.101
$n = 15$	0.030	0.025	0.025	0.018	0.025	0.031	0.026	0.026	0.018	0.032	0.034	0.029	0.029	0.018	0.095
$n = 30$	0.026	0.017	0.017	0.012	0.018	0.025	0.017	0.017	0.013	0.026	0.028	0.021	0.021	0.012	0.093

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C15

RMSE of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of ρ$_{I,X}$= .10 and ρ$_{I,Y}$= .30, and 50% Missing Data (True Value = 0.397)

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ$_B$ = .35)															
K = 50															
n = 5	0.116	0.117	0.107	0.075	0.116	0.112	0.123	0.114	0.075	0.119	0.127	0.136	0.124	0.075	0.170
n = 15	0.089	0.055	0.054	0.041	0.058	0.088	0.058	0.057	0.040	0.064	0.099	0.068	0.068	0.040	0.148
n = 30	0.082	0.039	0.039	0.029	0.040	0.084	0.039	0.039	0.028	0.050	0.091	0.048	0.048	0.028	0.144
K = 150															
n = 5	0.094	0.068	0.065	0.043	0.068	0.090	0.067	0.063	0.043	0.072	0.098	0.081	0.074	0.043	0.153
n = 15	0.083	0.032	0.032	0.023	0.034	0.083	0.035	0.035	0.024	0.046	0.084	0.039	0.039	0.023	0.143
n = 30	0.080	0.022	0.022	0.016	0.022	0.080	0.022	0.023	0.016	0.039	0.080	0.027	0.026	0.016	0.142
Large correlation at level 2 (ρ$_B$ = .60)															
K = 50															
n = 5	0.099	0.122	0.108	0.074	0.119	0.102	0.123	0.109	0.074	0.116	0.112	0.134	0.123	0.073	0.168
n = 15	0.071	0.060	0.058	0.041	0.060	0.071	0.057	0.056	0.040	0.065	0.083	0.070	0.069	0.041	0.150
n = 30	0.060	0.038	0.038	0.028	0.041	0.062	0.039	0.040	0.027	0.050	0.068	0.045	0.045	0.028	0.143
K = 150															
n = 5	0.073	0.066	0.061	0.043	0.069	0.076	0.071	0.066	0.045	0.076	0.080	0.077	0.072	0.043	0.150
n = 15	0.058	0.033	0.033	0.023	0.035	0.058	0.033	0.033	0.023	0.046	0.063	0.040	0.039	0.023	0.142
n = 30	0.055	0.022	0.022	0.016	0.023	0.056	0.024	0.024	0.016	0.039	0.057	0.027	0.027	0.016	0.141

Note. *K* = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C16

RMSE of the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}= .30$ and $\rho_{I,Y}= .30$, and 50% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.108	0.104	0.096	0.067	0.110	0.108	0.107	0.101	0.067	0.106	0.117	0.116	0.107	0.066	0.136
n = 15	0.088	0.047	0.047	0.035	0.052	0.087	0.051	0.051	0.034	0.055	0.090	0.059	0.059	0.036	0.111
n = 30	0.081	0.034	0.034	0.025	0.035	0.084	0.036	0.035	0.024	0.042	0.082	0.039	0.038	0.024	0.107
K = 150															
n = 5	0.086	0.057	0.055	0.038	0.060	0.090	0.061	0.057	0.038	0.064	0.092	0.066	0.062	0.038	0.116
n = 15	0.080	0.029	0.028	0.021	0.030	0.080	0.030	0.030	0.021	0.038	0.081	0.033	0.033	0.020	0.107
n = 30	0.079	0.021	0.021	0.015	0.021	0.079	0.020	0.020	0.014	0.030	0.078	0.023	0.023	0.015	0.105
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.085	0.107	0.100	0.067	0.110	0.082	0.103	0.097	0.067	0.103	0.092	0.119	0.110	0.066	0.136
n = 15	0.056	0.049	0.048	0.035	0.053	0.059	0.052	0.052	0.036	0.056	0.062	0.058	0.057	0.035	0.110
n = 30	0.049	0.035	0.035	0.024	0.036	0.050	0.034	0.034	0.025	0.041	0.052	0.040	0.041	0.025	0.109
K = 150															
n = 5	0.058	0.061	0.058	0.039	0.063	0.058	0.062	0.056	0.038	0.063	0.061	0.067	0.062	0.038	0.114
n = 15	0.047	0.029	0.028	0.021	0.030	0.044	0.030	0.029	0.021	0.037	0.046	0.034	0.033	0.021	0.105
n = 30	0.043	0.020	0.020	0.014	0.021	0.044	0.020	0.021	0.014	0.030	0.043	0.022	0.023	0.014	0.106

Note. *K* = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C17

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .10$, and 25% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	95.8	94.1	94.2	94.4	94.0	96.0	94.3	93.7	93.5	92.0	96.0	93.6	93.6	94.1	70.9
n = 15	93.3	92.6	92.6	92.2	93.5	94.8	94.3	95.2	94.2	90.6	94.8	93.6	93.8	93.6	33.4
n = 30	91.7	93.3	93.2	94.0	93.4	93.0	93.3	93.5	93.7	85.9	93.6	93.8	94.2	94.5	7.1
K = 150															
n = 5	93.9	94.8	95.3	94.9	94.8	95.7	95.4	95.4	95.4	92.8	93.8	94.6	93.7	95.0	41.4
n = 15	90.2	95.2	95.1	94.9	94.1	92.2	94.4	94.6	95.2	86.4	92.5	94.7	95.7	94.9	1.4
n = 30	86.4	96.6	96.3	95.3	95.1	87.1	94.1	94.6	95.5	72.5	90.2	95.8	95.7	94.0	0.0
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	95.6	94.4	94.2	93.2	93.7	95.5	93.5	94.6	94.0	93.6	95.8	94.2	94.9	94.1	72.8
n = 15	94.2	93.1	93.8	94.2	93.9	95.6	94.4	95.4	94.9	91.0	94.5	94.4	93.5	93.9	31.4
n = 30	95.1	95.0	94.8	94.5	94.0	94.7	94.6	95.3	94.7	87.6	94.9	94.2	94.6	94.1	5.5
K = 150															
n = 5	96.3	94.5	94.1	95.8	95.2	95.4	93.5	94.6	95.0	91.8	95.2	94.5	93.9	95.5	39.3
n = 15	95.0	93.7	93.6	94.5	94.8	94.8	95.3	95.5	95.0	85.2	95.2	94.8	94.2	95.5	1.4
n = 30	93.8	94.7	94.8	95.2	95.4	94.4	93.1	94.0	93.9	76.3	93.7	95.4	94.1	94.7	0.0

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C18

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,x}$ = .30 and $\rho_{I,y}$ = .10, and 25% Missing Data (True Value = 0.309)

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35)															
K = 50															
n = 5	96.2	95.1	94.6	94.6	93.6	94.1	92.4	92.9	93.6	91.9	96.4	95.1	94.7	94.0	79.4
n = 15	91.7	93.9	94.6	93.3	94.1	92.1	93.8	93.1	94.2	90.6	93.7	93.7	92.6	94.4	50.6
n = 30	87.4	95.6	95.0	94.3	94.0	87.7	95.0	94.7	94.1	90.1	89.9	94.6	93.8	94.2	20.6
K = 150															
n = 5	94.0	94.7	95.7	95.7	95.1	93.3	95.3	95.2	95.0	93.4	92.7	93.2	93.3	94.0	57.4
n = 15	81.4	93.9	94.0	93.9	94.3	83.5	95.0	94.3	94.9	89.3	84.8	93.1	94.4	95.5	9.6
n = 30	66.4	94.5	94.5	93.6	94.8	67.3	94.8	95.1	94.6	82.9	73.9	95.7	95.6	94.5	0.1
Large correlation at level 2 (ρ_B = .60)															
K = 50															
n = 5	95.5	95.1	94.3	93.9	94.5	96.4	94.0	94.7	93.8	93.9	96.4	92.7	93.8	93.2	79.2
n = 15	93.2	93.9	93.5	94.5	94.2	94.3	94.8	94.0	95.1	91.8	94.6	93.7	93.7	94.6	49.9
n = 30	92.3	94.4	93.5	93.3	94.7	94.8	95.3	95.5	94.8	90.4	92.1	94.2	93.6	93.5	20.2
K = 150															
n = 5	96.1	96.0	95.3	95.6	95.0	96.4	95.1	95.0	95.0	93.6	92.7	93.3	93.5	94.2	59.5
n = 15	91.8	94.7	95.1	93.5	94.2	93.7	94.6	96.2	95.0	88.1	94.2	94.9	96.0	94.6	7.1
n = 30	88.3	95.0	94.4	93.7	94.6	89.0	95.2	95.0	95.3	82.5	90.0	94.6	93.8	94.6	0.2

Note. *K* = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C19

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .30$, and 25% Missing Data (True Value = 0.397)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	91.0	93.6	94.8	94.0	93.0	93.9	94.1	94.3	93.6	92.7	93.4	93.0	93.6	94.0	71.5
n = 15	79.1	94.4	93.6	93.7	93.7	83.3	94.8	94.4	93.9	90.5	85.6	94.6	94.9	95.1	32.1
n = 30	63.4	93.5	92.9	94.1	93.1	65.9	93.6	94.1	94.3	87.0	80.1	93.7	94.5	94.1	6.6
K = 150															
n = 5	84.2	94.2	95.0	94.9	94.6	82.7	93.9	93.1	94.7	93.1	87.3	95.6	95.1	95.1	40.3
n = 15	47.4	95.2	94.3	93.6	93.7	55.2	95.4	95.1	95.0	87.0	62.7	94.0	93.9	94.2	1.2
n = 30	18.3	95.0	94.9	95.5	95.7	23.3	94.8	94.6	94.6	72.9	37.0	92.9	92.9	94.7	0.0
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	92.9	94.6	93.6	94.4	93.0	93.4	93.1	93.9	93.0	91.4	94.6	94.6	94.9	93.6	72.4
n = 15	88.9	94.1	93.9	94.8	93.9	89.1	93.5	94.4	94.0	90.0	92.7	92.9	93.7	94.0	32.1
n = 30	78.0	93.3	92.9	93.1	93.7	80.4	94.2	93.3	93.8	86.1	86.0	93.4	93.4	93.8	7.0
K = 150															
n = 5	90.3	94.8	95.5	94.3	95.1	90.5	95.2	95.7	94.3	91.3	91.4	94.2	93.4	93.5	42.4
n = 15	70.6	95.2	95.0	95.0	94.3	74.3	95.7	94.3	93.8	84.7	79.7	95.5	95.1	95.1	1.7
n = 30	46.6	95.4	95.3	95.7	96.1	53.9	94.6	94.1	94.9	73.6	67.3	94.5	94.8	95.4	0.0

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C20

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .30$, and 25% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	93.4	94.3	94.9	93.6	95.0	90.7	94.7	94.2	92.9	93.8	94.0	96.3	95.7	94.2	79.9
n = 15	79.1	96.1	95.6	95.4	94.9	78.9	95.0	93.9	94.0	91.3	84.7	95.1	94.9	94.9	50.5
n = 30	57.0	93.8	95.0	94.0	94.4	61.2	94.9	93.6	94.0	89.8	74.5	94.1	92.5	95.0	20.6
K = 150															
n = 5	80.6	95.6	94.6	94.3	95.2	81.0	95.4	95.6	95.3	93.1	84.9	91.9	92.4	94.5	60.9
n = 15	41.2	95.3	94.6	95.3	95.9	46.9	94.0	94.6	95.5	90.1	59.0	93.8	93.8	94.0	9.0
n = 30	10.8	95.5	94.8	94.8	94.9	14.1	95.1	95.0	95.2	83.1	31.1	96.2	95.3	95.6	0.3
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	92.1	92.8	93.5	93.0	93.7	94.3	93.3	93.1	94.0	92.5	94.7	94.8	94.4	94.1	80.8
n = 15	91.8	95.3	95.0	93.3	94.3	90.3	94.9	94.0	95.0	93.2	93.4	94.1	94.4	94.9	49.5
n = 30	83.3	93.9	93.8	93.9	93.1	85.7	94.7	93.6	94.2	90.2	90.8	93.7	94.8	93.2	20.5
K = 150															
n = 5	92.2	94.6	95.1	95.0	95.0	92.4	94.0	94.3	94.4	93.0	93.2	93.4	92.9	95.3	59.9
n = 15	77.4	95.7	96.2	95.1	95.1	78.8	94.3	94.0	94.6	87.7	88.0	95.4	95.5	95.1	8.1
n = 30	58.6	96.1	95.9	95.1	95.1	65.6	93.5	94.5	94.9	83.6	73.7	94.9	96.3	95.1	0.3

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C21

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .10$, and 50% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	95.4	92.9	94.0	94.3	93.3	94.6	93.3	93.6	94.0	92.2	95.7	93.0	94.4	93.6	62.9
n = 15	92.6	93.0	93.3	94.3	93.0	89.9	92.8	93.2	93.5	88.9	92.6	93.5	93.0	94.2	15.8
n = 30	88.8	93.1	93.4	93.7	93.5	91.0	95.0	95.7	95.0	85.9	89.6	94.1	92.8	93.1	1.7
K = 150															
n = 5	94.2	93.2	92.7	94.7	94.4	95.3	93.5	92.8	95.3	92.4	93.7	92.8	92.8	94.8	27.1
n = 15	87.3	94.0	93.3	95.6	94.6	86.9	93.6	93.5	94.6	84.8	90.5	93.0	94.5	94.7	0.3
n = 30	74.5	93.6	93.3	93.7	93.9	78.4	94.0	94.4	95.4	69.9	79.9	92.8	92.9	95.3	0.0
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	95.4	95.9	94.8	93.7	93.8	94.9	94.2	94.1	94.3	92.8	93.0	93.5	91.9	93.9	60.7
n = 15	95.0	95.1	93.5	93.6	94.4	93.4	93.7	94.1	94.3	89.1	94.1	94.0	93.7	94.0	18.2
n = 30	93.0	93.8	93.7	93.8	94.6	93.4	93.1	92.3	94.4	84.5	94.5	94.6	92.5	94.3	1.5
K = 150															
n = 5	95.5	93.6	94.5	95.5	95.3	93.9	93.5	92.7	93.8	91.4	95.4	94.4	94.5	94.5	26.7
n = 15	93.7	94.6	95.5	94.6	94.4	94.6	94.7	94.9	94.8	81.6	92.6	93.2	92.8	95.3	0.1
n = 30	90.1	94.5	94.2	95.0	95.1	92.9	94.8	93.9	94.9	69.9	93.2	93.6	93.2	94.6	0.0

Note. *K* = number of groups; *n* = group size; λ = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C22

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,x} = .30$ and $\rho_{I,y} = .10$, and 50% Missing Data (True Value = 0.309)

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	95.0	93.9	93.1	95.0	93.1	95.0	93.1	92.7	93.9	91.8	94.0	92.7	93.2	93.2	72.3
n = 15	84.0	93.2	93.1	92.9	93.7	84.5	92.8	93.9	93.4	90.7	89.1	93.8	93.9	94.0	33.8
n = 30	72.8	94.3	93.6	94.9	94.2	77.0	93.8	94.0	93.8	89.3	81.8	94.3	94.3	94.1	7.7
K = 150															
n = 5	86.7	94.2	95.3	94.6	94.4	89.9	94.2	94.1	94.3	92.6	90.6	94.4	94.3	94.3	44.2
n = 15	62.4	92.7	93.2	94.4	94.2	64.7	95.2	95.0	94.3	86.4	71.8	93.5	93.8	94.3	1.8
n = 30	31.6	92.3	92.9	95.0	94.4	37.5	93.7	94.4	95.2	78.9	49.5	91.7	91.9	92.9	0.0
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	95.2	93.3	93.3	95.7	95.0	95.9	92.2	93.0	95.0	93.0	95.2	92.2	94.3	94.1	74.1
n = 15	92.6	94.2	94.7	94.1	94.8	94.6	95.9	93.8	93.9	92.6	93.8	94.8	95.5	93.2	33.8
n = 30	92.4	94.1	94.4	92.6	92.9	91.2	95.1	94.3	94.1	90.3	91.5	94.2	95.5	93.3	8.5
K = 150															
n = 5	95.7	94.3	94.3	95.7	95.0	95.1	93.1	94.2	94.7	91.4	95.6	95.9	95.5	95.7	46.5
n = 15	86.1	95.6	95.6	95.6	96.0	86.5	93.7	93.3	94.6	87.5	89.8	93.5	94.6	94.5	2.3
n = 30	73.3	95.2	95.3	95.0	94.8	77.0	95.3	94.6	94.4	81.1	81.6	92.8	93.0	94.8	0.0

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C23

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X}= .10$ and $\rho_{I,Y}= .30$, and 50% Missing Data (True Value = 0.397)

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35)															
K = 50															
n = 5	89.1	93.4	94.1	94.1	93.9	90.8	92.4	93.6	93.5	91.4	90.7	93.0	92.5	93.6	62.7
n = 15	67.7	94.5	95.0	93.7	94.6	70.6	92.7	92.7	94.0	91.0	78.9	94.0	94.0	94.5	18.1
n = 30	42.9	94.0	95.1	93.3	94.3	44.4	92.9	93.5	93.1	86.4	59.3	92.7	93.4	94.3	1.2
K = 150															
n = 5	67.0	92.8	94.3	94.3	94.2	74.5	94.8	94.3	94.9	91.4	79.9	91.9	93.8	94.2	26.4
n = 15	21.9	93.6	94.0	94.5	94.5	25.2	94.0	94.1	93.8	83.0	43.2	93.1	94.0	95.3	0.1
n = 30	2.5	95.7	94.4	94.9	95.1	5.7	94.5	94.9	94.8	69.0	16.2	93.5	94.0	95.0	0.0
Large correlation at level 2 (ρ_B = .60)															
K = 50															
n = 5	91.8	92.3	93.0	94.4	92.4	92.9	94.1	93.9	94.6	92.3	94.5	94.8	93.7	94.3	64.3
n = 15	81.8	93.7	93.1	93.4	92.9	83.2	94.1	95.0	94.1	89.6	87.2	93.4	93.3	93.7	17.6
n = 30	69.4	94.3	94.3	94.0	94.0	71.0	94.4	93.7	94.4	85.5	79.6	93.5	93.4	93.7	1.2
K = 150															
n = 5	82.9	94.9	94.9	94.7	92.8	83.2	93.5	93.4	93.5	90.4	88.6	94.1	93.9	94.4	28.8
n = 15	54.7	93.9	93.9	94.5	94.0	59.6	94.6	94.6	94.8	82.6	67.0	93.5	92.9	95.5	0.0
n = 30	23.7	95.3	94.2	94.9	94.7	30.4	93.4	93.3	94.0	68.2	45.4	91.1	92.7	94.4	0.0

Note. K = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table C24

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (X on Y), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .30$, and 50% Missing Data (True Value = 0.350)

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35)															
K = 50															
n = 5	85.4	93.2	95.1	94.1	92.5	86.9	93.3	93.2	93.2	92.1	89.5	92.9	94.5	94.0	76.2
n = 15	55.5	95.8	95.6	94.9	93.8	62.1	94.0	94.2	95.3	91.8	70.9	92.5	92.7	92.8	35.7
n = 30	30.1	93.5	93.9	93.4	94.4	32.9	93.5	93.9	94.6	87.5	54.2	93.4	94.7	93.8	8.7
K = 150															
n = 5	63.5	95.3	94.7	95.2	95.2	62.9	94.0	94.2	95.4	92.2	72.9	95.0	95.1	94.3	46.5
n = 15	13.9	93.6	95.4	94.6	95.0	16.2	93.0	93.6	94.7	87.0	28.0	94.8	94.8	94.7	1.7
n = 30	0.7	93.5	94.0	94.3	94.3	1.5	94.0	94.1	94.3	78.6	7.4	93.4	93.3	94.0	0.0
Large correlation at level 2 (ρ_B = .60)															
K = 50															
n = 5	92.1	93.6	92.9	94.0	92.2	93.3	92.2	94.2	93.7	92.5	94.8	94.5	92.9	93.8	74.6
n = 15	87.7	94.6	94.3	94.2	92.8	87.4	94.2	94.2	93.0	90.9	90.4	93.8	94.1	94.5	36.0
n = 30	75.7	92.4	92.6	94.9	94.1	75.4	93.9	94.2	94.2	88.4	83.9	93.5	94.1	93.6	8.2
K = 150															
n = 5	88.1	93.5	93.6	93.9	93.5	89.3	93.5	94.6	94.4	93.2	92.8	93.9	94.7	94.4	46.6
n = 15	64.8	94.0	95.0	94.6	95.0	70.3	93.6	93.9	94.8	86.8	76.7	92.0	92.8	93.3	2.4
n = 30	38.3	93.7	94.2	95.1	94.5	40.3	94.6	94.4	95.0	78.1	58.3	94.3	93.4	95.5	0.0

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D1

Bias of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}=.10$ and $\rho_{I,Y}=.10$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
	Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)														
K = 50															
n = 5	−.001	.004	−.027	−.014	.006	.007	.010	−.021	.027	.023	−.001	−.030	−.052	−.005	.021
n = 15	.004	.010	−.004	.003	.001	−.002	−.004	−.018	−.011	−.011	−.009	−.011	−.024	−.003	.006
n = 30	.006	.009	.003	.010	.010	−.003	−.006	−.010	.000	−.003	.005	.006	−.001	.006	.007
K = 150															
n = 5	.001	.003	−.019	−.011	−.025	.004	.003	−.017	−.006	−.021	−.007	−.009	−.035	−.007	.019
n = 15	.003	.003	−.003	.001	.002	−.007	−.009	−.014	−.002	−.002	−.007	−.008	−.016	−.004	−.008
n = 30	.001	.001	−.001	.001	.002	−.003	−.002	−.005	−.002	−.004	.000	−.003	−.003	−.003	−.005
	Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)														
K = 50															
n = 5	−.043	.090	.001	.030	.033	−.039	.100	−.006	.022	.030	−.033	.160	−.052	.047	.113
n = 15	−.056	.002	−.019	.004	.008	−.051	.009	−.013	.013	.038	−.046	.018	−.010	.016	.161
n = 30	−.055	.002	−.009	.005	.007	−.047	.011	.000	.007	.036	−.046	.015	.001	.011	.122
K = 150															
n = 5	−.033	.056	.003	.036	.047	−.036	.040	−.013	.030	.038	−.037	.035	−.013	.036	.143
n = 15	−.057	.001	−.012	.000	.004	−.051	.005	−.007	.004	.029	−.056	.000	−.015	.005	.117
n = 30	−.053	.003	−.003	.006	.007	−.056	.000	−.007	−.001	.017	−.059	−.002	−.009	.000	.099

Note. *K* = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; PAN = two-level imputation; CD = complete data; LD = listwise deletion. DI = dummy-indicator approach;

Table D2

Bias of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .10$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.202)															
K = 50															
n = 5	.035	–.003	–.007	.001	–.002	.029	–.007	–.012	–.010	–.023	.033	.002	–.015	–.005	–.074
n = 15	.031	–.006	–.007	–.006	–.007	.032	–.003	–.004	–.005	–.018	.028	–.011	–.014	–.006	–.073
n = 30	.033	–.003	–.004	.000	.000	.037	.003	.001	.001	–.011	.034	.001	–.002	.002	–.061
K = 150															
n = 5	.033	–.001	–.003	–.002	–.001	.033	–.001	–.003	–.001	–.013	.029	.003	–.009	–.006	–.071
n = 15	.036	.002	.002	.003	.001	.032	–.003	–.004	–.002	–.015	.032	–.003	–.004	–.003	–.066
n = 30	.034	.001	.000	.001	.000	.033	–.001	–.002	.000	–.012	.033	.000	–.002	–.001	–.064
Large correlation at level 2 ($\rho_B = .60$, true value = 0.346)															
K = 50															
n = 5	.006	–.004	–.015	–.005	–.008	.014	.005	–.009	.003	.000	.015	.010	–.009	.002	–.012
n = 15	.009	–.002	–.002	–.001	.000	.011	.002	–.003	.003	–.001	.013	.002	–.004	–.004	–.021
n = 30	.008	.000	–.002	.000	.000	.008	–.002	–.004	–.002	–.006	.008	–.001	–.005	–.001	–.018
K = 150															
n = 5	.013	.005	–.001	.000	–.002	.011	.001	–.004	–.003	–.004	.009	.004	–.007	.001	–.017
n = 15	.009	.000	–.002	–.003	–.002	.009	–.001	–.003	.000	–.003	.008	.001	–.004	.000	–.015
n = 30	.009	.000	–.001	.001	.001	.009	.000	–.001	–.001	–.004	.009	–.002	–.003	.002	–.012

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D3

Bias of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .30$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.606)															
K = 50															
n = 5	−.024	.093	.043	.075	.075	.037	.155	.116	.095	.189	−.048	.036	−.015	.056	.220
n = 15	−.058	.011	.004	.023	.036	−.041	.034	.024	.024	.076	−.059	.008	−.001	.010	.174
n = 30	−.064	.004	.000	.005	.012	−.050	.023	.018	.016	.044	−.068	−.001	−.007	.004	.138
K = 150															
n = 5	−.048	.023	.002	.032	.061	−.046	.021	.002	.023	.072	−.045	.024	.005	.024	.217
n = 15	−.068	.000	−.003	.002	.001	−.059	.010	.006	.005	.031	−.061	.010	.005	.008	.143
n = 30	−.068	−.001	−.003	.002	.002	−.069	−.004	−.005	−.002	.022	−.065	.003	.002	.001	.124
Large correlation at level 2 ($\rho_B = .60$, true value = 1.039)															
K = 50															
n = 5	−.040	.222	.122	.184	.183	−.042	.267	.130	.188	.251	−.082	.237	.090	.173	.466
n = 15	−.123	.051	.035	.054	.086	−.139	.032	.015	.032	.136	−.129	.040	.021	.036	.455
n = 30	−.160	.005	−.001	.003	.014	−.153	.017	.008	.018	.085	−.146	.021	.012	.025	.364
K = 150															
n = 5	−.118	.063	.026	.058	.100	−.112	.068	.031	.066	.180	−.101	.079	.040	.086	.456
n = 15	−.161	.002	−.006	−.002	.004	−.149	.021	.013	.015	.078	−.151	.015	.007	.013	.337
n = 30	−.156	.010	.008	.007	.007	−.163	.003	−.002	.003	.061	−.162	.002	−.002	−.004	.291

Note. *K* = number of groups; *n* = group size; *λ* = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D4

Bias of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}$ = .30 and $\rho_{I,Y}$ = .30, and 25% Missing Data

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35, true value = 0.350)															
K = 50															
n = 5	−.003	−.005	−.011	−.008	−.007	.006	.006	−.001	.006	.008	−.004	−.006	−.018	.000	.006
n = 15	.009	.012	.011	.007	.008	−.003	−.003	−.003	.004	.003	.004	.005	.002	.010	.013
n = 30	.001	.003	.002	−.001	.001	.005	.004	.004	−.004	−.003	.003	.006	.003	−.001	.001
K = 150															
n = 5	−.001	−.004	−.005	.000	−.002	−.009	−.013	−.016	−.004	−.007	.003	.006	.000	.001	.003
n = 15	.003	.003	.003	−.001	.000	.005	.005	.004	.004	.004	.002	.002	.001	.000	.000
n = 30	−.004	−.004	−.004	.000	.000	−.004	−.005	−.005	−.004	−.004	.003	.004	.004	.004	.006
Large correlation at level 2 (ρ_B = .60, true value = 0.600)															
K = 50															
n = 5	−.038	.009	−.005	.019	.025	−.035	.012	−.003	.009	.033	−.039	−.001	−.013	.013	.116
n = 15	−.038	.007	.004	.005	.006	−.048	−.005	−.009	.000	.017	−.044	−.001	−.007	−.002	.081
n = 30	−.049	−.004	−.006	−.002	−.002	−.043	.000	−.001	.001	.018	−.041	.003	.000	−.002	.079
K = 150															
n = 5	−.035	.008	.004	.005	.007	−.039	.003	−.001	.001	.019	−.041	−.007	−.009	.004	.087
n = 15	−.045	−.002	−.003	−.001	.000	−.043	.001	.000	.001	.016	−.041	.002	.000	.000	.084
n = 30	−.044	.000	−.001	.001	.001	−.046	−.002	−.003	−.001	.014	−.045	.001	−.001	−.002	.079

Note. *K* = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; PAN = two-level imputation; CD = complete data; LD = listwise deletion. DI = dummy-indicator approach;

Table D5

Bias of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}=.10$ and $\rho_{I,Y}=.10$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
	Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)														
K = 50															
n = 5	.004	.053	−.092	.004	.038	.022	.102	−.037	.026	.054	−.003	−.074	−.092	−.015	−.117
n = 15	.001	.004	−.028	.012	.011	−.001	.003	−.030	−.009	.006	.004	.012	−.024	.006	.002
n = 30	.004	.014	−.004	.006	.010	.004	.003	−.013	.002	−.001	−.004	−.003	−.023	.000	−.018
K = 150															
n = 5	.018	.027	−.022	.004	.005	.008	.017	−.038	−.003	.010	−.005	−.014	−.061	.009	.012
n = 15	.000	.003	−.014	.000	−.002	.001	−.002	−.018	.002	−.002	.005	.004	−.015	.001	−.015
n = 30	.002	.004	−.004	.000	.000	−.003	−.005	−.013	−.003	−.003	−.002	−.003	−.011	−.006	−.006
	Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)														
K = 50															
n = 5	−.130	.093	−.092	.020	−.003	−.146	.036	−.146	.021	−.030	−.117	.057	−.137	.021	.059
n = 15	−.115	.010	−.047	.017	.031	−.113	.004	−.054	.011	.058	−.102	.021	−.050	.018	.268
n = 30	−.114	−.001	−.033	.000	.018	−.109	.005	−.029	.000	.052	−.110	.009	−.030	.006	.199
K = 150															
n = 5	−.115	.019	−.072	.028	.018	−.111	.012	−.081	.014	.029	−.121	−.013	−.093	.025	.143
n = 15	−.117	−.006	−.039	.000	.004	−.112	−.001	−.037	.004	.043	−.113	.001	−.037	.002	.189
n = 30	−.112	.003	−.015	.004	.006	−.107	.008	−.010	.001	.033	−.110	.004	−.015	.004	.175

Note. *K* = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D6

Bias of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}$ = .30 and $\rho_{I,Y}$ = .10, and 50% Missing Data

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35, true value = 0.202)															
K = 50															
n = 5	.066	−.002	−.019	−.004	−.012	.082	.030	.000	−.002	−.021	.062	.014	−.033	−.014	−.123
n = 15	.071	.003	−.001	−.001	−.004	.063	−.009	−.014	−.005	−.029	.065	.004	−.016	.001	−.114
n = 30	.069	−.001	−.004	−.004	−.006	.070	.005	−.001	−.001	−.019	.069	−.003	−.007	−.001	−.112
K = 150															
n = 5	.065	.002	−.009	−.005	−.007	.073	.021	−.001	−.003	−.026	.068	.034	−.009	.001	−.103
n = 15	.065	−.004	−.006	−.003	−.005	.069	.000	−.004	−.001	−.016	.066	.004	−.006	.002	−.096
n = 30	.070	.003	.002	.001	.001	.069	.002	.001	.000	−.016	.068	.003	.000	.001	−.103
Large correlation at level 2 (ρ_B = .60, true value = 0.346)															
K = 50															
n = 5	.016	−.003	−.028	.001	−.016	.019	−.006	−.029	−.004	.010	.015	−.001	−.039	−.002	−.003
n = 15	.017	−.002	−.013	.000	−.003	.015	−.006	−.018	−.002	−.008	.015	.003	−.018	.002	−.027
n = 30	.019	.001	−.006	.001	.001	.021	.006	−.001	.002	−.001	.012	−.008	−.019	−.002	−.036
K = 150															
n = 5	.021	.006	−.009	−.002	.000	.021	−.001	−.012	.003	−.002	.017	.012	−.019	−.002	−.019
n = 15	.019	.003	−.002	.001	.000	.016	−.003	−.008	−.002	−.005	.018	.003	−.008	−.001	−.026
n = 30	.017	.001	−.003	.001	.002	.017	−.003	−.005	.000	−.006	.018	.001	−.004	.000	−.024

Note. *K* = number of groups; *n* = group size; λ = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D7

Bias of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}=.10$ and $\rho_{I,Y}=.30$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.606)															
K = 50															
n = 5	−.098	.140	.020	.132	.085	−.074	.211	.054	.125	.062	−.075	.124	−.001	.092	.178
n = 15	−.121	.015	−.005	.013	.050	−.133	.000	−.024	−.002	.089	−.115	.033	.001	.025	.396
n = 30	−.131	.006	−.002	.005	.009	−.130	.009	−.005	.013	.061	−.143	−.010	−.023	.002	.226
K = 150															
n = 5	−.109	.036	−.011	.025	.102	−.125	−.006	−.043	.015	.128	−.114	−.005	−.020	.042	.321
n = 15	−.138	−.009	−.020	−.002	.006	−.134	−.003	−.012	−.005	.038	−.135	−.011	−.022	−.004	.239
n = 30	−.134	.000	−.004	−.004	−.003	−.137	−.006	−.011	−.002	.032	−.135	.003	−.003	.007	.218
Large correlation at level 2 ($\rho_B = .60$, true value = 1.039)															
K = 50															
n = 5	−.313	.197	−.027	.176	.099	−.323	.211	−.031	.198	.131	−.288	.151	−.005	.184	.382
n = 15	−.315	.032	−.016	.047	.147	−.325	.012	−.039	.032	.188	−.323	.025	−.033	.048	.746
n = 30	−.323	.008	−.012	.010	.051	−.317	.026	.000	.025	.139	−.329	.004	−.024	.014	.656
K = 150															
n = 5	−.295	.060	−.014	.077	.099	−.302	.052	−.029	.075	.258	−.306	−.032	−.064	.069	.604
n = 15	−.323	.013	−.011	.012	.027	−.320	.010	−.013	.007	.114	−.328	.000	−.025	.009	.575
n = 30	−.318	.016	.007	.011	.016	−.323	.011	.000	.005	.089	−.331	.002	−.011	.004	.513

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D8

Bias of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}$= .30 and $\rho_{I,Y}$= .30, and 50% Missing Data

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35, true value = 0.350)															
K = 50															
n = 5	−.012	−.006	−.030	−.008	−.013	.000	.001	−.020	.003	−.008	−.006	.001	−.036	−.001	−.005
n = 15	−.009	−.014	−.018	−.007	−.006	.007	.004	.001	.003	.006	.000	.004	−.006	.000	.000
n = 30	.002	.002	.000	.007	.005	−.001	.004	.000	.002	−.002	.003	.000	−.006	.001	.010
K = 150															
n = 5	.004	.003	−.005	−.001	−.002	.001	.007	−.004	−.001	−.003	.000	.008	−.012	.004	.000
n = 15	.002	.003	.001	.001	.001	−.001	.000	−.003	.005	.003	−.004	−.009	−.010	−.001	−.007
n = 30	.000	.001	−.001	.003	.003	−.003	−.001	−.002	−.001	−.002	.000	.002	−.001	.001	.004
Large correlation at level 2 (ρ_B = .60, true value = 0.600)															
K = 50															
n = 5	−.089	−.007	−.034	.005	.021	−.088	.006	−.039	.010	.058	−.085	−.045	−.054	.003	.206
n = 15	−.085	.006	−.003	.005	.004	−.089	−.005	−.014	−.002	.023	−.096	−.013	−.027	−.003	.142
n = 30	−.088	−.001	−.005	.002	.005	−.087	.004	.000	.004	.028	−.090	−.005	−.012	−.005	.135
K = 150															
n = 5	−.084	−.002	−.007	.010	.017	−.089	−.022	−.020	.003	.028	−.089	−.063	−.031	.001	.143
n = 15	−.086	.004	.000	.003	.004	−.089	−.004	−.004	−.001	.020	−.086	−.008	−.006	.001	.139
n = 30	−.090	−.002	−.004	.000	−.001	−.090	−.003	−.005	.002	.023	−.084	.002	.001	.003	.141

Note. *K* = number of groups; *n* = group size; λ = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D9

RMSE of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of ρ_{I,X} = .10 and ρ_{I,Y} = .10, and 25% Missing Data

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35, true value = 0.350)															
K = 50															
n = 5	0.470	0.889	0.662	0.594	0.739	0.487	1.063	0.667	0.702	0.896	0.535	0.965	0.689	0.662	1.201
n = 15	0.202	0.259	0.248	0.250	0.310	0.191	0.245	0.236	0.236	0.342	0.206	0.267	0.254	0.251	0.555
n = 30	0.152	0.197	0.192	0.189	0.207	0.152	0.197	0.192	0.184	0.218	0.148	0.186	0.183	0.180	0.319
K = 150															
n = 5	0.211	0.296	0.266	0.267	0.386	0.247	0.354	0.318	0.274	0.477	0.235	0.351	0.295	0.285	0.677
n = 15	0.104	0.134	0.131	0.125	0.141	0.107	0.136	0.134	0.126	0.159	0.108	0.139	0.135	0.131	0.251
n = 30	0.082	0.107	0.107	0.102	0.110	0.082	0.107	0.105	0.104	0.121	0.087	0.112	0.111	0.105	0.172
Large correlation at level 2 (ρ_B = .60, true value = 0.600)															
K = 50															
n = 5	0.407	0.848	0.559	0.540	0.741	0.444	0.758	0.598	0.563	0.744	0.469	0.901	0.637	0.550	1.021
n = 15	0.182	0.229	0.218	0.222	0.270	0.198	0.252	0.237	0.237	0.340	0.198	0.258	0.242	0.233	0.528
n = 30	0.149	0.181	0.176	0.168	0.186	0.145	0.177	0.172	0.167	0.213	0.143	0.174	0.167	0.169	0.325
K = 150															
n = 5	0.226	0.351	0.320	0.279	0.366	0.217	0.320	0.269	0.313	0.396	0.224	0.326	0.279	0.275	0.616
n = 15	0.112	0.128	0.124	0.119	0.143	0.112	0.131	0.126	0.121	0.160	0.116	0.131	0.126	0.116	0.247
n = 30	0.090	0.092	0.092	0.091	0.101	0.095	0.098	0.097	0.091	0.110	0.093	0.094	0.092	0.091	0.178

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D10

RMSE of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}$ = .30 and $\rho_{I,Y}$ = .10, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35, true value = 0.202)															
K = 50															
n = 5	0.160	0.207	0.189	0.178	0.226	0.173	0.230	0.206	0.189	0.255	0.175	0.227	0.203	0.185	0.388
n = 15	0.105	0.124	0.122	0.116	0.128	0.109	0.126	0.123	0.114	0.138	0.108	0.128	0.121	0.111	0.191
n = 30	0.090	0.102	0.101	0.096	0.101	0.093	0.102	0.102	0.096	0.108	0.094	0.108	0.105	0.097	0.155
K = 150															
n = 5	0.092	0.113	0.104	0.097	0.118	0.094	0.115	0.106	0.095	0.126	0.094	0.114	0.104	0.095	0.191
n = 15	0.065	0.065	0.064	0.060	0.066	0.062	0.064	0.064	0.061	0.072	0.064	0.069	0.065	0.061	0.118
n = 30	0.058	0.057	0.056	0.054	0.057	0.057	0.057	0.056	0.054	0.062	0.056	0.055	0.053	0.050	0.096
Large correlation at level 2 (ρ_B = .60, true value = 0.346)															
K = 50															
n = 5	0.150	0.201	0.181	0.165	0.205	0.149	0.201	0.181	0.165	0.223	0.163	0.217	0.190	0.171	0.346
n = 15	0.088	0.108	0.106	0.099	0.112	0.089	0.108	0.106	0.098	0.117	0.097	0.119	0.113	0.100	0.161
n = 30	0.072	0.086	0.086	0.084	0.089	0.078	0.094	0.093	0.088	0.098	0.076	0.092	0.090	0.083	0.124
K = 150															
n = 5	0.087	0.109	0.102	0.092	0.111	0.085	0.110	0.100	0.089	0.118	0.088	0.114	0.105	0.092	0.173
n = 15	0.049	0.060	0.058	0.056	0.062	0.053	0.062	0.062	0.057	0.067	0.055	0.064	0.063	0.054	0.088
n = 30	0.043	0.051	0.051	0.047	0.050	0.042	0.050	0.050	0.047	0.053	0.045	0.052	0.051	0.048	0.072

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D11

RMSE of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .30$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.606)															
K = 50															
n = 5	0.681	1.051	0.969	0.932	1.118	0.730	1.177	1.027	0.953	1.439	0.755	1.108	1.026	0.987	1.950
n = 15	0.308	0.396	0.391	0.378	0.455	0.311	0.402	0.395	0.381	0.557	0.300	0.371	0.367	0.349	0.845
n = 30	0.242	0.302	0.298	0.296	0.315	0.242	0.308	0.305	0.297	0.351	0.243	0.300	0.297	0.290	0.516
K = 150															
n = 5	0.291	0.367	0.355	0.390	0.532	0.303	0.412	0.369	0.373	0.591	0.290	0.390	0.370	0.344	0.925
n = 15	0.165	0.192	0.191	0.194	0.218	0.168	0.202	0.201	0.190	0.238	0.158	0.187	0.185	0.185	0.362
n = 30	0.149	0.171	0.171	0.164	0.174	0.144	0.161	0.161	0.159	0.185	0.144	0.163	0.164	0.164	0.290
Large correlation at level 2 ($\rho_B = .60$, true value = 1.039)															
K = 50															
n = 5	0.655	1.164	0.897	0.858	1.009	0.641	1.162	0.851	0.861	1.145	0.647	1.182	1.002	0.866	1.873
n = 15	0.301	0.361	0.354	0.371	0.476	0.305	0.359	0.350	0.341	0.518	0.324	0.385	0.371	0.362	0.954
n = 30	0.259	0.262	0.261	0.262	0.291	0.263	0.275	0.272	0.270	0.336	0.256	0.270	0.267	0.262	0.623
K = 150															
n = 5	0.333	0.425	0.403	0.406	0.551	0.346	0.469	0.424	0.416	0.682	0.355	0.482	0.428	0.419	1.051
n = 15	0.215	0.183	0.180	0.179	0.207	0.211	0.193	0.189	0.188	0.247	0.211	0.188	0.183	0.179	0.490
n = 30	0.194	0.149	0.148	0.145	0.154	0.200	0.149	0.149	0.146	0.183	0.204	0.157	0.156	0.147	0.380

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D12

RMSE of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of ρ$_{I,X}$=.30 and ρ$_{I,Y}$=.30, and 25% Missing Data

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ$_B$ = .35, true value = 0.350)															
K = 50															
n = 5	0.196	0.243	0.234	0.224	0.274	0.197	0.249	0.239	0.221	0.310	0.203	0.248	0.234	0.217	0.540
n = 15	0.137	0.164	0.162	0.160	0.168	0.143	0.170	0.169	0.165	0.190	0.149	0.172	0.171	0.159	0.241
n = 30	0.125	0.152	0.152	0.154	0.157	0.124	0.148	0.148	0.148	0.160	0.129	0.156	0.155	0.153	0.215
K = 150															
n = 5	0.100	0.122	0.121	0.115	0.132	0.104	0.130	0.128	0.118	0.148	0.115	0.138	0.136	0.122	0.215
n = 15	0.074	0.089	0.089	0.088	0.093	0.077	0.092	0.092	0.087	0.099	0.080	0.097	0.095	0.089	0.132
n = 30	0.068	0.082	0.082	0.081	0.083	0.071	0.085	0.084	0.084	0.091	0.071	0.084	0.083	0.082	0.115
Large correlation at level 2 (ρ$_B$ = .60, true value = 0.600)															
K = 50															
n = 5	0.179	0.225	0.211	0.209	0.264	0.173	0.218	0.206	0.199	0.274	0.195	0.244	0.224	0.203	0.477
n = 15	0.125	0.144	0.144	0.142	0.146	0.127	0.141	0.140	0.138	0.160	0.136	0.152	0.150	0.142	0.229
n = 30	0.122	0.135	0.134	0.130	0.135	0.116	0.130	0.129	0.130	0.145	0.126	0.140	0.138	0.129	0.201
K = 150															
n = 5	0.107	0.123	0.121	0.111	0.131	0.105	0.118	0.116	0.107	0.139	0.110	0.129	0.121	0.108	0.215
n = 15	0.085	0.087	0.086	0.082	0.087	0.083	0.083	0.083	0.079	0.090	0.087	0.089	0.088	0.082	0.151
n = 30	0.075	0.073	0.073	0.072	0.074	0.077	0.073	0.073	0.071	0.080	0.078	0.075	0.075	0.072	0.130

Note. *K* = number of groups; *n* = group size; *λ* = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D13

RMSE of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}$ = .10 and $\rho_{I,Y}$ = .10, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35, true value = 0.350)															
K = 50															
n = 5	0.335	1.183	0.709	0.605	0.926	0.349	1.179	0.628	0.615	0.995	0.344	1.230	0.660	0.615	1.464
n = 15	0.158	0.317	0.273	0.253	0.433	0.163	0.304	0.270	0.248	0.563	0.171	0.357	0.306	0.254	1.115
n = 30	0.116	0.210	0.198	0.184	0.259	0.119	0.212	0.200	0.185	0.284	0.117	0.213	0.197	0.180	0.559
K = 150															
n = 5	0.179	0.381	0.307	0.305	0.524	0.179	0.396	0.308	0.284	0.640	0.192	0.478	0.326	0.278	1.042
n = 15	0.086	0.156	0.148	0.130	0.190	0.082	0.153	0.139	0.131	0.216	0.089	0.165	0.146	0.128	0.419
n = 30	0.065	0.117	0.113	0.103	0.133	0.066	0.115	0.114	0.102	0.151	0.069	0.123	0.118	0.101	0.252
Large correlation at level 2 (ρ_B = .60, true value = 0.600)															
K = 50															
n = 5	0.359	1.100	0.636	0.588	0.820	0.350	1.024	0.648	0.564	0.911	0.358	1.253	0.722	0.557	1.356
n = 15	0.189	0.328	0.273	0.240	0.416	0.183	0.275	0.248	0.224	0.489	0.193	0.313	0.270	0.235	1.017
n = 30	0.155	0.194	0.185	0.169	0.241	0.151	0.189	0.177	0.166	0.277	0.160	0.206	0.191	0.171	0.549
K = 150															
n = 5	0.198	0.372	0.295	0.260	0.478	0.209	0.405	0.301	0.249	0.518	0.216	0.457	0.316	0.283	0.968
n = 15	0.141	0.145	0.138	0.117	0.177	0.140	0.152	0.144	0.121	0.226	0.141	0.157	0.140	0.118	0.460
n = 30	0.126	0.106	0.103	0.092	0.118	0.122	0.110	0.103	0.091	0.142	0.127	0.111	0.106	0.092	0.298

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D14

RMSE of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}=.30$ and $\rho_{I,Y}=.10$, and 50% Missing Data

Moderate correlation at level 2 (ρ_B = .35, true value = 0.202)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
n = 5	0.161	0.265	0.225	0.182	0.381	0.171	0.272	0.220	0.187	0.401	0.172	0.291	0.220	0.183	0.747
n = 15	0.113	0.135	0.126	0.109	0.144	0.112	0.143	0.133	0.111	0.168	0.118	0.162	0.137	0.110	0.292
n = 30	0.097	0.104	0.100	0.096	0.116	0.102	0.109	0.106	0.096	0.128	0.104	0.121	0.110	0.094	0.227
K = 150															
n = 5	0.103	0.135	0.122	0.097	0.160	0.111	0.150	0.124	0.093	0.181	0.115	0.224	0.130	0.095	0.331
n = 15	0.082	0.073	0.072	0.061	0.077	0.084	0.076	0.070	0.060	0.087	0.087	0.092	0.076	0.062	0.174
n = 30	0.080	0.059	0.058	0.054	0.062	0.081	0.061	0.060	0.054	0.070	0.083	0.070	0.064	0.053	0.149

Large correlation at level 2 (ρ_B = .60, true value = 0.346)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
n = 5	0.143	0.257	0.217	0.166	0.307	0.138	0.258	0.209	0.165	0.366	0.159	0.296	0.222	0.172	0.706
n = 15	0.083	0.128	0.121	0.102	0.135	0.083	0.134	0.123	0.100	0.157	0.094	0.151	0.132	0.099	0.258
n = 30	0.069	0.099	0.098	0.083	0.101	0.068	0.097	0.094	0.082	0.112	0.074	0.111	0.100	0.084	0.183
K = 150															
n = 5	0.077	0.127	0.112	0.092	0.149	0.081	0.150	0.116	0.094	0.174	0.092	0.217	0.126	0.093	0.309
n = 15	0.048	0.068	0.067	0.055	0.073	0.049	0.070	0.066	0.055	0.080	0.056	0.087	0.075	0.056	0.133
n = 30	0.039	0.053	0.053	0.047	0.056	0.042	0.058	0.056	0.046	0.062	0.048	0.067	0.061	0.048	0.102

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D15

RMSE of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}=.10$ and $\rho_{I,Y}=.30$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.606)															
K = 50															
n = 5	0.453	1.247	0.945	1.006	1.421	0.450	1.242	0.949	1.039	1.631	0.522	1.458	0.850	1.005	2.515
n = 15	0.259	0.416	0.395	0.363	0.627	0.255	0.382	0.366	0.379	0.843	0.248	0.397	0.373	0.361	1.755
n = 30	0.216	0.308	0.303	0.291	0.349	0.220	0.315	0.308	0.292	0.434	0.225	0.297	0.291	0.291	0.902
K = 150															
n = 5	0.252	0.432	0.374	0.360	0.828	0.237	0.431	0.347	0.335	0.942	0.256	0.481	0.374	0.348	1.608
n = 15	0.180	0.208	0.203	0.192	0.258	0.178	0.210	0.205	0.188	0.301	0.185	0.218	0.209	0.192	0.637
n = 30	0.163	0.166	0.163	0.161	0.193	0.168	0.173	0.171	0.162	0.223	0.166	0.169	0.167	0.160	0.429
Large correlation at level 2 ($\rho_B = .60$, true value = 1.039)															
K = 50															
n = 5	0.512	1.156	0.840	0.835	1.225	0.551	1.324	0.967	0.852	1.460	0.524	1.342	0.915	0.831	2.113
n = 15	0.378	0.400	0.378	0.362	0.683	0.385	0.408	0.368	0.358	0.686	0.383	0.378	0.344	0.354	1.530
n = 30	0.358	0.277	0.271	0.274	0.366	0.354	0.289	0.280	0.267	0.452	0.365	0.278	0.271	0.262	1.094
K = 150															
n = 5	0.377	0.512	0.452	0.424	0.659	0.375	0.497	0.401	0.407	0.863	0.378	0.524	0.401	0.428	1.587
n = 15	0.341	0.197	0.189	0.177	0.281	0.339	0.205	0.193	0.178	0.345	0.348	0.206	0.197	0.185	0.897
n = 30	0.330	0.158	0.154	0.149	0.188	0.335	0.156	0.155	0.147	0.228	0.344	0.159	0.155	0.145	0.651

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D16

RMSE of the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}$ = .30 and $\rho_{I,Y}$ = .30, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35, true value = 0.350)															
K = 50															
n = 5	0.161	0.266	0.241	0.216	0.424	0.167	0.281	0.252	0.215	0.538	0.186	0.319	0.262	0.219	1.033
n = 15	0.118	0.175	0.172	0.159	0.190	0.122	0.181	0.178	0.165	0.219	0.125	0.188	0.179	0.157	0.367
n = 30	0.100	0.154	0.153	0.151	0.159	0.103	0.159	0.156	0.150	0.182	0.121	0.171	0.167	0.154	0.295
K = 150															
n = 5	0.092	0.143	0.140	0.115	0.165	0.096	0.160	0.142	0.117	0.198	0.104	0.211	0.147	0.115	0.345
n = 15	0.065	0.098	0.097	0.091	0.106	0.067	0.101	0.098	0.090	0.118	0.075	0.107	0.104	0.088	0.187
n = 30	0.058	0.088	0.088	0.082	0.088	0.055	0.082	0.082	0.081	0.096	0.066	0.089	0.090	0.084	0.155
Large correlation at level 2 (ρ_B = .60, true value = 0.600)															
K = 50															
n = 5	0.177	0.250	0.230	0.200	0.369	0.183	0.273	0.236	0.207	0.467	0.194	0.300	0.249	0.203	0.949
n = 15	0.136	0.159	0.154	0.146	0.178	0.134	0.158	0.152	0.136	0.190	0.154	0.181	0.170	0.146	0.377
n = 30	0.125	0.134	0.132	0.131	0.141	0.127	0.138	0.136	0.129	0.163	0.140	0.149	0.147	0.132	0.286
K = 150															
n = 5	0.122	0.142	0.135	0.111	0.174	0.127	0.148	0.133	0.107	0.195	0.133	0.233	0.144	0.109	0.388
n = 15	0.104	0.087	0.086	0.079	0.094	0.105	0.085	0.082	0.077	0.105	0.109	0.100	0.095	0.079	0.223
n = 30	0.102	0.074	0.073	0.069	0.076	0.104	0.078	0.077	0.074	0.091	0.102	0.082	0.079	0.074	0.198

Note. K = number of groups; *n* = group size; *λ* = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D17

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .10$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value $= 0.350$)															
K = 50															
n = 5	97.5	96.4	94.9	93.0	93.4	97.6	97.4	92.5	93.7	93.7	93.2	93.7	92.5	93.7	93.4
n = 15	96.0	95.5	94.6	91.2	91.9	96.0	96.0	94.4	92.8	92.8	92.2	92.6	94.0	92.8	92.4
n = 30	94.0	93.8	92.9	92.1	91.3	94.6	93.6	92.5	92.9	92.0	93.1	93.1	93.6	92.9	92.0
K = 150															
n = 5	98.8	97.8	96.8	94.6	95.3	97.9	96.0	94.3	93.9	93.9	94.2	94.3	96.0	93.9	94.5
n = 15	96.7	96.9	95.6	94.6	94.7	96.7	96.4	95.2	94.6	94.8	93.2	93.5	95.2	94.3	94.8
n = 30	96.3	95.3	93.8	93.9	93.5	96.5	94.6	93.7	94.6	94.6	94.1	93.1	94.9	94.3	94.6
Large correlation at level 2 ($\rho_B = .60$, true value $= 0.600$)															
K = 50															
n = 5	97.3	98.1	96.5	92.8	92.3	97.3	95.5	94.0	93.1	94.1	97.9	98.1	96.0	93.3	95.0
n = 15	95.0	97.3	94.8	92.6	92.9	94.0	96.1	94.0	92.4	93.4	92.9	97.9	95.0	91.5	90.3
n = 30	92.8	93.6	93.0	92.4	92.2	93.2	94.7	94.7	92.8	92.0	93.3	95.8	94.6	92.0	90.5
K = 150															
n = 5	97.3	96.8	96.5	94.2	94.4	97.7	97.6	96.1	94.2	94.5	98.7	98.7	96.7	94.3	94.2
n = 15	94.8	97.1	95.6	95.0	93.1	93.8	96.5	96.0	93.3	92.4	95.7	96.1	93.6	93.2	93.5
n = 30	91.9	96.7	95.2	93.9	93.9	89.5	95.7	94.9	94.3	93.4	94.9	94.9	94.6	93.7	94.1

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D18

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .10$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.202)															
K = 50															
n = 5	96.7	97.6	96.2	93.4	92.8	95.0	96.6	95.1	92.4	92.0	95.3	97.5	95.8	91.7	90.2
n = 15	91.7	94.3	93.1	90.2	90.7	91.3	95.0	92.9	90.9	90.4	92.6	97.4	94.2	93.0	89.5
n = 30	89.9	93.4	92.3	92.2	91.5	90.3	94.4	92.0	92.3	91.8	89.4	95.6	93.7	92.2	89.7
K = 150															
n = 5	96.7	97.9	95.6	94.5	93.6	95.6	98.0	95.4	94.4	94.8	96.1	98.9	96.9	94.8	93.3
n = 15	91.5	98.5	95.1	94.5	94.9	91.6	96.6	95.0	94.7	94.2	91.3	98.5	95.4	93.5	87.3
n = 30	88.0	95.2	93.9	93.8	93.8	88.1	95.8	94.4	94.0	93.6	89.9	97.4	96.3	96.0	87.5
Large correlation at level 2 ($\rho_B = .60$, true value = 0.346)															
K = 50															
n = 5	96.7	96.6	95.0	92.6	92.8	95.9	97.9	95.2	92.8	92.6	96.0	97.3	95.9	92.9	91.8
n = 15	95.5	95.9	94.0	92.8	92.1	94.8	96.6	94.6	93.3	93.7	93.5	97.8	94.2	93.2	93.0
n = 30	94.8	95.9	94.7	93.2	93.0	93.5	95.1	93.6	92.5	92.1	94.2	96.1	94.7	92.8	92.1
K = 150															
n = 5	97.0	98.7	95.4	94.6	93.6	97.0	98.1	96.1	94.6	94.5	97.2	98.9	95.8	94.2	93.6
n = 15	96.2	96.7	95.0	94.0	93.8	94.4	96.9	93.9	93.8	94.1	94.5	98.3	94.6	94.9	93.9
n = 30	93.7	95.5	93.7	95.0	94.9	95.0	95.7	94.9	94.7	94.3	93.3	97.6	94.7	93.5	93.4

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D19

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .30$, and 25% Missing Data

Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.606)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
n = 5	95.1	94.9	93.4	91.3	91.8	96.8	95.4	95.4	93.0	91.9	93.7	95.1	93.5	90.9	92.8
n = 15	93.1	93.2	92.7	93.0	92.6	92.8	92.2	91.4	92.1	90.6	93.8	95.2	93.4	92.6	91.3
n = 30	91.4	92.7	91.5	91.8	92.4	92.7	93.6	92.7	92.4	92.7	90.7	92.5	91.8	91.7	92.2
K = 150															
n = 5	96.1	96.4	94.8	93.7	93.4	97.0	96.4	95.7	94.3	92.8	96.4	97.0	94.3	94.5	94.5
n = 15	93.2	95.8	95.3	94.1	93.4	92.3	94.7	93.0	94.0	93.9	93.1	96.8	96.1	94.1	92.5
n = 30	87.9	93.4	92.4	93.7	93.2	90.7	95.3	94.9	94.4	94.8	91.3	95.6	94.8	93.7	90.4

Large correlation at level 2 ($\rho_B = .60$, true value = 1.039)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
n = 5	93.0	95.3	94.1	90.9	92.0	92.9	95.4	93.9	91.7	93.0	92.5	93.9	92.6	90.3	93.0
n = 15	87.7	92.7	90.9	90.9	89.7	87.3	92.6	90.4	92.0	89.2	86.5	92.7	91.8	90.7	86.2
n = 30	84.6	93.3	93.1	92.6	91.8	84.3	92.3	92.0	91.1	90.9	85.7	94.7	93.9	93.5	83.0
K = 150															
n = 5	87.2	92.4	89.8	88.4	88.3	86.3	92.5	89.4	87.8	88.1	87.7	92.9	90.1	88.6	86.7
n = 15	74.3	94.8	93.7	92.5	91.6	76.1	94.4	93.7	93.1	90.5	79.7	94.6	93.8	93.0	78.6
n = 30	70.0	95.1	94.6	93.7	93.4	67.9	95.1	94.3	94.0	92.7	67.3	94.0	93.5	93.2	74.9

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D20

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .30$, and 25% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)															
K = 50															
n = 5	95.0	95.9	93.1	91.7	91.9	95.3	96.1	93.8	91.9	92.6	94.5	96.7	93.7	92.8	92.8
n = 15	91.8	93.8	93.2	92.3	92.6	91.0	93.6	92.2	92.1	91.6	95.0	95.0	92.4	92.6	92.5
n = 30	91.0	92.8	92.6	91.1	90.9	91.4	93.8	93.6	93.1	92.3	93.8	93.8	93.1	92.1	92.5
K = 150															
n = 5	96.8	96.8	95.1	94.2	94.8	95.8	98.1	95.0	94.7	94.2	95.0	97.3	93.8	92.2	94.0
n = 15	94.6	96.2	95.3	94.8	94.6	94.6	95.7	94.6	94.5	94.1	95.4	95.4	93.9	93.8	94.9
n = 30	93.8	94.8	94.4	94.5	94.6	93.3	95.2	94.7	94.7	94.8	92.7	95.6	94.9	94.1	94.5
Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)															
K = 50															
n = 5	95.4	96.0	94.0	92.0	92.5	94.5	96.7	93.8	93.0	93.0	93.1	96.7	93.4	91.8	88.8
n = 15	92.0	93.9	93.2	92.1	93.2	91.4	95.8	94.3	93.3	93.0	89.2	93.5	91.8	91.3	90.9
n = 30	89.3	94.0	93.2	93.5	92.6	89.0	94.0	93.5	92.5	92.1	87.6	93.2	91.6	91.9	90.7
K = 150															
n = 5	93.5	95.0	93.2	93.2	92.7	93.2	96.8	94.3	94.8	93.6	93.7	97.1	94.7	95.1	92.1
n = 15	85.8	94.7	93.6	93.1	93.3	87.6	95.7	93.6	94.3	94.1	87.8	95.4	92.3	93.1	87.4
n = 30	85.2	95.1	95.2	94.2	94.6	84.6	94.6	93.7	94.4	94.2	84.6	95.5	94.3	94.1	86.6

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D21

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,x} = .10$ and $\rho_{I,y} = .10$, and 50% Missing Data

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)															
K = 50															
n = 5	98.9	98.8	97.5	92.9	93.0	99.4	98.7	98.4	93.5	93.9	99.5	99.2	97.4	93.6	94.3
n = 15	98.7	97.6	96.5	91.9	93.0	98.3	98.5	96.5	92.4	93.2	98.7	98.8	97.3	93.1	91.8
n = 30	97.8	97.5	95.0	92.4	91.9	97.9	96.4	94.1	92.3	92.4	96.7	98.0	95.8	92.9	92.9
K = 150															
n = 5	99.4	98.8	96.9	93.7	94.9	99.3	97.3	94.1	93.8	94.1	99.3	99.1	96.9	94.6	94.8
n = 15	99.1	98.4	95.7	93.9	94.5	99.1	98.5	96.5	93.3	94.1	99.1	98.9	95.7	94.5	94.0
n = 30	97.6	96.3	93.8	93.9	93.7	98.0	97.8	94.9	93.9	93.4	97.3	98.7	94.0	94.5	94.1
Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)															
K = 50															
n = 5	97.7	98.8	97.1	92.8	93.0	98.3	99.2	97.6	92.9	93.2	97.0	98.2	98.2	93.7	94.1
n = 15	95.2	98.3	95.7	92.0	91.5	94.4	98.3	96.8	92.4	92.7	95.0	98.8	96.7	92.9	92.0
n = 30	89.4	97.4	94.9	91.9	91.9	90.2	97.9	96.4	91.8	91.3	89.1	98.0	95.3	92.1	90.4
K = 150															
n = 5	98.0	99.1	98.0	94.3	95.1	97.5	98.4	95.8	93.8	94.1	96.5	98.0	96.0	93.1	95.1
n = 15	84.9	99.1	95.6	93.9	94.2	87.5	98.4	95.3	94.1	92.1	88.4	98.9	96.3	94.5	91.2
n = 30	68.2	97.6	95.2	94.6	94.6	72.2	98.1	95.4	94.0	93.1	70.7	98.7	95.4	94.4	87.1

Note. *K* = number of groups; *n* = group size; λ = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D22

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .10$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.202)															
K = 50															
n = 5	96.4	98.5	94.9	92.0	92.8	95.0	98.3	96.3	91.9	91.0	96.8	97.7	97.5	92.9	92.1
n = 15	89.9	98.0	95.4	92.8	92.8	90.6	97.7	94.4	91.9	92.4	91.7	98.3	95.6	92.6	90.0
n = 30	83.3	96.9	95.9	92.2	92.2	81.9	97.6	95.1	92.0	91.0	86.5	94.9	94.9	92.7	88.1
K = 150															
n = 5	94.9	99.1	95.8	93.5	93.3	93.3	97.6	95.8	94.8	93.8	94.0	95.9	96.1	94.5	92.7
n = 15	80.2	98.5	96.5	94.1	95.3	79.3	98.9	96.2	94.6	94.7	83.4	99.2	95.1	94.2	88.7
n = 30	62.5	97.7	94.9	93.6	94.1	60.8	97.7	95.2	93.9	93.9	68.4	98.7	95.3	94.2	81.2
Large correlation at level 2 ($\rho_B = .60$, true value = 0.346)															
K = 50															
n = 5	98.5	98.4	95.9	92.3	91.9	98.5	98.9	96.7	92.4	92.6	97.7	97.5	97.1	92.0	92.2
n = 15	96.8	97.5	96.0	92.3	91.5	96.4	98.3	95.0	92.2	91.5	97.0	99.4	95.6	92.1	92.7
n = 30	93.9	96.9	95.3	92.8	92.6	94.0	97.5	95.2	93.4	91.4	94.9	98.5	96.3	93.0	91.3
K = 150															
n = 5	98.2	99.3	96.4	94.1	94.6	99.1	98.8	96.4	93.5	93.3	97.0	96.3	95.6	93.3	94.0
n = 15	96.6	98.6	95.2	94.6	94.6	97.3	99.7	96.9	95.0	95.4	95.3	99.2	94.9	94.1	93.8
n = 30	94.1	98.9	95.6	93.9	93.9	93.2	98.3	96.0	94.5	95.1	92.4	98.4	96.3	93.7	92.6

Note. *K* = number of groups; *n* = group size; λ = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D23

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{1,X} = .10$ and $\rho_{1,Y} = .30$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.606)															
K = 50															
n = 5	98.4	98.2	96.8	92.4	92.0	98.3	97.3	96.8	90.9	92.3	98.0	98.3	97.1	92.5	93.7
n = 15	91.4	95.9	93.6	92.4	91.9	92.5	97.3	95.3	91.6	90.8	93.5	96.2	95.0	92.8	91.0
n = 30	84.2	94.7	93.5	91.9	93.1	87.3	94.5	92.9	92.9	92.0	86.5	95.4	93.9	91.6	90.8
K = 150															
n = 5	97.9	98.1	95.5	94.0	93.7	97.2	98.3	96.2	94.3	93.2	97.4	97.0	94.9	93.5	94.5
n = 15	82.4	96.9	94.9	94.3	93.4	85.1	97.0	95.2	94.7	93.8	84.1	97.2	93.6	93.8	91.6
n = 30	73.8	95.1	94.5	94.4	93.6	72.3	94.7	93.8	93.9	94.0	73.5	96.5	95.1	94.7	89.9
Large correlation at level 2 ($\rho_B = .60$, true value = 1.039)															
K = 50															
n = 5	87.8	93.8	90.7	91.3		88.0	96.1	94.3	88.4	92.5	89.4	96.8	94.5	92.1	94.4
n = 15	64.5	95.9	92.4	92.1		62.7	95.4	94.0	90.5	90.1	66.8	96.6	94.5	91.7	86.3
n = 30	42.9	94.8	94.0	91.0		45.9	95.9	94.2	93.0	89.8	46.0	95.6	94.3	92.6	82.3
K = 150															
n = 5	74.9	96.2	91.5	87.6	91.1	77.2	96.6	93.0	89.0	91.5	77.4	95.5	92.8	90.1	92.6
n = 15	27.0	96.0	94.0	93.5	90.8	26.6	96.5	92.8	93.0	89.6	28.8	97.7	94.3	93.0	79.6
n = 30	6.8	95.7	94.5	93.5	92.7	7.2	96.1	93.9	94.1	90.0	8.3	96.6	93.7	93.5	67.4

Note. *K* = number of groups; *n* = group size; *λ* = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table D24

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Between-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .30$, and 50% Missing Data

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$, true value = 0.350)															
K = 50															
n = 5	97.8	98.2	96.3	94.5	92.3	97.2	97.9	96.1	92.8	92.3	96.7	95.4	93.4		91.8
n = 15	94.0	96.5	94.2	94.0	92.6	93.1	96.3	92.5	91.7	91.8	93.4	96.5	93.7	92.7	92.3
n = 30	90.6	93.9	91.5	92.5	92.5	90.8	95.1	93.3	92.6	92.5	89.6	94.8	92.8	91.6	91.2
K = 150															
n = 5	97.9	98.6	94.7	94.8	95.0	98.3	97.6	95.3	93.8	93.5	97.3	95.7	95.4	94.7	94.8
n = 15	94.3	96.1	94.3	93.7	93.9	94.0	97.6	94.4	95.0	93.9	92.8	98.3	94.4	94.1	94.3
n = 30	91.8	96.3	95.5	94.5	94.4	94.7	97.0	96.2	94.3	95.1	91.2	96.2	93.9	93.9	94.3
Large correlation at level 2 ($\rho_B = .60$, true value = 0.600)															
K = 50															
n = 5	95.1	97.9	95.0	93.2	91.9	93.8	97.8	95.4	92.1	92.5	94.7	97.6	95.7	91.9	90.6
n = 15	86.5	96.0	93.8	91.8	91.3	86.7	97.1	94.7	93.6	93.4	83.7	97.3	93.5	91.9	88.8
n = 30	76.8	95.0	93.5	92.3	92.8	78.8	95.1	93.8	92.5	91.7	78.7	95.8	92.5	91.8	89.3
K = 150															
n = 5	89.2	98.5	94.7	93.1	93.7	89.4	98.3	95.0	94.6	92.7	91.2	93.5	94.4	93.7	91.6
n = 15	69.3	98.0	95.8	94.7	94.6	67.0	98.6	96.9	95.5	94.1	72.6	98.6	94.3	94.3	85.5
n = 30	51.0	96.2	94.4	94.9	95.1	54.2	95.8	94.5	93.0	93.1	63.3	97.4	94.9	94.0	80.0

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E1

Bias of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}= .10$ and $\rho_{I,Y}= .10$, and 25% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	.002	.001	.002	.000	.000	.004	.002	.002	.000	.000	−.005	−.009	−.011	.000	−.005
n = 15	.000	.001	.001	.001	.001	−.001	.000	.000	.000	.001	.005	.005	.004	.002	.003
n = 30	.000	.001	.000	.000	.000	.000	.000	.000	.000	.001	.000	.000	−.001	.000	.000
K = 150															
n = 5	−.002	−.001	−.001	−.001	.000	.001	.001	.001	−.001	.000	.001	.000	−.001	−.001	.000
n = 15	.000	.000	.000	.000	.000	.000	.001	.001	.000	.001	.000	.000	−.001	.000	−.001
n = 30	.000	.001	.000	−.001	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	.008	.000	.002	.004	.005	.009	.001	.002	.003	.005	.007	−.006	−.005	.002	.003
n = 15	.008	.001	.002	.000	.000	.006	.000	.000	−.001	−.001	.007	.000	−.002	.000	.000
n = 30	.007	.000	.000	.000	.000	.005	−.001	−.001	−.001	−.001	.004	−.001	−.004	−.001	−.001
K = 150															
n = 5	.005	−.003	.000	.000	−.001	.005	.000	.000	−.001	.002	.007	.000	.001	−.001	.000
n = 15	.007	.001	.002	.001	.001	.005	−.001	.000	.000	−.001	.006	.000	−.001	.000	.001
n = 30	.006	.000	.000	.000	.000	.008	.001	.001	.001	.001	.006	.000	−.001	.000	.000

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E2

Bias of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}= .30$ and $\rho_{I,Y}= .10$, and 25% Missing Data (True Value = 0.397)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
						Moderate correlation at level 2 ($\rho_B = .35$)									
$K = 50$															
$n = 5$	−.016	.000	−.001	.001	−.001	−.014	.000	−.001	−.004	−.004	−.011	.006	.001	.001	−.002
$n = 15$	−.013	.001	.000	.001	.001	−.015	−.001	−.001	.000	−.001	−.011	.005	.003	.001	.001
$n = 30$	−.013	.001	.001	.000	.000	−.014	.000	.000	.000	.001	−.013	.002	.001	.001	.000
$K = 150$															
$n = 5$	−.016	−.001	−.002	−.001	−.001	−.016	−.002	−.003	−.002	−.002	−.014	.001	−.002	−.001	−.001
$n = 15$	−.014	.001	.000	−.001	−.001	−.014	.001	.001	.000	.001	−.015	.000	−.001	.001	.000
$n = 30$	−.014	.000	.000	.001	.001	−.015	.000	.000	.000	.000	−.013	.001	.001	.000	.000
						Large correlation at level 2 ($\rho_B = .60$)									
$K = 50$															
$n = 5$	−.003	.001	.000	.000	−.002	−.006	−.002	−.004	−.001	−.001	−.010	−.008	−.014	−.006	−.008
$n = 15$	−.007	−.002	−.002	−.001	−.001	−.005	−.001	−.002	.000	−.001	.002	.004	.002	.001	.001
$n = 30$	−.006	−.003	−.003	−.001	−.001	−.003	.001	.000	.000	.000	−.006	−.003	−.005	.000	−.001
$K = 150$															
$n = 5$	−.004	.000	.000	−.001	−.002	−.006	−.004	−.003	.000	−.001	−.004	.000	−.002	.000	.002
$n = 15$	−.004	−.001	.000	.000	−.001	−.003	.000	.000	.000	.000	−.005	−.002	−.003	−.001	−.001
$n = 30$	−.003	.001	.001	.000	.000	−.004	.000	.000	.000	−.001	−.004	.000	−.001	.000	−.001

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E3

Bias of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .30$, and 25% Missing Data (True Value = 0.309)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
						Moderate correlation at level 2 ($\rho_B = .35$)									
K = 50															
n = 5	.004	–.003	–.003	–.001	–.001	.007	–.001	–.001	.001	.000	.005	–.002	–.004	.001	–.001
n = 15	.006	–.001	–.001	.000	–.001	.009	.001	.001	.000	–.001	.005	–.002	–.003	–.001	–.001
n = 30	.008	.000	.000	.000	.000	.007	–.001	–.001	.001	.001	.006	.000	–.001	.000	.000
K = 150															
n = 5	.009	.001	.003	.000	.000	.008	.000	.001	.002	.002	.007	.000	.000	.000	.000
n = 15	.008	.000	.000	–.001	.000	.008	.001	.000	.000	.000	.007	–.001	–.001	.000	.000
n = 30	.007	–.001	–.001	.000	–.001	.008	.000	.000	.000	.000	.007	–.001	–.001	.000	.000
						Large correlation at level 2 ($\rho_B = .60$)									
K = 50															
n = 5	.013	–.007	–.003	–.003	–.003	.017	–.002	.000	–.001	.001	.018	–.002	–.001	–.001	.002
n = 15	.019	.000	.001	.000	.000	.018	.000	.000	–.001	–.001	.017	.001	–.001	.000	.001
n = 30	.017	.000	.000	.000	.000	.017	–.001	–.001	.000	.000	.019	.002	.001	.001	.001
K = 150															
n = 5	.018	–.001	.001	–.001	–.001	.018	–.001	.001	–.001	.000	.019	.001	.001	–.001	.001
n = 15	.018	.000	.000	.001	.001	.017	–.001	–.001	–.001	.000	.018	.001	.000	.000	.001
n = 30	.018	.000	.000	.000	.000	.019	.000	.001	.000	.000	.018	.000	.000	.001	.000

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E4

Bias of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}= .30$ and $\rho_{I,Y}= .30$, and 25% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	.000	.001	.001	.001	.001	−.002	−.001	−.003	−.003	.000	.002	−.001	−.002	.000	−.001
n = 15	.001	.000	−.001	.000	.000	.002	.002	.002	.001	.001	.003	.001	.001	.000	.001
n = 30	−.002	−.002	−.002	−.001	−.001	.000	−.001	−.001	.001	.000	−.001	−.001	−.002	−.001	.000
K = 150															
n = 5	−.001	.000	.000	.001	.002	−.001	.000	−.001	.001	.001	.002	.001	.001	−.001	.002
n = 15	.000	.001	.001	.000	.000	.000	−.001	−.001	−.001	−.001	.000	−.001	−.001	.000	.000
n = 30	−.002	−.002	−.001	−.001	−.001	.000	.001	.001	.000	.000	.000	.000	.000	.000	.000
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	.019	.000	.002	.000	.000	.016	−.004	−.002	−.003	−.002	.015	−.002	−.005	.001	.003
n = 15	.019	.001	.002	.001	.001	.020	.001	.001	.001	.001	.017	−.001	−.003	−.001	−.001
n = 30	.018	.000	.000	−.001	−.001	.018	−.001	−.001	−.001	.000	.020	.001	.000	.001	.000
K = 150															
n = 5	.019	.000	.001	−.001	.000	.018	−.001	.000	.001	.001	.021	.003	.001	.002	.003
n = 15	.018	−.001	−.001	.000	.000	.019	.000	.000	.000	−.001	.019	.000	.000	−.001	.000
n = 30	.018	.000	.000	.000	.000	.018	.000	.000	.000	.000	.018	.000	−.001	.000	.000

Note. *K* = number of groups; *n* = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E5

Bias of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .10$, and 50% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
						Moderate correlation at level 2 ($\rho_B = .35$)									
K = 50															
n = 5	−.001	−.002	.000	.000	.000	.001	−.002	−.001	−.001	.000	−.001	.002	−.007	.001	.003
n = 15	.000	−.001	.000	.000	.001	−.002	−.002	−.002	−.001	−.001	−.002	−.003	−.006	−.001	−.002
n = 30	−.001	−.003	−.002	−.001	−.003	.001	.001	.001	−.001	.000	.000	.001	−.002	−.001	.000
K = 150															
n = 5	.002	.001	.003	.002	.003	.004	.002	.005	.000	.001	.000	.000	−.003	.000	.000
n = 15	−.001	−.001	.000	.000	.000	.001	.002	.002	.000	.000	−.001	−.001	−.003	.000	.000
n = 30	.000	.000	.000	.000	.000	.001	.001	.001	.000	.001	.000	.001	−.002	−.001	.000
						Large correlation at level 2 ($\rho_B = .60$)									
K = 50															
n = 5	.008	−.007	−.001	.002	.005	.015	−.002	.003	.001	.006	.013	−.001	−.006	.002	−.001
n = 15	.013	.001	.001	.000	.001	.012	.000	.000	.002	.001	.013	.000	−.005	−.001	−.002
n = 30	.012	.000	.000	.000	.000	.012	−.001	.000	.000	.000	.012	.000	−.003	−.001	−.001
K = 150															
n = 5	.009	−.004	.001	−.003	−.001	.013	.000	.006	−.001	.003	.011	−.006	−.001	−.001	.001
n = 15	.011	−.001	.000	.000	.000	.012	−.001	−.001	.000	−.001	.009	−.003	−.004	.000	−.002
n = 30	.011	−.001	.000	−.001	−.001	.014	.001	.002	.000	.000	.012	.000	−.001	.000	.000

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E6

Bias of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}$= .30 and $\rho_{I,Y}$= .10, and 50% Missing Data (True Value = 0.397)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35)															
K = 50															
n = 5	–.032	–.002	–.005	–.002	–.008	–.027	–.003	–.004	.001	–.004	–.032	–.004	–.013	.002	–.010
n = 15	–.025	.003	.003	.001	.002	–.032	–.002	–.004	–.001	–.004	–.030	–.001	–.006	.000	.001
n = 30	–.026	.004	.003	.001	.003	–.029	.000	–.001	.001	.001	–.029	.000	–.003	.000	–.001
K = 150															
n = 5	–.033	–.004	–.004	–.002	–.004	–.027	.001	.000	.001	.002	–.032	–.004	–.010	.000	–.006
n = 15	–.030	.000	–.001	.000	–.001	–.027	.002	.002	.001	.001	–.030	–.002	–.004	–.001	–.003
n = 30	–.029	.000	–.001	.000	.000	–.029	.000	–.001	.001	.000	–.029	.000	.000	.000	–.001
Large correlation at level 2 (ρ_B = .60)															
K = 50															
n = 5	–.012	–.005	–.006	–.003	–.003	–.012	–.003	–.003	–.002	–.004	–.018	–.012	–.019	.000	–.005
n = 15	–.007	.000	–.001	.000	.000	–.007	.001	.000	.002	.003	–.015	–.007	–.013	–.001	–.004
n = 30	–.006	.000	.000	.001	.000	–.006	.001	.000	.000	.000	–.011	–.003	–.006	–.001	–.001
K = 150															
n = 5	–.007	.000	.001	.000	–.001	–.005	.003	.001	–.001	–.001	–.005	.003	–.002	.001	–.003
n = 15	–.008	.000	–.001	.000	.001	–.008	.000	–.001	–.001	–.001	–.009	–.001	–.003	–.001	–.003
n = 30	–.008	.000	.000	.000	.000	–.006	.001	.001	.000	.001	–.007	.001	–.001	–.001	.000

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E7

Bias of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,x}= .10$ and $\rho_{I,y}= .30$, and 50% Missing Data (True Value = 0.309)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
					Moderate correlation at level 2 ($\rho_B = .35$)										
$K = 50$															
$n = 5$	.012	−.005	−.003	−.003	.000	.023	.001	.005	.003	.005	.026	.010	.008	.003	.010
$n = 15$	.013	−.001	.000	.001	.001	.018	.003	.003	.001	.002	.014	−.002	−.004	.000	.001
$n = 30$	.015	.000	.000	−.001	.000	.014	.000	.000	.000	.000	.012	−.001	−.002	−.001	−.001
$K = 150$															
$n = 5$	.014	−.001	.002	−.001	.001	.019	.005	.006	.001	.003	.015	−.005	−.003	−.001	−.001
$n = 15$	.015	.001	.001	.000	.001	.014	.000	.000	.000	.000	.015	.000	.000	.000	.000
$n = 30$	.015	.000	.000	.000	.000	.015	.000	.000	.000	.000	.015	−.001	−.001	.000	−.001
					Large correlation at level 2 ($\rho_B = .60$)										
$K = 50$															
$n = 5$	.040	.002	.009	.001	.004	.035	−.004	.003	.002	.006	.042	.003	.001	.002	.008
$n = 15$	.035	.001	.003	.000	.001	.036	.000	−.001	−.001	−.001	.031	−.006	−.008	−.002	−.002
$n = 30$	.037	.001	.002	.001	.000	.036	−.001	.000	.000	.000	.034	.000	−.002	.000	−.001
$K = 150$															
$n = 5$	.034	−.004	.003	.001	.000	.035	−.004	.003	−.002	−.002	.037	.000	.002	.000	.004
$n = 15$	.037	.001	.002	.001	.002	.039	.002	.003	.000	.000	.034	−.001	−.003	.000	.000
$n = 30$	.037	.000	.000	.000	.000	.036	.000	.000	.000	.000	.035	.000	−.001	.000	.001

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E8

Bias of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}= .30$ and $\rho_{I,Y}= .30$, and 50% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
	Moderate correlation at level 2 ($\rho_B = .35$)														
K = 50															
n = 5	–.004	–.002	–.002	–.001	–.003	.001	.003	.002	.000	.004	–.004	.005	–.004	–.001	.003
n = 15	–.002	.001	.000	.001	.000	.001	.000	–.002	–.001	–.001	.000	.001	–.002	.001	.002
n = 30	.002	.002	.002	.000	.002	–.003	–.001	–.002	–.001	–.001	.003	.001	.000	–.001	.001
K = 150															
n = 5	.002	.001	.002	.001	.002	–.002	–.002	–.003	–.001	–.002	–.004	–.005	–.008	–.001	–.001
n = 15	.000	–.001	–.001	.001	.001	.001	.002	.002	.000	.000	–.002	.000	–.002	.000	.000
n = 30	.000	.000	–.001	.000	.000	–.001	–.001	–.001	.000	.000	.000	–.001	–.001	.000	–.001
	Large correlation at level 2 ($\rho_B = .60$)														
K = 50															
n = 5	.033	–.003	–.001	.001	.002	.041	.004	.006	–.001	.002	.037	–.001	–.009	.000	.003
n = 15	.037	.001	.002	.000	.000	.035	.000	–.002	.000	–.001	.035	.001	–.003	.000	.004
n = 30	.037	.001	.000	.000	.000	.036	.000	.000	.000	.001	.039	.003	.001	.001	.000
K = 150															
n = 5	.037	–.002	.000	.000	–.001	.036	.001	.003	.000	.002	.040	.006	.002	.001	.003
n = 15	.036	–.002	–.002	.000	–.001	.038	.001	.001	–.001	–.001	.039	.003	.002	.001	.003
n = 30	.036	–.001	–.001	.000	–.001	.036	.000	.000	–.001	–.001	.038	.000	.000	.000	–.001

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E9

RMSE of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,x}= .10$ and $\rho_{I,y}= .10$, and 25% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.072	0.081	0.076	0.065	0.077	0.074	0.084	0.078	0.066	0.080	0.089	0.096	0.090	0.066	0.090
n = 15	0.042	0.044	0.043	0.037	0.042	0.042	0.043	0.043	0.036	0.044	0.050	0.051	0.050	0.035	0.048
n = 30	0.029	0.029	0.029	0.024	0.029	0.030	0.031	0.031	0.025	0.030	0.034	0.034	0.034	0.024	0.034
K = 150															
n = 5	0.043	0.047	0.045	0.038	0.046	0.042	0.046	0.044	0.037	0.046	0.051	0.055	0.052	0.037	0.052
n = 15	0.024	0.025	0.025	0.021	0.024	0.023	0.023	0.023	0.019	0.023	0.027	0.028	0.027	0.020	0.028
n = 30	0.016	0.016	0.016	0.014	0.016	0.017	0.018	0.018	0.014	0.017	0.020	0.020	0.020	0.014	0.019
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.071	0.078	0.074	0.064	0.074	0.075	0.085	0.078	0.063	0.079	0.087	0.098	0.090	0.066	0.089
n = 15	0.041	0.043	0.042	0.036	0.042	0.040	0.042	0.041	0.034	0.042	0.050	0.050	0.050	0.036	0.049
n = 30	0.029	0.029	0.029	0.025	0.029	0.030	0.030	0.029	0.024	0.030	0.035	0.035	0.034	0.025	0.034
K = 150															
n = 5	0.043	0.047	0.045	0.037	0.044	0.045	0.049	0.047	0.039	0.048	0.053	0.058	0.054	0.038	0.055
n = 15	0.025	0.025	0.024	0.020	0.024	0.024	0.025	0.025	0.020	0.025	0.028	0.027	0.027	0.020	0.026
n = 30	0.018	0.017	0.016	0.015	0.017	0.019	0.018	0.018	0.014	0.017	0.021	0.020	0.020	0.014	0.020

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E10

RMSE of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .10$, and 25% Missing Data (True Value = 0.397)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.080	0.092	0.087	0.076	0.092	0.084	0.096	0.090	0.075	0.093	0.092	0.105	0.095	0.074	0.102
n = 15	0.046	0.047	0.047	0.041	0.047	0.048	0.049	0.049	0.040	0.049	0.053	0.055	0.055	0.040	0.053
n = 30	0.034	0.032	0.032	0.028	0.032	0.035	0.033	0.033	0.028	0.033	0.039	0.038	0.038	0.028	0.037
K = 150															
n = 5	0.050	0.054	0.052	0.044	0.053	0.049	0.053	0.051	0.043	0.052	0.057	0.061	0.058	0.043	0.059
n = 15	0.030	0.028	0.028	0.024	0.027	0.030	0.028	0.028	0.023	0.027	0.034	0.033	0.032	0.023	0.031
n = 30	0.023	0.019	0.019	0.016	0.019	0.023	0.019	0.019	0.016	0.018	0.024	0.020	0.020	0.016	0.020
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.081	0.091	0.086	0.075	0.088	0.079	0.093	0.086	0.073	0.089	0.093	0.108	0.101	0.076	0.102
n = 15	0.046	0.048	0.048	0.040	0.046	0.048	0.051	0.050	0.040	0.049	0.050	0.054	0.053	0.039	0.053
n = 30	0.032	0.034	0.034	0.028	0.033	0.030	0.032	0.032	0.027	0.032	0.038	0.039	0.039	0.028	0.037
K = 150															
n = 5	0.045	0.053	0.050	0.043	0.052	0.048	0.057	0.052	0.043	0.054	0.055	0.066	0.059	0.044	0.061
n = 15	0.026	0.028	0.028	0.023	0.028	0.026	0.027	0.027	0.022	0.027	0.029	0.030	0.030	0.023	0.030
n = 30	0.017	0.018	0.019	0.016	0.019	0.020	0.020	0.020	0.016	0.019	0.021	0.022	0.021	0.016	0.021

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E11

RMSE of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .30$, and 25% Missing Data (True Value = 0.309)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.067	0.072	0.068	0.060	0.071	0.071	0.073	0.071	0.057	0.072	0.083	0.085	0.082	0.058	0.082
n = 15	0.038	0.036	0.036	0.031	0.036	0.041	0.039	0.038	0.032	0.038	0.048	0.045	0.045	0.031	0.043
n = 30	0.028	0.026	0.025	0.022	0.026	0.029	0.026	0.026	0.021	0.026	0.034	0.030	0.030	0.022	0.030
K = 150															
n = 5	0.040	0.041	0.040	0.034	0.040	0.044	0.044	0.043	0.034	0.042	0.047	0.047	0.045	0.034	0.047
n = 15	0.024	0.022	0.022	0.019	0.022	0.024	0.022	0.023	0.018	0.022	0.028	0.025	0.025	0.018	0.025
n = 30	0.017	0.015	0.015	0.012	0.014	0.018	0.015	0.015	0.013	0.015	0.021	0.018	0.018	0.013	0.017
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.073	0.075	0.074	0.059	0.072	0.073	0.074	0.072	0.060	0.073	0.084	0.084	0.080	0.059	0.084
n = 15	0.043	0.038	0.038	0.031	0.037	0.044	0.039	0.039	0.032	0.038	0.049	0.046	0.044	0.031	0.044
n = 30	0.032	0.026	0.026	0.022	0.025	0.034	0.027	0.027	0.022	0.027	0.039	0.032	0.032	0.022	0.031
K = 150															
n = 5	0.043	0.041	0.040	0.034	0.040	0.044	0.043	0.041	0.034	0.043	0.053	0.050	0.050	0.035	0.048
n = 15	0.028	0.021	0.021	0.018	0.021	0.028	0.022	0.022	0.018	0.021	0.031	0.024	0.024	0.018	0.024
n = 30	0.024	0.015	0.014	0.012	0.014	0.025	0.016	0.016	0.013	0.015	0.027	0.018	0.018	0.013	0.017

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E12

RMSE of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}=.30$ and $\rho_{I,Y}=.30$, and 25% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.073	0.081	0.077	0.068	0.080	0.079	0.085	0.082	0.067	0.082	0.090	0.092	0.090	0.066	0.090
n = 15	0.043	0.042	0.042	0.036	0.041	0.045	0.045	0.044	0.036	0.044	0.051	0.047	0.048	0.036	0.047
n = 30	0.029	0.029	0.028	0.024	0.028	0.031	0.030	0.030	0.025	0.029	0.037	0.034	0.034	0.025	0.033
K = 150															
n = 5	0.042	0.046	0.044	0.039	0.046	0.045	0.048	0.048	0.038	0.048	0.052	0.056	0.054	0.038	0.053
n = 15	0.025	0.025	0.025	0.020	0.024	0.026	0.026	0.026	0.021	0.025	0.028	0.028	0.028	0.021	0.027
n = 30	0.017	0.016	0.016	0.014	0.016	0.018	0.017	0.017	0.014	0.017	0.021	0.019	0.019	0.014	0.019
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.078	0.084	0.080	0.066	0.078	0.079	0.085	0.084	0.066	0.082	0.086	0.093	0.089	0.066	0.091
n = 15	0.044	0.040	0.040	0.037	0.043	0.048	0.044	0.043	0.035	0.042	0.052	0.048	0.048	0.035	0.046
n = 30	0.034	0.029	0.029	0.025	0.030	0.035	0.030	0.030	0.025	0.030	0.039	0.033	0.032	0.024	0.032
K = 150															
n = 5	0.046	0.047	0.045	0.038	0.047	0.048	0.049	0.047	0.038	0.047	0.057	0.055	0.054	0.039	0.054
n = 15	0.030	0.024	0.024	0.020	0.023	0.031	0.026	0.025	0.021	0.025	0.034	0.027	0.027	0.020	0.027
n = 30	0.025	0.016	0.016	0.014	0.016	0.025	0.017	0.017	0.014	0.016	0.027	0.020	0.019	0.014	0.019

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E13

RMSE of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of ρ_{I,X} = .10 and ρ_{I,Y} = .10, and 50% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.087	0.112	0.096	0.063	0.097	0.096	0.117	0.103	0.064	0.103	0.113	0.140	0.118	0.065	0.122
n = 15	0.049	0.053	0.052	0.036	0.054	0.054	0.058	0.056	0.036	0.055	0.068	0.071	0.070	0.036	0.066
n = 30	0.036	0.037	0.037	0.025	0.036	0.037	0.038	0.037	0.025	0.038	0.046	0.047	0.046	0.025	0.045
K = 150															
n = 5	0.053	0.064	0.056	0.038	0.059	0.054	0.065	0.059	0.038	0.062	0.063	0.081	0.066	0.039	0.073
n = 15	0.030	0.031	0.031	0.020	0.030	0.031	0.032	0.032	0.021	0.032	0.038	0.039	0.038	0.020	0.038
n = 30	0.021	0.022	0.021	0.014	0.021	0.021	0.022	0.022	0.014	0.021	0.028	0.028	0.028	0.014	0.027
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.087	0.103	0.091	0.067	0.096	0.095	0.113	0.100	0.065	0.102	0.119	0.142	0.121	0.066	0.123
n = 15	0.050	0.050	0.050	0.036	0.051	0.055	0.057	0.055	0.036	0.055	0.070	0.070	0.069	0.036	0.068
n = 30	0.038	0.037	0.036	0.025	0.035	0.040	0.039	0.039	0.025	0.037	0.048	0.048	0.047	0.024	0.046
K = 150															
n = 5	0.052	0.066	0.056	0.038	0.060	0.058	0.069	0.059	0.038	0.062	0.065	0.079	0.068	0.038	0.070
n = 15	0.031	0.031	0.030	0.021	0.031	0.032	0.033	0.031	0.020	0.031	0.039	0.041	0.039	0.020	0.038
n = 30	0.024	0.021	0.021	0.014	0.021	0.026	0.022	0.022	0.014	0.022	0.029	0.027	0.026	0.014	0.026

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E14

RMSE of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of ρ_I,x = .30 and ρ_I,y = .10, and 50% Missing Data (True Value = 0.397)

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35)															
K = 50															
n = 5	0.099	0.122	0.109	0.071	0.112	0.101	0.131	0.114	0.076	0.122	0.123	0.153	0.135	0.076	0.138
n = 15	0.062	0.064	0.060	0.041	0.060	0.067	0.065	0.064	0.041	0.062	0.073	0.072	0.069	0.039	0.070
n = 30	0.046	0.041	0.041	0.028	0.040	0.049	0.043	0.042	0.028	0.040	0.055	0.049	0.049	0.028	0.048
K = 150															
n = 5	0.064	0.074	0.065	0.044	0.069	0.062	0.073	0.064	0.044	0.071	0.074	0.087	0.076	0.044	0.082
n = 15	0.043	0.036	0.034	0.024	0.034	0.043	0.036	0.036	0.023	0.035	0.050	0.042	0.042	0.023	0.041
n = 30	0.037	0.024	0.024	0.016	0.023	0.039	0.026	0.025	0.016	0.025	0.042	0.030	0.030	0.017	0.029
Large correlation at level 2 (ρ_B = .60)															
K = 50															
n = 5	0.097	0.132	0.114	0.077	0.121	0.094	0.136	0.113	0.073	0.118	0.123	0.157	0.134	0.075	0.138
n = 15	0.052	0.059	0.057	0.041	0.058	0.053	0.059	0.059	0.039	0.059	0.069	0.074	0.072	0.041	0.071
n = 30	0.038	0.041	0.040	0.028	0.040	0.040	0.042	0.042	0.028	0.041	0.048	0.049	0.049	0.028	0.048
K = 150															
n = 5	0.051	0.068	0.059	0.041	0.065	0.056	0.077	0.067	0.045	0.072	0.069	0.087	0.074	0.044	0.082
n = 15	0.031	0.034	0.034	0.023	0.033	0.034	0.037	0.036	0.024	0.036	0.040	0.042	0.041	0.024	0.042
n = 30	0.023	0.023	0.023	0.016	0.023	0.024	0.025	0.025	0.016	0.024	0.028	0.029	0.029	0.015	0.029

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E15

RMSE of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of ρ$_{I,X}$ = .10 and ρ$_{I,Y}$ = .30, and 50% Missing Data (True Value = 0.309)

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ$_B$ = .35)															
K = 50															
n = 5	0.086	0.100	0.087	0.058	0.091	0.094	0.106	0.094	0.058	0.097	0.117	0.129	0.114	0.060	0.118
n = 15	0.053	0.047	0.046	0.032	0.046	0.055	0.049	0.049	0.031	0.047	0.066	0.059	0.059	0.031	0.058
n = 30	0.037	0.032	0.031	0.022	0.031	0.041	0.035	0.034	0.022	0.033	0.050	0.042	0.042	0.022	0.040
K = 150															
n = 5	0.052	0.055	0.051	0.033	0.052	0.056	0.057	0.053	0.034	0.055	0.065	0.072	0.064	0.033	0.067
n = 15	0.033	0.027	0.027	0.018	0.026	0.033	0.029	0.029	0.018	0.029	0.040	0.035	0.035	0.018	0.034
n = 30	0.025	0.018	0.017	0.012	0.017	0.026	0.019	0.019	0.013	0.019	0.030	0.023	0.023	0.013	0.023
Large correlation at level 2 (ρ$_B$ = .60)															
K = 50															
n = 5	0.096	0.105	0.092	0.057	0.092	0.096	0.106	0.092	0.058	0.095	0.120	0.127	0.110	0.056	0.114
n = 15	0.060	0.049	0.048	0.032	0.046	0.063	0.050	0.049	0.031	0.048	0.075	0.064	0.062	0.032	0.059
n = 30	0.051	0.031	0.031	0.022	0.031	0.052	0.032	0.032	0.021	0.033	0.058	0.040	0.041	0.021	0.038
K = 150															
n = 5	0.061	0.058	0.052	0.035	0.053	0.064	0.060	0.056	0.035	0.056	0.075	0.070	0.063	0.033	0.066
n = 15	0.047	0.028	0.027	0.018	0.027	0.048	0.028	0.028	0.018	0.027	0.051	0.036	0.035	0.018	0.034
n = 30	0.042	0.019	0.018	0.012	0.018	0.042	0.020	0.020	0.013	0.019	0.044	0.024	0.024	0.013	0.023

Note. K = number of groups; *n* = group size; *λ* = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E16

RMSE of the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,x}=.30$ and $\rho_{I,y}=.30$, and 50% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	0.090	0.110	0.100	0.066	0.105	0.099	0.120	0.108	0.066	0.111	0.115	0.133	0.119	0.065	0.128
n = 15	0.054	0.052	0.052	0.036	0.053	0.057	0.056	0.054	0.035	0.054	0.069	0.065	0.063	0.036	0.063
n = 30	0.039	0.035	0.035	0.024	0.034	0.042	0.038	0.038	0.025	0.038	0.054	0.045	0.044	0.024	0.043
K = 150															
n = 5	0.051	0.062	0.058	0.039	0.061	0.055	0.065	0.061	0.037	0.062	0.065	0.074	0.069	0.038	0.072
n = 15	0.031	0.031	0.030	0.021	0.030	0.033	0.032	0.032	0.021	0.031	0.039	0.035	0.036	0.020	0.036
n = 30	0.023	0.022	0.022	0.015	0.021	0.024	0.022	0.022	0.014	0.021	0.030	0.026	0.026	0.014	0.025
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	0.097	0.113	0.102	0.066	0.107	0.103	0.115	0.103	0.067	0.109	0.119	0.139	0.121	0.066	0.128
n = 15	0.063	0.051	0.050	0.035	0.052	0.063	0.055	0.054	0.036	0.053	0.075	0.066	0.064	0.035	0.063
n = 30	0.053	0.036	0.036	0.024	0.035	0.054	0.037	0.037	0.025	0.037	0.063	0.045	0.045	0.026	0.045
K = 150															
n = 5	0.065	0.064	0.060	0.038	0.061	0.066	0.068	0.060	0.038	0.063	0.076	0.078	0.071	0.038	0.072
n = 15	0.047	0.030	0.030	0.021	0.030	0.048	0.032	0.032	0.021	0.031	0.055	0.039	0.037	0.020	0.036
n = 30	0.042	0.021	0.021	0.014	0.021	0.043	0.022	0.022	0.014	0.021	0.048	0.025	0.025	0.014	0.025

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E17

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .10$, and 25% Missing Data (True Value = 0.350)

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	95.5	94.9	95.0	94.0	93.7	96.0	93.2	94.8	94.2	93.6	95.7	93.4	93.9	92.8	93.9
n = 15	93.8	92.9	93.9	93.3	93.0	95.5	93.9	93.6	93.1	93.4	96.2	94.3	94.0	93.8	94.1
n = 30	95.6	93.8	94.5	94.3	93.4	94.7	93.1	93.3	93.8	93.3	95.5	94.6	94.2	94.9	94.3
K = 150															
n = 5	95.2	93.3	93.9	94.3	94.1	96.9	96.7	96.5	94.7	95.1	95.1	94.6	94.6	95.4	94.9
n = 15	96.0	94.5	95.0	94.8	94.4	96.1	95.2	96.0	96.2	95.6	96.0	93.6	95.1	95.7	95.1
n = 30	96.1	94.9	95.1	94.8	94.8	95.1	94.4	94.1	95.0	95.0	95.2	94.2	93.2	94.4	94.1
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	96.3	95.8	95.4	94.9	95.0	95.8	93.6	95.0	94.7	94.7	94.4	93.8	93.9	93.8	94.3
n = 15	95.4	94.0	94.8	93.7	94.2	95.9	95.2	96.2	95.1	94.9	94.6	94.0	94.1	93.5	93.6
n = 30	95.1	94.5	94.1	94.2	94.5	94.7	93.7	94.7	94.8	94.1	95.5	93.0	93.7	93.6	93.3
K = 150															
n = 5	94.6	93.3	94.0	94.9	94.8	95.7	94.6	93.9	94.6	94.4	94.4	93.6	94.5	94.5	94.2
n = 15	94.8	94.7	94.0	95.1	95.4	95.6	94.2	95.1	94.9	94.6	95.9	95.9	95.3	96.0	96.5
n = 30	93.5	94.8	94.3	93.9	95.3	92.0	93.6	94.0	94.8	95.1	94.4	94.8	94.4	94.8	95.0

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E18

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .30$ and $\rho_{I,Y} = .10$, and 25% Missing Data (True Value = 0.397)

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρB = .35)															
K = 50															
n = 5	96.7	94.3	94.6	93.7	93.6	96.4	94.3	94.7	94.5	93.6	94.9	93.8	95.2	94.2	92.8
n = 15	95.0	94.6	95.4	94.2	94.3	94.7	93.8	94.2	93.2	93.5	95.7	93.8	93.7	94.6	94.0
n = 30	94.3	95.0	94.2	94.8	94.1	94.7	94.8	94.8	92.9	94.4	95.0	92.7	94.5	94.9	93.6
K = 150															
n = 5	95.5	94.4	94.1	94.2	93.8	96.0	95.3	94.6	95.0	95.3	94.1	93.6	93.6	94.8	95.0
n = 15	93.9	94.2	93.6	93.9	94.3	93.8	94.6	94.3	95.2	94.5	93.0	93.8	93.4	94.7	94.1
n = 30	90.0	94.8	95.1	94.0	94.9	91.5	96.0	95.9	95.6	95.8	95.0	94.5	95.9	94.9	93.6
Large correlation at level 2 (ρB = .60)															
K = 50															
n = 5	96.0	95.0	95.0	93.9	94.2	97.6	94.6	95.0	95.3	94.5	95.5	94.1	93.8	92.6	92.8
n = 15	94.8	93.6	93.8	93.8	94.4	94.7	93.9	94.6	94.3	94.7	96.3	95.2	94.9	94.1	94.3
n = 30	95.2	93.8	94.1	93.7	93.8	96.9	96.5	94.7	95.2	94.7	95.6	93.5	93.5	94.1	93.7
K = 150															
n = 5	97.4	94.3	95.3	95.5	94.5	96.6	93.0	93.9	95.2	93.9	95.1	92.1	93.3	94.7	93.8
n = 15	96.0	95.5	95.1	94.9	94.3	97.3	94.8	96.3	94.4	95.2	97.3	95.9	95.9	95.5	95.6
n = 30	95.5	95.3	94.9	94.9	94.1	94.8	94.1	93.4	95.1	94.2	95.8	94.4	94.0	95.5	94.2

Note. K = number of groups; *n* = group size; λ = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E19

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .30$, and 25% Missing Data (True Value = 0.309)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
$n = 5$	97.0	94.0	94.2	92.8	92.9	96.6	95.5	94.8	94.4	93.9	96.1	94.4	94.6	94.3	94.3
$n = 15$	95.8	94.9	93.9	94.4	94.6	95.7	94.8	94.4	93.5	93.9	96.0	92.5	94.0	94.4	93.9
$n = 30$	94.6	94.1	94.6	93.3	93.1	95.9	94.4	94.0	95.5	93.6	96.5	93.7	94.2	93.9	93.8
K = 150															
$n = 5$	95.6	94.6	94.8	94.7	94.7	95.7	93.8	92.8	95.3	94.8	97.2	94.7	95.6	94.8	95.5
$n = 15$	95.2	93.9	93.8	94.0	93.7	95.4	93.5	94.4	94.0	94.3	96.5	95.0	95.0	94.5	94.6
$n = 30$	94.2	94.9	95.0	94.4	95.5	94.9	94.8	95.0	94.8	95.5	95.9	93.9	93.3	94.7	94.3
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
$n = 5$	94.7	94.1	93.5	92.9	93.6	96.3	94.8	94.9	93.7	93.8	96.2	94.4	94.2	93.2	93.2
$n = 15$	92.6	94.4	93.7	93.3	93.9	94.4	93.2	93.7	93.6	93.8	95.3	93.9	92.9	93.8	92.3
$n = 30$	91.0	95.1	93.8	94.7	94.8	91.9	93.7	93.4	93.6	93.5	93.9	93.0	92.9	92.6	94.1
K = 150															
$n = 5$	94.8	95.2	94.9	94.6	95.6	96.0	94.9	94.8	94.7	94.4	93.3	93.5	93.6	94.0	94.6
$n = 15$	89.0	93.7	94.6	94.5	95.2	90.5	94.9	93.9	94.1	95.2	93.2	94.4	95.0	93.8	95.1
$n = 30$	80.0	95.5	95.0	95.5	95.2	80.6	92.5	94.5	94.6	94.4	88.8	94.7	95.1	94.4	95.1

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E20

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}$ = .30 and $\rho_{I,Y}$ = .30, and 25% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	97.8	94.1	96.0	93.9	93.6	96.3	94.5	93.8	92.8	93.6	95.8	94.1	94.7	93.9	94.3
n = 15	96.1	95.0	94.5	94.0	94.0	95.4	94.9	94.0	94.0	93.6	96.8	94.4	94.4	93.8	94.0
n = 30	96.3	94.0	94.6	95.1	94.7	95.8	94.2	94.2	94.0	93.9	96.3	92.8	93.2	94.1	93.4
K = 150															
n = 5	97.6	95.8	95.1	93.8	94.5	97.6	95.6	94.9	94.6	94.9	96.3	92.1	92.8	95.2	93.6
n = 15	96.2	93.9	94.0	94.9	94.9	97.2	94.9	93.9	95.0	95.2	97.0	94.2	93.2	94.4	94.2
n = 30	95.5	94.4	94.0	95.2	94.7	96.6	95.1	94.4	94.2	94.5	98.3	95.3	94.5	94.2	95.2
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	95.8	94.5	94.3	94.2	94.4	96.3	93.1	92.8	93.8	93.4	96.7	94.2	94.4	94.4	93.2
n = 15	94.5	94.6	93.4	92.3	94.4	95.0	94.0	94.6	94.8	94.1	95.5	94.0	93.7	93.8	95.2
n = 30	90.4	94.3	95.1	93.5	93.4	92.2	94.7	94.4	94.1	93.5	94.8	93.8	95.0	94.2	94.8
K = 150															
n = 5	96.1	93.8	94.3	94.2	94.5	96.1	94.0	94.9	94.8	94.7	95.1	93.5	94.2	94.6	93.4
n = 15	90.5	95.0	93.9	94.8	95.6	90.5	94.7	94.7	94.5	93.4	92.3	94.5	95.4	94.9	95.1
n = 30	85.2	95.2	95.8	94.4	94.6	88.0	95.6	95.5	95.4	95.8	90.1	93.0	94.0	94.3	94.2

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E21

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X} = .10$ and $\rho_{I,Y} = .10$, and 50% Missing Data (True Value = 0.350)

Moderate correlation at level 2 (ρ_B = .35)

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
n = 5	95.4	94.4	94.2	94.9	93.8	95.8	93.7	93.1	94.1	92.5	93.9	92.6	93.6	93.4	93.5
n = 15	95.5	93.2	94.2	93.6	92.2	94.5	91.6	93.3	94.6	93.7	92.7	92.2	92.3	94.6	93.3
n = 30	93.9	93.5	93.0	93.2	93.8	93.7	93.7	94.1	93.4	93.5	93.8	94.6	93.4	94.4	93.1
K = 150															
n = 5	95.5	94.7	93.8	94.4	94.6	96.1	95.3	94.6	94.7	94.6	95.8	93.0	94.4	94.9	94.8
n = 15	94.8	93.8	93.3	95.5	94.5	94.3	94.0	94.7	94.8	94.3	94.9	94.4	94.5	95.0	95.2
n = 30	94.2	93.8	91.9	94.4	94.4	95.0	94.5	94.8	95.2	95.7	94.5	93.2	92.9	95.2	94.6

Large correlation at level 2 (ρ_B = .60)

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
K = 50															
n = 5	95.9	96.5	94.9	93.1	93.6	95.4	94.2	92.2	94.1	93.3	93.9	93.9	93.1	94.2	92.5
n = 15	94.8	94.5	94.8	93.6	94.3	94.5	93.9	94.1	94.4	93.8	92.7	93.3	92.5	93.3	93.4
n = 30	93.7	93.8	93.8	93.6	94.4	92.5	93.2	93.6	93.3	93.2	93.8	94.6	93.4	94.4	93.1
K = 150															
n = 5	95.0	93.4	94.6	95.7	94.2	93.5	93.1	93.4	94.5	94.4	94.4	93.7	94.0	94.9	95.4
n = 15	94.5	93.6	94.3	94.9	93.5	93.2	94.5	93.8	95.0	94.8	93.6	92.9	95.4	95.0	95.3
n = 30	90.1	94.3	94.9	95.0	94.5	90.0	93.6	93.8	94.6	93.6	93.0	94.0	93.0	94.9	94.7

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E22

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,x}$ = .30 and $\rho_{I,y}$ = .10, and 50% Missing Data (True Value = 0.397)

	MCAR (λ = 0)					MAR (λ = 0.4)					MAR (λ = 0.8)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35)															
K = 50															
n = 5	94.9	93.3	94.5	95.3	94.0	96.2	93.3	93.3	93.4	92.6	95.3	93.4	92.7	94.5	93.8
n = 15	92.7	92.6	94.0	93.5	93.6	91.0	93.4	93.1	93.7	93.7	94.9	93.3	93.0	95.4	94.2
n = 30	91.0	93.9	93.4	93.6	94.2	91.5	94.4	93.5	93.5	94.4	90.7	94.3	93.4	94.6	94.9
K = 150															
n = 5	94.2	93.0	93.1	93.8	94.1	95.4	94.1	95.3	94.9	94.7	95.1	93.3	93.8	94.5	94.4
n = 15	86.7	93.6	95.0	94.7	94.1	87.8	95.8	94.3	94.9	95.3	89.6	93.5	92.5	94.4	94.8
n = 30	77.9	91.5	91.8	95.1	94.1	76.7	93.4	93.6	94.2	94.3	83.2	92.0	93.3	93.9	93.6
Large correlation at level 2 (ρ_B = .60)															
K = 50															
n = 5	96.4	93.3	92.6	92.0	91.8	97.4	92.6	94.2	94.5	92.9	95.2	91.8	92.6	93.8	93.3
n = 15	96.4	94.7	94.0	94.7	93.9	96.3	93.4	94.6	94.3	94.1	94.1	93.1	92.8	93.3	93.2
n = 30	96.0	93.9	94.1	93.8	93.2	94.7	94.7	93.7	94.9	94.3	95.8	93.8	94.9	93.6	94.9
K = 150															
n = 5	97.4	95.8	95.3	96.1	95.8	96.6	93.1	92.4	93.6	94.9	95.1	94.8	94.0	94.2	93.8
n = 15	95.9	95.0	94.0	95.1	95.2	93.7	93.5	93.5	94.0	93.8	94.1	93.2	94.4	94.3	93.3
n = 30	95.6	94.3	95.3	94.9	95.2	94.3	94.7	94.3	94.9	94.9	94.8	93.5	93.4	95.5	94.0

Note. *K* = number of groups; *n* = group size; λ = effect of *X* on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E23

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}= .10$ and $\rho_{I,Y}= .30$, and 50% Missing Data (True Value = 0.309)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 ($\rho_B = .35$)															
K = 50															
n = 5	96.2	93.4	94.8	94.2	93.4	95.0	93.8	93.8	94.7	93.5	94.6	91.5	92.1	94.6	92.6
n = 15	93.6	94.9	93.9	93.3	94.0	94.6	94.4	93.9	94.7	94.2	95.0	93.8	94.0	94.7	93.6
n = 30	92.6	93.6	93.8	93.1	94.3	94.4	93.3	92.6	93.6	94.1	93.9	93.9	92.5	94.9	94.5
K = 150															
n = 5	95.0	93.9	93.7	95.2	95.1	95.2	93.9	94.4	94.2	94.8	95.8	93.1	94.6	94.8	94.4
n = 15	91.5	94.5	94.0	93.8	94.0	92.2	93.2	94.1	94.4	93.8	95.1	93.1	93.2	94.9	95.0
n = 30	89.8	96.1	95.3	94.4	96.1	91.5	93.7	94.0	94.3	93.9	93.3	93.5	94.1	94.8	95.0
Large correlation at level 2 ($\rho_B = .60$)															
K = 50															
n = 5	93.6	92.5	92.9	94.7	92.6	94.6	92.5	94.0	94.0	93.5	94.2	93.4	93.0	94.8	93.2
n = 15	88.7	92.2	91.9	93.6	93.1	89.5	94.6	93.5	95.3	94.0	91.4	92.1	92.5	93.5	93.0
n = 30	81.9	95.0	95.0	93.8	95.1	86.2	95.1	94.7	94.8	94.4	90.0	93.1	93.3	94.1	94.7
K = 150															
n = 5	90.5	92.7	92.6	93.9	93.9	90.9	93.1	94.3	93.2	94.5	91.6	93.6	93.1	95.3	94.8
n = 15	76.0	94.4	94.6	94.7	93.9	77.4	95.8	95.0	94.9	95.4	85.6	92.9	93.3	95.1	94.3
n = 30	56.2	94.5	94.7	95.1	95.0	60.4	92.6	92.9	94.3	93.8	78.2	92.5	92.6	94.8	94.8

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

Table E24

Coverage of the 95% Confidence Interval (in %) for the Estimator of the Within-Group Regression Coefficient (Y on X), Given Intraclass Correlations of $\rho_{I,X}$ = .30 and $\rho_{I,Y}$ = .30, and 50% Missing Data (True Value = 0.350)

	MCAR ($\lambda = 0$)					MAR ($\lambda = 0.4$)					MAR ($\lambda = 0.8$)				
	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD	NORM	DI	PAN	CD	LD
Moderate correlation at level 2 (ρ_B = .35)															
K = 50															
n = 5	97.4	93.2	94.9	93.9	93.8	95.8	93.2	93.2	93.1	93.2	96.3	93.1	93.5	94.4	93.1
n = 15	94.5	95.4	95.6	94.1	94.0	95.3	94.6	94.5	95.1	94.5	94.7	93.5	94.5	92.8	94.0
n = 30	95.6	94.9	94.6	94.4	94.6	94.3	93.1	93.9	93.9	93.2	94.1	93.1	93.8	94.0	95.1
K = 150															
n = 5	97.8	94.3	94.2	94.0	94.4	96.7	93.9	93.9	94.6	94.1	97.0	93.4	94.2	94.0	94.6
n = 15	95.0	92.5	94.6	94.5	94.2	95.8	94.0	92.9	94.5	94.7	96.5	95.4	94.4	95.4	94.6
n = 30	95.2	93.0	93.2	93.7	93.8	95.2	94.0	94.5	95.6	95.6	94.5	93.3	92.8	94.6	94.4
Large correlation at level 2 (ρ_B = .60)															
K = 50															
n = 5	94.3	92.8	93.2	94.1	92.2	95.4	92.8	93.5	93.0	92.5	95.3	92.9	93.8	93.6	92.2
n = 15	90.3	95.3	93.9	94.7	94.0	91.8	93.9	94.7	93.8	94.1	92.8	92.8	92.9	95.0	93.6
n = 30	83.6	93.6	94.4	94.2	94.0	85.0	95.0	94.3	93.6	94.4	88.2	95.0	94.4	93.4	93.2
K = 150															
n = 5	91.5	93.2	93.3	94.6	94.6	93.2	93.2	92.9	94.3	94.4	92.8	93.5	92.2	94.8	94.8
n = 15	81.4	94.4	95.1	94.9	95.0	83.2	93.9	94.0	95.0	94.7	84.2	92.5	92.6	95.1	94.9
n = 30	64.1	94.2	94.4	93.9	94.9	66.3	94.5	93.1	94.4	95.4	75.4	93.4	92.2	94.6	94.7

Note. K = number of groups; n = group size; λ = effect of X on missingness; NORM = normal model imputation; DI = dummy-indicator approach; PAN = two-level imputation; CD = complete data; LD = listwise deletion.

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