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Effects of including versus excluding nonparticipants as potential nominees in peer nomination measures

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Abstract

In peer nomination research, individuals who do not provide nominations (nonparticipants) are often included on rosters as potential nominees. This can present ethical questions regarding informed consent, but psychometric consequences of excluding nonparticipants from rosters are unknown. In this investigation, Study 1 simulated both random and systematic missingness with a sample of 1,630 Dutch adolescents, comparing the reliability and correlation matrices of nomination measures when nonparticipants were included and excluded as nominees. Study 2 began with a two-school sample that already included systematic nonparticipation (≈19% missingness among 599 7th grade nominees) and examined how findings would differ if students who had not provided nominations were excluded as nominees. Results showed that the impact of including versus excluding nonparticipants as nominees may vary depending on the type of missingness (Study 1) or in different peer groups (Study 2). Both studies demonstrated that the choice of including versus excluding nonparticipants *can* affect reliability and intercorrelations in peer nomination data, and provide some evidence that excluding nonparticipants as nominees may compromise peer nomination data quality.

Keywords

Peer nominations, sociometric methods, missing data

Participant missingness is a concern for peer nomination research. Missing nominators result in less data for the nominees; each missing nominator is analogous to dropping one binary item from a questionnaire. If nonparticipation is completely random, missingness reduces nomination measure reliabilities (Marks, Babcock, Cillessen, & Crick, 2013). Unfortunately, peer nomination nonparticipation is often not completely random (e.g. Fournier, 2009; Noll, Zeller, Vannatta, Bukowski, & Davies, 1997), thus potentially affecting the reliability and validity of nominations (Babcock, Marks, van den Berg, & Cillessen, 2018).

Research on the effects of peer nomination nonparticipation is sparse and based almost entirely on simulation studies, given that experimental control of participant missingness is nearly impossible. Early analyses by Crick and Ladd (1989) and Hamilton, Fuchs, Fuchs, and Roberts (2000) recalculated sociometric scores after randomly removing subsets of nominators; both studies demonstrated that higher nomination rates resulted in more reliable scores.

More recently, our research team has built upon these studies, exploring the effects of missingness on peer nominations. We first assessed the effects of completely random missingness on the internal reliability of nominations (Marks et al., 2013). Internal reliability dropped curvilinearly as missingness increased, with reliability declines being more pronounced with greater missingness. The rate of decline varied across variables (e.g. popularity was more robust than acceptance). More recently (Babcock et al., 2018), we investigated the effects of systematic missingness on peer nomination measures by systematically removing certain nominators (e.g. least popular, least preferred). This is described in the missingness framework as missing at random (MAR), as opposed to missing completely at random (MCAR) or missing not at random (MNAR). The missingness was systematic, yet nominations received by missing nominators were still included. Systematic nominator removal affected correlations between nomination variables, even when missingness was low. Removal based on popularity had larger effects than removal based on social preference, indicating that missingness effects vary depending on the types of missing nominators.

It is useful to note the missingness types as they apply to peer nominations. MCAR is not driven by any systematic mechanism. If a study randomly selected schoolmates to participate, those not participating would be MCAR. MAR is driven by a systematic mechanism, though that mechanism does not involve the variable of interest. If students higher in self-reported depression were less likely to participate in a study, but the study was about self-reported extraversion, the missingness is MAR. In peer nominations, missing nominators are generally MAR. Suppose that we are studying popularity, and people low in popularity are less likely to participate. The popularity nominations a missing person would have

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given are not driving the missingness; *the missingness driver is measured by the nominations received, not given*. Their nominations received from others are still available. If we excluded those same people from *receiving* popularity nominations, then the missing data are a measure of the missingness driver, making it MNAR. For further examples, see Schafer and Graham (2002).

Both Marks et al (2013) and Babcock et al (2018) assumed that missing nominators would remain nominees. In practice, this is often the case. Generally, rosters of nominees include all classmates or grademates, even those not participating as nominators. However, including missing nominators as nominees may mean that data are collected about youths who did not receive parental consent to participate. School administrators or review boards may request that youths without consent to nominate also be excluded as nominees, but removing nominees from the roster violates a basic principle of sociometric research – that measurements are only valid when collected within a complete and self-contained reference group (Bronfenbrenner, 1943; Moreno, 1934). Therefore, it is important to understand the effects of excluding nominees on peer nomination data so that informed decisions can be made about the best course of action.

The goal of this investigation was to assess the impact of including versus excluding nonparticipants as potential nominees in peer nomination research. Study 1 simulated both random (MCAR) and systematic missingness (MAR: excluding nominators; MNAR: excluding nominators and nominees) and compared the reliability and correlation matrices of nomination measures. Study 2 began with a large dataset that may already have MAR and examined how the data would differ if nonparticipants were also excluded as nominees. Study 1 was a controlled comparison of missingness types, whereas Study 2 was a "real world" example in which missingness occurred naturally.

Terminology: Defining *Participants*

The term "nonparticipants" is ambiguous when discussing missingness in peer nomination research. Our previous research noted that a classical measurement approach to data analysis treats nominators as items and nominees as participants (Marks et al., 2013). In the current study, however, we use the term "participants" interchangeably with "nominators" to refer to youths providing peer nominations and "nonparticipants" to refer to youths not providing peer nominations. We believe this terminology provides optimal clarity.

Study 1

Study 1 extended the Babcock et al. (2018) study. We began with a high participation rate dataset, then simulated either random or systematic participant removal. The previous study determined that correlations between nomination variables differed depending on whether nominator removal was random (MCAR) or systematic (MAR). The goal of the current study was to compare correlations across conditions in which individuals removed as participants were included or excluded as nominees. Additionally, we compared reliability estimates of nominations when including and excluding nominees.

Method

Sample. We used the same dataset as Babcock et al. (2018). Data were collected from 1,630 Dutch adolescents in 32 7th grade and 31 8th grade classrooms ($M_{\text{ClassSize}} = 26.45$, $SD_{\text{ClassSize}} = 3.54$; 50.4% male, 96.2% native Dutch) as part of the seventh wave of the Nijmegen Longitudinal Study on Infant and Child Development (van den Berg, Burk, & Cillessen, 2015).

As a result of school policies (approved by the Institutional Review Board), a passive consent procedure was used for recruitment. A total of 116 students were absent during data collection or treated as missing because they provided no nominations; two additional students did not receive consent. The final sample included 1,512 participants (92.8% of the total sample). All students in the participating classrooms, including nonparticipants, were potential nominees. Participants differed significantly from nonparticipants on two of the sociometric constructs described below – nonparticipants scored lower on social preference and higher on relational aggression ($p < .01$).

Measures and Procedure. Peer nominations were completed on netbook computers. Participants were presented with each item, followed by a classmate roster, and could click on any number of peers of either sex. The names were randomized for each participant.

The current study analyzed data from items measuring popularity (*most popular*, *least popular*), social preference (*like most*, *like least*), friendship (*number one best friend*, *other best friends*), overt aggression (3 items), relational aggression (2 items), overt victimization (3 items), relational victimization (2 items), and prosocial behavior (3 items). See Babcock et al. (2018) for sample item wordings.

Raw popularity and social preference scores were calculated by oppositely keying negative items (*least popular*, *like least*) from the corresponding positive items (*most popular*, *like most*). All other raw scores were calculated by adding nominations across items. Raw scores were z-score transformed within classrooms.

Missingness Simulation. This simulation removed participants either randomly or systematically, creating several types of missingness. Conditions in which we removed nominators or nominees completely at random (MCAR) were for baseline comparisons. Removing participants systematically created MAR (systematically removing nominators) and MNAR (systematically removing nominees) conditions to gauge the effects of these patterns of missingness. For MCAR, we randomly removed 20% of participants as nominators. This rate was based on Babcock et al. (2018), in which missingness rates of 20% were enough to meaningfully affect correlations between nomination scores. After calculating the relevant statistics, we additionally eliminated the randomly drawn 20% as nominees and calculated the same statistics. We conducted 3,000 replications to obtain a MCAR effect distribution.

The systematic missingness simulations used four removal conditions: removing the 20% most popular students, removing the 20% least popular students, removing the 20% most preferred students, and removing the 20% least preferred students.[1] We intentionally created extreme missingness conditions to examine the range of missingness effects. For each case, we removed 20% of the relevant students' nominations (MAR) and calculated intercorrelations and reliability estimates (Cronbach, 1951). We then

Table 1. Study 1 Absolute Differences in *r* Following Different Types of Simulated Participant Removal.

Conditions Under Comparison	Absolute Differences in *r*-values Between Conditions				
Type of Missingness	*M*	(*SD*)	Max.	*N* outside CI[a]	$N \geq .10$[b]
Inclusion (MAR) vs. Exclusion (MNAR)					
Random Removal	.01	(.00)	.02	NA	0
Most Popular Removed	.10	(.07)	.28	21	10
Least Popular Removed	.18	(.12)	.43	25	21
Most Preferred Removed	.04	(.03)	.11	7	1
Least Preferred Removed	.13	(.09)	.31	23	15
Inclusion (MAR) vs. Full Sample					
Random Removal	.01	(.01)	.04	NA	0
Most Popular Removed	.07	(.08)	.28	NA	8
Least Popular Removed	.04	(.04)	.13	NA	5
Most Preferred Removed	.03	(.02)	.08	NA	0
Least Preferred Removed	.02	(.01)	.06	NA	0
Exclusion (MNAR) vs. Full Sample					
Random Removal	.01	(.01)	.03	NA	0
Most Popular Removed	.09	(.08)	.28	NA	9
Least Popular Removed	.15	(.12)	.45	NA	15
Most Preferred Removed	.04	(.04)	.14	NA	4
Least Preferred Removed	.13	(.09)	.32	NA	15

Note. Full sample included 1,512 participants and 1,630 nominees. Each simulated removal condition involved removing 20% of participants as nominators.
[a]Number of correlations (out of 28) outside of the bootstrapped 99% confidence interval for MAR vs. MNAR conditions.
[b]Number of correlations (out of 28) that differed by more than .10 across the two conditions.

removed the students as nominees (MNAR), recalculating the same statistics.

Significance Tests for MNAR: Randomly Removing Nominees. To test for statistical significance when removing nominees, we created bootstrapped confidence intervals for reliabilities and for intercorrelations. This process centered around having the same systematically missing nominees still missing as nominators but randomly removing 20% of nominees from the dataset's participants (MAR nominators with MCAR nominees, 3,000 replications, 99% confidence interval). This allowed us to determine the effects of systematically removing nominees above and beyond random nominee removal given that there are systematically removed nominators. Although this is not a direct significance test for the MNAR condition, it was a conservative substitute that did not violate the statistical test's assumptions. In most cases, the means of the bootstrapped distribution of reliability estimates were close but slightly lower than the estimate when including nominees. The exception was friendship, for which bootstrapped distributions varied widely. Concerning intercorrelations, the means based on the bootstrapped distribution were extremely close to the correlations with systematically missing nominees but no missing nominators (mean difference of -.01 across 28 correlation coefficients, maximum absolute difference of .028).

Results

Internal Reliability. Cronbach's α for each individual variable was calculated within each classroom using the "pasting" procedure described by Babcock, Marks, Crick, and Cillessen (2014), and then averaged across classrooms. The pasting procedure involves simply concatenating the 1/0 nomination matrices for related nomination items such that each row corresponds to the same nominee and then using the typical formula to calculate α (Cronbach, 1951). The statistics below were calculated across variables after taking the average across classrooms within each variable.

Under completely random nonparticipation, there was minimal change in α when nonparticipants were included versus excluded as nominees; the average difference in α across variables was .02 ($SD_{\Delta\alpha} = .02$, $\text{range}_{\Delta\alpha} = -.01$ to .05). Under MAR, inclusion or exclusion of nonparticipants as nominees also resulted in very small changes in α when the most popular participants ($M_{\Delta\alpha} = .01$, $SD_{\Delta\alpha} = .03$, $\text{range}_{\Delta\alpha} = -.04$ to .07) or the most preferred participants ($M_{\Delta\alpha} = .03$, $SD_{\Delta\alpha} = .03$, $\text{range}_{\Delta\alpha} = .00$ to .09) were removed.

However, internal reliabilities were markedly lower under MNAR when the least popular participants ($M_{\Delta\alpha} = -.13$, $SD_{\Delta\alpha} = .17$, $\text{range}_{\Delta\alpha} = -.48$ to .02) or the least preferred participants ($M_{\Delta\alpha} = -.13$, $SD_{\Delta\alpha} = .15$, $\text{range}_{\Delta\alpha} = -.38$ to .00) were also removed as nominees. The largest differences occurred for the internal reliabilities of friendship, social preference, and both types of victimization. The alpha reductions from MAR to MNAR were statistically significant (using the bootstrapped confidence intervals) for these variables and for popularity. Inclusion or exclusion of nominees had a minimal impact on reliability estimates for prosocial behavior and both types of aggression; the largest absolute change in α between inclusion/exclusion for these three variables was .04.

Intercorrelations. Correlations were computed between the eight peer nomination variables for both conditions (missing participants included vs. excluded as nominees) under each of the five types of missingness (random and the four systematic methods). The eight constructs yielded 28 correlations per case. Table 1 summarizes the absolute differences between the correlations for inclusion versus exclusion.

When nonparticipation was MCAR, differences were small between inclusion and exclusion of nonparticipants as nominees. As Table 1 shows ("Inclusion vs. Exclusion Condition" section),

Table 2. Study 1 Intercorrelations Between Nomination Variables with Nonparticipants Either Included (below diagonal) or Excluded (above diagonal) as Nominees Following Removal of Least Popular or Least Preferred Participants.

	Friendship	Popularity	Social Preference	Overt Aggression	Relational Aggression	Prosocial Behavior	Overt Victimization	Relational Victimization
20% Least Popular Participants Removed								
Friendship	-	***.39***	***.61***	***-.02***	***.02***	***.42***	***-.22***	***-.36***
Popularity	.66	-	***.18***	***.43***	***.56***	***.40***	***-.15***	***-.30***
Social Preference	.74	.55	-	***-.37***	***-.27***	***.43***	***-.33***	***-.39***
Overt Aggression	.05	.33	-.26	-	.54	-.06	***.32***	***.02***
Relational Aggression	.16	.50	-.09	.55	-	.14	***.04***	***.03***
Prosocial Behavior	.55	.52	.56	-.04	.17	-	***-.24***	***-.19***
Overt Victimization	-.48	-.58	-.63	.10	-.11	-.39	-	***.48***
Relational Victimization	-.58	-.68	-.65	-.03	-.13	-.39	.88	-
20% Least Preferred Participants Removed								
Friendship	-	***.44***	***.64***	***.05***	.11	***.44***	***-.24***	***-.40***
Popularity	.56	-	***.29***	***.46***	***.56***	***.36***	***-.30***	***-.51***
Social Preference	.72	.47	-	***-.19***	***-.08***	***.48***	***-.28***	***-.37***
Overt Aggression	-.02	.33	-.34	-	***.49***	-.06	***.17***	***-.12***
Relational Aggression	.07	.50	-.17	.57	-	.14	-.10	-.14
Prosocial Behavior	.54	.48	.55	-.06	.13	-	***-.24***	***-.22***
Overt Victimization	-.46	-.59	-.59	.11	-.11	-.38	-	***.56***
Relational Victimization	-.54	-.69	-.63	-.02	-.13	-.37	.88	-

Note. Full sample included 1,512 participants and 1,630 nominees.
Values below the diagonal included the removed participants as nominees; values above the diagonal excluded removed participants as nominees. Bold and italicized values (above diagonal only) were significantly different than random nominee removal. Underlined values indicate differences of .10 or greater than comparison group (below diagonal: difference from no nominators removed; above diagonal: difference from nominators but no nominees removed).

the absolute difference between conditions across the 28 correlations averaged .01. Differences were larger with MAR and MNAR but varied across the missingness types. The largest correlation differences for inclusion versus exclusion conditions occurred when the least popular adolescents were removed (.43; see Table 2).

Table 1 also summarizes the differences between the correlations based on the full sample and each condition ("Inclusion (MAR) vs. Full Sample" and "Exclusion (MNAR) vs. Full Sample"). Correlations were more strongly affected when removed participants were excluded as nominees than when they were included, particularly when they were least popular or least preferred. Over half of those correlations differed by.10 or more, and 23 of 28 correlations differed significantly from random nominee removal.

Discussion

Study 1 investigated differences between inclusion and exclusion of nonparticipants as nominees by simulating 20% removal of participants randomly or systematically. When simulated nonparticipation was MCAR, inclusion or exclusion of nominees made little difference for the reliability of or the correlations between variables. When simulated nonparticipation was systematic, however, the measurement quality of peer nominations was lower when excluding nonparticipants as nominees (MNAR) than when including them (MAR). This was particularly the case when removing the least popular and least preferred participants. Similarly, when the least popular or preferred participants were removed, reliabilities were much lower when missing participants were excluded as nominees.

Study 1 indicated that excluding nonparticipants as nominees can have a substantial negative effect on the study of peer nomination constructs. It is interesting that this effect was largest when the least popular and least preferred participants were missing, as these are the exact students who are least likely to participate in peer nomination and other school-based research (Detty, 2013; Noll et al., 1997).

The simulation of missingness in this study was a strength and a weakness. Simulating nonparticipation made it possible to compare the effects of missingness when including versus excluding nonparticipants as nominees and allowed us to use the full sample nominations for comparison. However, more control meant less external validity. The amount of missingness simulated in this study was realistic (20% of initial nominators or 26% of total nominees), but such extreme systematic missingness is improbable in real data.

Study 2

Given the simulated nature of missingness in Study 1, Study 2 investigated the difference between including versus excluding nonparticipants as nominees in a dataset that already had nonparticipation. The dataset included two large samples with similarities in nonparticipation levels but differences in the extent to which nonparticipation may have been systematic.

Method

Sample. A total of 599 7th grade students across two middle schools were part of a larger longitudinal study of peer relationships in the northeastern United States. Some 51.5% of the sample was male and 70.4% was white (17.9% black/African American, 10.52% Hispanic/Latino). The schools requested (and the Institutional Review Board approved) a passive consent procedure for recruitment. Approximately 1% of adolescents were excluded by parental request; other

Table 3. Study 2 Intercorrelations Between Nomination Variables with Nonparticipants Either Included (below diagonal) or Excluded (above diagonal) as Nominees Across Each School.

	Friendship	Popularity	Social Preference	Overt Aggression	Relational Aggression	Prosocial Behavior	Overt Victimization	Relational Victimization
School 1								
Friendship	-	.72	.69	.06	.46	.68	-.17	-.12
Popularity	.71	-	.65	.10	.63	.65	-.45	-.33
Social Preference	.68	.59	-	***-.22***	.13	.61	-.51	-.47
Overt Aggression	.04	.14	-.33	-	.55	-.19	.15	.22
Relational Aggression	.43	.62	.05	.60	-	.35	.04	.21
Prosocial Behavior	.70	.65	.61	-.18	.30	-	-.18	-.12
Overt Victimization	-.19	-.45	-.51	.14	.04	-.18	-	.92
Relational Victimization	-.11	-.32	-.45	.20	.21	-.11	.91	-
School 2								
Friendship	-	.64	.74	.30	.44	.52	***-.32***	-.10
Popularity	.63	-	.57	.26	.60	.59	-.36	***-.03***
Social Preference	.74	.62	-	-.07	.07	.49	-.47	***-.35***
Overt Aggression	.25	.24	-.10	-	.68	-.04	.10	.18
Relational Aggression	.44	.57	.08	.67	-	.28	-.01	***.34***
Prosocial Behavior	.55	.54	.49	-.04	.32	-	***-.26***	.04
Overt Victimization	-.27	-.49	-.51	.07	-.01	-.15	-	***.63***
Relational Victimization	-.16	-.37	-.46	.08	.15	-.01	.89	-

Note. School 1 included 227 participants and 282 nominees. School 2 included 256 participants and 317 nominees.
p-values $\geq .12$ are statistically significant at the traditional alpha level ($p < .05$) in both schools.
Values below the diagonal indicate raw correlations based on data collected, in which nonparticipants (i.e., individuals who did not provide peer nominations) were included as nominees. Values above the diagonal excluded nonparticipants as nominees.
Bold and italicized values (above diagonal only) were significantly different than random removal of nominees. Underlined values indicate differences of .10 or greater between excluding versus including nominees.

reasons for missingness included school absence, failure to nominate any peers on relevant items, or lack of participant assent. Ultimately, 19.5% of students in School 1 (55 out of 282) and 19.2% of students in School 2 (61 out of 317) were nonparticipants. Students who did not participate were included on sociometric rosters.

Measures and Procedure. Peer nominations were completed using pencil-and-paper packets. Each page included an item and a list of all same-grade students. Each item asked participants to circle an unlimited number of same-grade peers. The current analyses focused on the same eight constructs as Study 1: friendship (1 item), popularity (*most popular* minus *least popular*), social preference (*like most* minus *like least*), overt aggression (1 item), relational aggression (2 items, summed), overt victimization (2 items, summed), relational victimization (2 items, summed), and prosocial behavior (2 items, summed). See Marks, Babcock, and Cillessen (2015) for specific item wordings.

We simulated exclusion of nonparticipants as nominees by selecting students who had not provided any nominations and then excluding them from the reliability and correlation calculations.

Significance Tests: Removal of Nominees. We conducted the same bootstrapped significance tests as in Study 1; that is, we created a 99% confidence interval around reliability estimates and intercorrelations by resampling random nominee removal in the same proportion that nominators were missing in each school. The means of the bootstrapped distributions of reliability coefficients were the same as the full sample (nominators systematically removed but not nominees) in all cases to two decimals. The mean of the bootstrapped correlations were almost identical to the "nominees in" dataset, with no difference exceeding .01.

Comparing Participants and Nonparticipants. We conducted independent samples t-tests ($\alpha < .01$) by school comparing nominations received between participants and nonparticipants. School 1 nonparticipants received fewer friendship nominations ($t = 3.32$). School 2 nonparticipants scored lower on friendship ($t = 4.80$), preference ($t = 4.06$), and prosocial behavior ($t = 3.64$).

Results

Reliability Estimates. We calculated Cronbach's α for each peer nomination composite measure within each school under conditions in which (a) nonparticipants were included as nominees, and (b) nonparticipants were excluded as nominees (see Babcock, Marks, Crick, & Cillessen, 2014).

School 1 results demonstrated few α differences under inclusion versus exclusion conditions. Across variables, absolute differences in αs ranged from .00 to .04. The reliability drop for overt aggression (difference of .04) was the only change significantly different from random nominee removal.

School 2 reliability was higher when nonparticipants were included as nominees for overt victimization ($\alpha = .95$ vs. .83) and relational victimization ($\alpha = .92$ vs. .73). These large reliability drops were significantly different from random nominee removal. For other variables, inclusion/exclusion did not affect α much (differences ranged from .00 to .03).

Intercorrelations. Correlations between peer nomination variables were calculated by school under conditions in which (a) nonparticipants were included as nominees and (b) nonparticipants were excluded as nominees (see Table 3). In School 1, most correlations did not vary substantially between conditions. The mean absolute

change in *r* between including versus excluding nonparticipants as nominees was .03. Only the correlation between overt aggression and social preference differed by .10 or greater; this was the only statistically significant correlation difference.

In School 2, correlations were more affected by condition. The mean absolute change in *r* between including versus excluding nonparticipants as nominees was .06. Six correlations differed by at least .10; the largest difference was .34 (relational aggression/relational victimization). Six correlations were statistically different from completely random nominee removal. The correlations that were most affected involved victimization.

Discussion

Study 2 replicated the results of Study 1 with data from two schools with 19% participant missingness to show that internal reliability of and correlations between peer nomination measures can be affected by including versus excluding nonparticipants as nominees. Excluding missing students as nominees had little impact for one school; it had a sizable impact for the other school. Over 20% of the correlations in School 2 differed by .10 or more between including versus excluding nonparticipants as nominees. These results indicate that the negative impact nominee exclusion is not limited to simulation but can happen with real data.

Although substantive explanations fall outside of our methodological goals, the fact that victimization was consistently affected by the inclusion vs. exclusion of nonparticipants in School 2 is worth highlighting, particularly given that participants and nonparticipants did not differ by victimization in this sample. The lower reliabilities of both victimization variables in the exclusion condition may have affected intercorrelations, but it is also possible that the pattern of nominations received by the nonparticipants (who were lower in friendship, social preference, and prosocial behavior than participants) impacted the associations between victimization and other variables. Further research should examine the patterns of nominations received by students low in positive constructs such as friendship, preference, and prosocial behavior to see if there is a statistical reason for the change in victimization reliability and intercorrelations (e.g. decrease in victimization variation; exclusion of high-leverage points for victimization).

The primary limitation of Study 2 was that, because we did not simulate missingness, we have no indication of the "full sample" statistics. We can compare the inclusion and exclusion conditions, but we cannot compare each condition to complete data. It is likely that the inclusion condition is providing more accurate results than the exclusion condition, given that (a) the exclusion condition uses less data, (b) inclusion of nonparticipants as nominees is a general requirement of peer nomination measurement, and (c) the results of Study 1 indicated that including nonparticipants as nominees provided results that were closer to the full sample.

General Discussion

Except in rare instances of 100% participation, each peer nomination study will require a decision regarding the treatment of nonparticipants. Whether to include or exclude nonparticipants as nominees may seem a minor methodological decision but has not been studied before. Historically, inclusion of nonparticipants has been the default decision and a fundamental requirement for valid peer nomination measures (Bronfenbrenner, 1943; Moreno, 1934). Unfortunately, inclusion of nonparticipants raises ethical concerns (see Mayeux, Underwood, & Risser, 2007).

We investigated two separate datasets, showing that the choice of including or excluding nonparticipants as nominees *can* affect psychometric properties of peer nominations. The effects varied between studies; differences between inclusion and exclusion were greater for certain types of missingness in Study 1 and greater in one school versus another in Study 2. Study 1 also indicated that, when the inclusion and exclusion conditions differed noticeably, exclusion consistently yielded lower reliability and different correlations than inclusion.

From a psychometric perspective, our results indicate that nonparticipants should be included as potential nominees. Although exclusion of nonparticipants did not always detract from data quality, it was likely to do so under conditions that are most probable in real-world situations; that is, when nonparticipants differ in status and peer preference from participants (Noll et al., 1997). Excluding nonparticipants as potential nominees removes the ability to test for systematic differences between participants and nonparticipants. Even if nonparticipants can be excluded as nominees without consequence when nonparticipation is completely random, the very exclusion of nonparticipants as nominees makes it impossible to demonstrate that nonparticipation is random.

If our findings are representative of the research literature more generally, the fact that excluding low-status peers as nominees resulted in the greatest reduction in reliability and change in intercorrelations is concerning. Many peer relationships studies focus on youths who are rejected or unpopular, and they are least likely to participate in school-based research. Our findings highlight the importance of properly representing low-status or marginalized youths and, more generally, in maximizing participation rates with peer nominations. Our study used two large samples and investigated relatively low levels of missingness; however, because previous studies have shown that higher levels of nonparticipation are associated with greater reductions in reliability (Marks et al., 2013) and internal validity (Babcock et al., 2018) of nomination measures, we expect that higher nonparticipation rates will result in even larger differences between including and excluding nonparticipants on rosters. Although the literature on practical solutions is sparse, Mayeux and Kraft (2017) recently suggested several strategies to deal with logistical hurdles (like low consent/participation rates) in peer nomination research.

Limitations

Although only one of our studies involved simulation of participant missingness, both involved simulating the exclusion of nonparticipants from rosters. When participants chose nominees, all peers were available on the roster; removal of choices happened post hoc. Nominations may have been different if nonparticipants were excluded from the rosters before data collection. While a key limitation, it is difficult to think of a methodologically sound way to test this issue without simulating roster exclusion.

Additionally, there is currently no theoretical reason to believe that excluding nonparticipating peers from rosters would result in *less* error. The foundation of peer nominations is that nominators are comparing nominees to all other peers within a natural and closed social system (Cillessen & Marks, 2017; Moreno, 1934). Providing participants with a non-random peer subgroup fundamentally changes the nature of their choices. For example, it is

difficult to predict how participants might react to naming peers they dislike when the most rejected peers are excluded from consideration. Some may choose fewer peers, which means losing valuable peer group data. Others may name the same number of less-disliked peers, in which case the sample distribution of rejection nominations is biased. Regardless, the result is increased error and decreased accuracy.

Another limitation of this investigation was that, due to at times double- and triple-layered non-statistical independence, it was not possible to conduct traditional significance tests of differences between inclusion and exclusion. Our conclusions are based on bootstrapped distributions comparing randomly missing nominees to systematically missing nominees, which is not quite the same as comparing systematically missing nominees to no missing nominees. Future research might explore different data structures or new statistical tests to account for the multiple layers of dependency of our current study.

Research Ethics

This study focused on the psychometric impact of including versus excluding nonparticipants as nominees in peer nomination research; however, there is also an ethical impact to collecting data about individuals not participating in a study. We were fortunate to have two datasets collected using passive consent procedures. Only a small handful of students failed to participate because their parents actively withheld consent, and we acknowledge that these parents may not have realized that secondary data were being collected on their children anyway. Most "nonparticipants" who served as nominees, however, were either absent for data collection or did not provide any nominations. In an active consent procedure, the participation rates would be lower and a larger proportion of participant missingness would have been due to lack of parental consent.

Treating individuals without consent to participate in a study (particularly those who have been actively denied consent) as nominees in peer nomination measures results in identifiable data collection for them. This could be a violation of a key principle of informed consent in behavioral research. However, the violation of this principle does not, in-and-of-itself, cause a research methodology to be unethical. Previous research has indicated that the risks of being involved in sociometric research are no greater than risks faced by children and adolescents in everyday life (Mayeux et al., 2007), and the benefits of peer nomination research are substantial. Peer measurements provide a unique perspective on social behaviors among adolescents (particularly behaviors hidden from teachers or observers, such as relational aggression) and are irreplaceable to assess affective and status variables like friendship, social preference, and popularity (Cillessen & Marks, 2017). Moreover, sociometric data can play an important role in solving school problems (bullying prevention, identifying at-risk students, etc.).

The possible deviation from principles of informed consent is a cost that cannot be ignored. This cost, however, should be weighed against the benefits of collecting data on social status, relationships, and behaviors that other methods cannot measure. If strictly maintaining informed consent (i.e. excluding nonparticipants as nominees) undermines the quality of peer nomination data, then invalid measurements will be the cost of avoiding the ethical conflict.

Ultimately, we recommend that researchers take a holistic approach to the cost/benefit analysis inherent in peer nomination research and consider psychometric and theoretical concerns alongside ethical ones. Our investigation presented information relevant to this cost/benefit analysis by quantitatively assessing the differences between including and excluding nonparticipants as nominees. Two studies showed that data quality can be negatively affected by the choice of whether nonparticipants are included as nominees. We hope that this research will spark further discussion and investigation of peer nomination methodology and of the intersection between methodology and ethics in social developmental research.

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Note

1. As in Babcock et al. (2018), this study simulated systematic missingness based on popularity and preference because the variables are commonly assessed in peer nomination research and because other researchers (e.g. Detty, 2013; Noll et al., 1997) have noted that nonparticipants often differ in status and liking.

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