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A Social–Ecological Model of Preschoolers' Aggressive Behavior: An Exploratory Analysis

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Abstract

Understanding classroom-level correlates of preschool children's aggressive behavior is critical to identifying multiple avenues for intervention within schools. The present school-based study evaluated the reliability and validity of a classroom-level measure of physical and relational aggression and examined a social–ecological model to test whether individual variables (i.e., temperament), dyadic peer factors (i.e., peer victimization, the number of a child's play partners), and classroom-level aggression were associated with individual aggression. Observations of play partners and teacher reports of temperament (i.e., daring, prosociality, and negative emotionality), peer victimization (i.e., physical and relational victimization), and classroom aggression were collected in a sample of preschoolers (N = 307; M_{age} = 48.99 months, SD = 7.51). Observer reports of aggression were used to create aggression severity and directionality scores, reflecting the overall level of aggression a child displays and their propensity to use physical relative to relational aggression, respectively. There was evidence to support the reliability and validity of the classroom-level aggression measure providing initial support that this measure could be used by school psychologists. A multilevel regression model indicated that higher levels of negative emotionality, daring, and a greater number of play partners were associated with higher levels of aggression severity. Children in classrooms with more relational aggression were more likely to use relational instead of physical aggression. These findings demonstrate the importance for school psychologists to account for multiple levels of influence when examining preschoolers' aggression.

Keywords

classroom aggression; preschool; temperament; relational aggression; physical aggression

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Ecological models emphasize the importance of interactions between individuals and the proximal and distal environments in which they reside (Swearer & Hymel, 2015). Classroom aggression, a broad environmental factor, may serve as an important correlate of preschool children's aggressive behavior. In classrooms where aggression is prevalent, children may model this behavior regardless of whether they experience victimization (Kuppens et al., 2008). However, limited research has investigated these processes in the preschool period, and it is unclear whether classroom aggression effects persist when controlling for both individual- and dyadic-level factors, such as temperament and peer victimization (e.g., Kuppens et al., 2008; Müller et al., 2016; Thomas et al., 2011). This research gap is unfortunate, as work in this area has the potential to inform interventions to reduce aggression before children reach formal schooling. School psychologists regularly assess and intervene on aggressive behavior. Tools to accurately and quickly assess classroom-level predictors of aggressive behavior are needed to better understand the multitude of factors contributing to a child's aggression. To the best of our knowledge, there are no measures assessing classroom-level relational and physical aggression for preschoolers. Therefore, the present study evaluated the reliability and validity of a classroom measure of relational and physical aggression. Second, we examined a social–ecological model of aggressive behavior, by testing whether individual factors (i.e., temperament), dyadic peer variables (i.e., peer victimization and the number of play partners), and classroom-level aggression were related to individual-level aggression to better understand how predictors at various levels are associated with aggressive behavior.

Aggression is defined as behavior with the intent to hurt, harm, or injure another person (Malti & Rubin, 2018), and children and adults with a higher frequency or severity of aggressive behavior are at risk for a number of negative outcomes (Malti & Rubin, 2018). In addition to severity, aggression may also be distinguished by forms. Two commonly studied forms of aggression are physical aggression (i.e., the intent to harm through physical means or threat of physical harm) and relational aggression (i.e., the intent to harm using the relationship as the vehicle of harm; Swit & Slater, 2021). Preschool is a unique time for the development of aggressive behavior. Relational aggression has been reliably observed around 30 months, and a wealth of research has examined relational aggression during early childhood (e.g., 106 articles examined relational aggression for children 0–8 years of age; for a review, see Swit & Slater, 2021). Relational aggression has been theorized to increase as children get older, and peaks in early adolescence (Crick et al., 2006; Fite & Pederson, 2018) and physical aggression peaks in toddlerhood, is common in preschool, and substantially decreases by middle childhood (Tremblay, 2000; Vitaro & Brendgen, 2011). Children who demonstrate higher levels of aggressive behavior as they leave preschool are at a risk for a number of negative outcomes, such as peer, academic, and psychological difficulties (Early Child Care Research Network, 2004). Therefore, it is critical to identify the correlates of aggression in early childhood, when physical aggression is still relatively normative and relational aggression is first emerging, to identify potential prevention targets before children transition to middle childhood and there is less malleability in aggressive behavior. To capture both facets of aggression, we used a severity and directionality technique (Park et al., 2005) to generate an aggression severity score (i.e., regardless of type, how aggressive is this child) and an aggression directionality score (i.e., whether a

child is more likely to use physical or relational aggression). Prior research suggests the use of directionality and severity scores reduces collinearity among constructs (Park et al., 2005).

One factor that may influence children's severity or directionality of aggressive behavior is the level of observed aggression in their classrooms. In fact, classroom-level factors, such as classroom-level antisocial behavior in early adolescence (Müller et al., 2016) and classroom climate (e.g., teacher involvement) in first grade (Thomas et al., 2008), are important predictors of children's aggressive behavior. Classroom relational aggression is also related to individual-level relational aggression among elementary school children (Kuppens et al., 2008), particularly for children low in relational aggression at the start of the school year (Rohlf et al., 2016). To date, researchers have not assessed associations between both physical and relational aggression at the classroom level and preschoolers' individual aggression. This knowledge gap is unfortunate, as the specificity hypothesis, based on social learning theory (Bandura & Walters, 1977), indicates that children exposed to one form of victimization will be more likely to develop that form of aggression (Ostrov, 2008). Further, it is important to assess these associations in preschool samples, given that prior research has found that the peer group explains more variation in children's experiences of peer victimization in preschool relative to later developmental periods, such as kindergarten (Hanish et al., 2005). These findings suggest that classroom-level aggression may be a salient predictor of individual aggression in preschool. The present study sought to examine whether, similar to later developmental periods, classroom-level aggression is associated with individual child aggression in the preschool period.

Social–ecological models emphasize the importance of individual-, dyadic-, and broader contextual-level factors as contributing to bullying and aggression (Swearer & Hymel, 2015). Importantly, most prior research has not controlled for relational and physical victimization (i.e., being the target of aggressive behavior) when examining the impact of classroom-level aggression. In classrooms where there is more aggression, children are also more likely to experience peer victimization (Mercer et al., 2009), and these dyadic experiences could be driving associations between classroom-level and individual-level aggression. The inclusion of these constructs is particularly important for preschool children given prior work indicating that social play and peers' aggressive behavior are related to preschoolers' aggressive behavior (Hanish et al., 2005). These findings are also congruent with past work in a subset of the current sample (n = 80), which found that a greater number of male play partners was uniquely related to physical aggression (Perry & Ostrov, 2019). When considering other responses to peer experiences, theories of social withdrawal posit that a lack of interest in peers may be somewhat protective in preschool but becomes more maladaptive as children enter subsequent developmental stages (Coplan et al., 2019). In fact, more complex social factors, such as friendships and peer acceptance, are predictors of kindergarten peer victimization, but not preschool victimization (Hanish et al., 2005). The findings indicate that simple proximity to peers is a salient risk factor for preschool children when aggression is direct, overt, and in response to what is happening at the moment.

In addition to these dyadic and classroom risk factors for aggressive behavior, theoretical models, including the social–ecological model, suggest that temperamental traits play

an important role in aggression. Temperament is biologically based, relatively stable, and broadly related to individual differences in reactivity and regulation (De Pauw & Mervielde, 2010). A focus on temperament is consistent with the Practice Model from the National Association of School Psychologists, which emphasizes that school psychologists should use data-based decision making at the individual to systems level and should consider the broader context, such as the classroom context when conducting assessments and interventions (National Association of School Psychologists, 2020). A focus on temperament is also consistent with prior evidence that temperament is a primary factor that contributes to a goodness of fit between children and their classroom environment (Carey, 1998; Vitiello et al., 2012), and meta-analytic work has found a direct link between temperament and school readiness (Potmesilova & Potmesil, 2021). Interventions, such as INSIGHTS, target teacher and parent responding to facilitate school readiness for children with high-maintenance temperaments (McCormicketal.,2015). Researchers have previously recommended that educators be trained on the most up-to-date research on child temperament and that school psychologists be knowledgeable on assessments of children's temperament (Rothbart & Jones, 1998).

Despite the acknowledgment of temperament as a key individual factor contributing to children's outcomes within a particular environment (Dong et al., 2022), temperament assessments are not commonly used by school psychologists (see Oakland et al., 2016, for a list of the most common school psychologist instruments used across 64 countries). Therefore, we examined temperament as a predictor of individual aggression along with dyadic- and classroom-level variables to clarify the importance of temperament as a predictor to be assessed in school contexts. One temperament model that is particularly relevant to the study of children's aggressive behavior is the developmental propensity model. The developmental propensity model posits that higher daring (i.e., fearlessness, behavioral disinhibition) and negative emotionality (i.e., propensity to experience negative emotions), and lower prosociality (i.e., readily showing concern for the feelings of others) increase the risk for the development of conduct problems in a dimensional manner (Lahey & Waldman, 2003, 2005; Mikolajewski et al., 2019; Waldman et al., 2006).

The simultaneous investigation of individual-, dyadic-, and classroom-level factors in aggressive behavior has important implications for efforts to reduce aggression among school psychologists. For instance, if temperament, an individual factor related to biological risk, is predictive of children's aggression but social factors are not, this finding would suggest that school psychologists should evaluate children's temperament to help dictate who should receive limited prevention or intervention resources. Prior research has indeed found that children with certain temperament styles may need additional resources to succeed in preschool classrooms (Vitiello et al., 2012). However, some prevention models emphasize that universal interventions should target contextual factors, including social relationships, that influence aggression (Farmer et al., 2007). If social factors but not temperament are predictive of preschoolers' aggressive behavior, it would be important for school psychologists to evaluate and intervene on these factors using social skills–based training, such as the Incredible Years classroom social skills and problem-solving curriculum (Webster-Stratton & Reid, 2004). Moreover, if social factors are more predictive of a certain type of aggressive behavior, it would be useful to tailor interventions to

the more prevalent type of aggressive behavior seen in each particular classroom. For example, the Preventing Relational Aggression in Schools Everyday program is a universal classroom program specifically focused on addressing relational aggression (Leff et al., 2010). Therefore, school psychologists would benefit from measuring the relative frequency of forms of aggression in each classroom and making recommendations to modify prevention/intervention efforts accordingly. More research is needed in the investigation of social–ecological models of aggression in preschoolers to inform targeted prevention and intervention efforts by school psychologists.

Finally, it is important for researchers to identify reliable and valid measures for assessing classroom-level risk factors for aggression. Many prior studies examining classroom-level aggression have taken a classroom aggregate of individual aggression scores to generate a classroom norm or classroom level of aggression (e.g., Kuppens et al., 2008; Müller et al., 2016; Thomas et al., 2011). Aggregate scores are an average of the individual scores of the participating children. Therefore, these scores may not capture the average level of classroom aggression unless every child participates in the study. Additionally, these scores may be influenced by outliers if there are a few highly aggressive children in the classroom. In contrast to this aggregate approach, a classroom-level assessment of aggression asks teachers to rate the level of aggression within the classroom (e.g., “Children in my classroom hit other children”) and is not dependent on the number of participating children. It is not clear how individual aggregate and classroom-level reports of aggression are associated with one another. More research is necessary to determine what methods may be used to assess aggression at the classroom level.

The Present Study

The two primary aims of this research were to (a) investigate whether a preschool classroom-level measure of relational and physical aggression demonstrated acceptable reliability and validity and (b) examine whether classroom aggression, peer victimization, play partners, and temperament (daring, negative emotionality, prosociality) served as predictors of individual-level aggression to clarify how individual, dyadic, and classroom risk factors are associated with preschoolers’ aggression. Regarding Aim 1, we evaluated mean-level differences in an observer-reported classroom aggregate of children’s aggression relative to the teacher-reported classroom-level aggression scores, to determine how an overall classroom composite compared to an individual aggregate of aggression. Given the novelty of the classroom-level aggression measure, these analyses were considered exploratory. To evaluate Aim 2, a multilevel regression was used to examine the correlates of individual-level aggression. Consistent with the specificity hypothesis of aggression, we theorized that classroom physical aggression would be uniquely associated with individual-level physical aggression and classroom relational aggression would be uniquely associated with individual-level relational aggression, over and above individual and dyadic variables. Similarly, we hypothesized that relational victimization would be associated with relational aggression, physical victimization would be associated with physical aggression, and female or male play partners would be related to aggression severity. Finally, we investigated associations between temperament and aggression. The developmental propensity model posits that temperament is related to conduct problems broadly, rather than different

subtypes of conduct problems (e.g., overt vs. covert conduct problems; Tackett et al., 2013). Therefore, we hypothesized that temperament characteristics would be more strongly associated with aggression severity than directionality.

Method

Participants and Procedure

The present study included 307 participants (M_{age} = 48.99 months, SD = 7.51; 45.6% girls) from a four-cohort study (see Table 1 for demographic information). The racial and ethnic makeup of the sample (10.1% Asian or Asian American or Pacific Islander, 4.2% Black/African American, 2% Hispanic or Latinx, 11.4% multiracial, 67.7% White, 4.6% missing) was representative of the larger county from which the data were derived (U.S. Census Bureau, 2021). Children were recruited from 10 National Association for the Education of Young Children accredited or recently accredited early childhood education centers in a large northeastern city. Data for the study were collected as a part of a larger four-cohort longitudinal study in early childhood focused on examining relations between early temperament and aggressive behavior across early childhood (Ostrov et al., 2023). The first time point for the larger study was collected in the spring so that it could occur in proximity to a lab visit, which occurred in the summer prior to a child's prekindergarten (pre-k) year (see Ostrov et al., 2023). Participants were only included in the present study if their classrooms participated in the classroom aggression assessment portion of the study.

Preschoolers (i.e., 3- to 4-year-old children) and prekindergartners (i.e., 4- to 5-year-old children) were invited to participate in the study. Specifically, Cohort 1 (n = 80) included preschoolers and prekindergartners, Cohort 2 (n = 70) included primarily prekindergartners, and Cohort 3 (n = 114) and Cohort 4 (n = 43) included primarily preschoolers. These differences were due to changes in data collection procedures throughout the project (e.g., recruitment focused on preschool classrooms in later cohorts to increase summer session participation, which was limited to preschoolers entering pre-k; relevant measures were not collected for preschoolers for Cohort 2). Cohort was related to age, $F(3, 300) = 119.05$, $p < .001$, adjusted $R^2 = .54$, as expected given that preschool classrooms are younger than pre-k classrooms. The cohorts also differed on the racial/ethnic background of the participants, $\chi^2(12) = 22.61$, $p = .03$, Cramér's $V = .08$; see Table 1 for cohort demographics. Cohort 3 varied by race/ethnicity from Cohort 1, $\chi^2(4) = 10.47$, $p = .03$, and Cohort 4, $\chi^2(3) = 8.36$, $p = .04$. Cohort 3 did not vary from Cohort 2, $\chi^2(4) = 6.60$, $p = .16$, Cohort 1 did not vary from Cohort 2, $\chi^2(4) = 5.12$, $p = .28$, or Cohort 4, $\chi^2(4) = 5.25$, $p = .26$, and Cohort 2 did not vary from Cohort 4, $\chi^2(4) = 8.59$, $p = .07$. Overall, Cohort 3 had a greater number of White participants relative to the other cohorts. The cohorts did not vary on their gender distribution, $\chi^2(3) = 5.88$, $p = .12$, Cramér's $V = .08$. Cohort was related to the physical aggression, relational aggression, male play partners, daring, and prosociality variables, significant Fs (3, 300) range from 5.69 to 18.75, $ps < .001$, adjusted R^2 range from .05 to .15. Cohort 4 had significantly higher prosociality scores than Cohort 1, Cohort 2 had significantly higher male play partners than any other cohort, and Cohorts 1 and 2 had higher relational and physical aggression scores than Cohorts 3 and 4. To address these differences, age and cohort (dummy-coded) were controlled in all analyses. Additionally,

robustness analyses that controlled for race/ethnicity in the final model are included in the Supplemental Materials and showed no difference in results.

Teachers and observers completed reports from April to June, and observations took place between March and June. The school breakdown by cohort was as follows: two schools participated in all cohorts, four schools participated in three of the four cohorts, three schools participated in two of the four cohorts, and one school participated in one cohort of data collection. All children in participating classrooms were invited to participate, and parents provided written consent for their children's participation prior to beginning the study. The consent rates, which were taken from the larger study, were 78.67% for Cohort 1, 51.18% for Cohort 2, 64.93% for Cohort 3, and 52.07% for Cohort 4. Teachers provided written consent prior to report completion. All teachers consented to study participation. The study was approved by the local institutional review board. Teachers were compensated $10–$30 depending on their class size. All teachers consented to participate in the study.

Classrooms ($N = 47$) were nested within 10 schools, such that one school had 11 participating classrooms, three schools had six participating classrooms, one school had five participating classrooms, one school had four participating classrooms, two schools had three participating classrooms, one school had two participating classrooms, and one school had one participating classroom. The lead teacher in each classroom was asked to complete the reports. In the event that the lead teacher was not able to complete the reports, the assistant teacher was asked to complete these reports. All classrooms had at least one assistant teacher. Teachers who completed the reports were mostly female (95.74% female), most had a master's degree (53.19% master's degree, 36.17% bachelor's degree, 6.38% associate's degree, and 4.26% additional graduate degree), had on average 12.02 years of experience as an early childhood educator ($SD = 9.57$), and 14.5 children in their classroom ($SD = 2.64$).

Measures

Observations and Observer Ratings of Aggression

Female and Male Play Partners.: Trained undergraduate and graduate research assistants collected naturalistic observations using a focal child sampling with a continuous recording procedure (see Perry & Ostrov, 2019, for more information on procedures). On average, observers ($N = 29$, one male) spent approximately 9 hr a week or 72 hr total in the classroom. Observations were undertaken in a 2-month period, with the goal of completing eight, 10-min observation sessions per child. On average, each child had a total of 7.75, 10-min observations at the end of 2 months. The number of times a child played with a new male or female play partner was summed and then divided by the total number of observation sessions, yielding an average number of female and play partners per session. To ensure that observations were reliable, interrater reliability was calculated by having two research assistants observe the same session. Interrater reliability was calculated for 18.6% of observations for Cohort 1, 17.02% of observations for Cohort 2, 16.24% of observations for Cohort 3, and 17.89% of observations for Cohort 4. Cohort 1 previously demonstrated acceptable reliability (intraclass correlations [ICCs] with absolute agreement >.91; see Perry & Ostrov, 2019), and there was acceptable reliability for female play partners (ICC with

absolute agreement = .84) and male play partners (ICC with absolute agreement = .86) for Cohorts 2, 3, and 4.

Physical and Relational Aggression.: Physical aggression and relational aggression were measured with the Preschool Social Behavior Scale–Observer Report (PSBS-OR; Crick et al., 1997; Ostrov, 2008). After observers completed behavioral observations over a 2-month period, the primary undergraduate observer who spent the most time in the classroom rated each child's aggressive behavior. In classrooms where there were multiple observers, one observer was randomly selected to rate each child's aggressive behavior. Observer reports of aggressive behavior have previously demonstrated significant correlations with observations and teacher reports of aggressive behavior within a subset of this sample (r values for observer report and observations range from .40 to .41 and values for observer report and teacher report range from .25 to .41; see Perry et al., 2021) and with teacher reports in an independent sample (r values range from .21 to .50; Ostrov, 2008). In fact, in a previous study when examining latent variables of relational aggression and physical aggression using teacher report, parent report, observer report, and observations, observer report had the strongest factor loadings on each of the factors, underscoring the utility of observer report for assessing aggression within the classroom context and its overlap with other informants of aggressive behavior (Perry et al., 2021). Relationally aggressive behavior (six items; e.g., "This child tells others not to play with or be a peer's friend") and physically aggressive behavior (six items; e.g., "This child pushes or shoves other children") were rated on a 5-point Likert scale (1 = *never or almost never true* to 5 = *always or almost always true*). Items were summed to generate scale scores with higher scores indicating more aggression. Prior research has validated the use of observer reports (e.g., Perry & Ostrov, 2019). To assess internal consistency, omega (ω) values were used in addition to Cronbach's α values given that the assumptions of Cronbach's α (i.e., items contribute equally to scale scores, items are continuous, errors are uncorrelated, and the scale is unidimensional) are often violated (McNeish, 2018). McDonald's ω addresses several of these limitations (Hayes & Coutts, 2020) and was computed using Jeffreys's Amazing Statistics Program software (JASP Team, 2022). Both subscales were internally consistent in the current sample (Cronbach's $\alpha \geq .90$; McDonald's $\omega \geq .91$).

Directionality and Severity Variables.: Severity and directionality variables were created by standardizing the relational (Z_{ra}) and physical (Z_{pa}) aggression scores consistent with procedures outlined in Park et al. (2005). These scores were averaged $[(Z_{pa}+Z_{ra})/2]$ to generate an aggression severity score, where higher scores indicate higher levels of aggression generally. Aggression directionality was calculated using the standardized half difference between physical and relational aggression $[(Z_{pa}-Z_{ra})/2]$, where higher scores indicate that a child is more likely to use physical relative to relational aggression.

Teacher Ratings

Temperament.: The Child and Adolescent Dispositions Scale (CADS; Lahey et al., 2008) has been used in early childhood (Mathesius et al., 2017) and assesses prosociality (11 items; e.g., "Cares about others' feelings"), negative emotionality (eight items; e.g., "Moods change unpredictably"), and daring (five items; e.g., "Enjoys risky and dangerous things").

Teachers rated items on a 4-point Likert scale (1 = *not at all to* 4 = *very much*) with higher average scores indicating greater levels of the temperament factor. All subscales were internally consistent (Cronbach's α > .91, McDonald's ω ≥ .92). The CADS has previously demonstrated external validity through associations with psychopathology and internal validity through replication of the three dimensions of temperament in different samples (Lahey et al., 2008). Notably, the observed correlations among the three subscales (i.e., no correlation between daring and prosociality, negative moderate correlation between prosociality and negative emotionality, and moderate positive correlation between daring and negative emotionality) in the present study are consistent with the correlations observed in previous research (Mathesius et al., 2017).

Classroom Physical and Relational Aggression.: Classroom-level physical aggression and relational aggression were measured with the Preschool Social Behavior Scale–Classroom (PSBS-C), which is an adapted version of the PSBS with items paralleling the individual child observer and teacher report versions (Crick et al., 1997; Ostrov, 2008). Teachers rated the level of relationally (six items; e.g., "Children in my classroom tell others not to play with or be a peer's friend") and physically (six items; e.g., "Children in my classroom push or shove other children") aggressive behavior in their classroom (see Ostrov et al., 2009). Items were rated on a 5-point Likert scale (1 = *never or almost never true* to 5 = *always or almost always true*) and summed with higher scores indicating higher levels of classroom aggression. Classroom-level physical aggression (Cronbach's α= .85, McDonald's ω= .86) and relational aggression (Cronbach's α=.87, McDonald's ω=.88) were reliable in the present sample.

Peer Victimization.: Teachers reported on children's relational (four items; e.g., "This child gets told 'you can't play' by peers when they are angry at him/her") and physical victimization (four items; e.g., "This child gets hit, kicked, or pinched by peers") using the Preschool Peer Victimization Measure–Teacher Report Revised (Crick et al., 1999; Godleski et al., 2015). Items were rated on a 5-point Likert scale (1 = *never or almost never true* to 5 = *always or almost always true*), with higher average scores indicating higher levels of peer victimization. The subscales have demonstrated good psychometric properties (e.g., Crick et al., 1999), and both subscales demonstrated acceptable reliability in the present study (relational victimization: Cronbach's α = .91, McDonald's ω = .91; physical victimization: Cronbach's α = .83, McDonald's ω = .83). In support of the validity of the individual victimization and aggression measures in the present study, observer report of relational aggression was associated with teacher report of relational victimization (r = .18, p < .01) but not physical victimization (r = .10, p = .07), and observer report of physical aggression was associated with teacher report of physical victimization (r = .19, p < .01) but not relational victimization (r = .11, p = .05). These within-form correlations between victimization and aggression are also consistent with the aforementioned specificity hypothesis (Ostrov, 2008).

Data Analysis

First, descriptive data of the measures were obtained, including means, standard deviations, and analysis of outliers (a value that is greater than 3 *SD*s above or below the mean; Kline,

2016). Skew values ranged from −0.30 to 1.47 and kurtosis statistics ranged from −1.03 to 1.43, indicating that the data were slightly skewed. Therefore, a model estimator was used that accounted for skew (Kline, 2016).

Descriptive statistics and correlations were examined at the classroom level. For classrooms with more than five children participating ($n = 34$), the average of the children's PSBS-OR aggression scores within that classroom was calculated to correlate with the PSBS-C scales at the classroom level.

Multilevel modeling procedures were tested following the steps outlined by Sommet and Morselli (2021). First, an empty model was constructed to examine the ICC and Design EFFect (DEFF) values. A DEFF value above 1.5 suggests that the hierarchical structure of the data cannot be ignored (Sommet & Morselli, 2021). We did not expect the impact of the within variables to differ as a result of classroom and therefore the residual slope variance and covariance terms across classrooms were not tested (Sommet & Morselli, 2021). Finally, the severity and directionality of aggression variables were regressed on the individual and dyadic variables and covariates, and classroom physical and relational aggression. All of the Level 1 variables were grand-mean centered to obtain the estimation of the average effects across the classroom.

All analyses were estimated in Mplus Version 8.7 (Muthén & Muthén, 2022). The maximum likelihood estimation with robust standard errors estimator was used for analyses. Missing data were minimal, with less than 1.4% of missing data for each variable, which were accommodated using full information maximum likelihood (FIML; Baraldi & Enders, 2010).

The likelihood ratio χ^2 test was used to test overall model fit where $p > .05$ indicates good model fit. Alternative fit indices, including the comparative fit index (CFI), root-mean-square error of approximation (RMSEA), and standardized root-mean-square residual (SRMR), were also used. As specific cutoffs for assessing "good" fit cannot be generalized across all models (Hu & Bentler, 1999; Marsh et al., 2004), ranges were used to determine the acceptability of model fit (CFI values close to .95, RMSEA values close to .06, and SRMR values close to .08).

Results

Preliminary Analyses

Descriptive statistics and correlations of the individual-level variables are provided in Table 2. There were gender differences across scales except for negative emotionality, $F(1, 303) = 1.46$, $p = .23$, and relational victimization, $F(1, 304) = 3.23$, $p = .07$. Specifically, boys had higher scores on physical aggression, $F(1, 303) = 12.25$, $p < .001$, adjusted $R^2 = .04$; physical victimization, $F(1, 304) = 4.32$, $p = .04$, adjusted $R^2 = .01$; and daring, $F(1, 303) = 18.36$, $p < .001$, adjusted $R^2 = .06$, scales and had a higher number of male play partners, $F(1, 301) = 45.46$, $p < .001$, adjusted $R^2 = .13$, than girls. Girls had higher scores on relational aggression, $F(1, 303) = 5.19$, $p = .02$, adjusted $R^2 = .01$, and prosociality, $F(1, 303)$

= 14.23, $p < .001$, adjusted $R^2 = .04$, scales and a greater number of female play partners, $F(1, 301) = 55.72$, $p < .001$, adjusted $R^2 = .15$, than boys.

The number of children in the classroom on an average day was moderately but nonsignificantly associated with classroom relational aggression ($r = .28$, $p = .06$) and weakly and nonsignificantly associated with physical aggression ($r = .04$, $p = .97$). Although these correlations did not reach significance, research indicates that smaller preschool classes are associated with better outcomes (Francis & Barnett, 2019) and proximity to peers is a key predictor of peer victimization and aggression during preschool (Hanish et al., 2005). Thus, we controlled the number of children in the classroom. Teacher experience was weakly and nonsignificantly associated with classroom-level relational aggression ($r = .14$, $p = .35$) and negatively associated with classroom-level physical aggression ($r = -.04$, $p = .81$). Given the weak and nonsignificant correlation between teacher experience and classroom-level aggression, teacher experience was not controlled in subsequent analyses.

Primary Analyses

PSBS-C—First, descriptive statistics were examined at the classroom level. Means and standard deviations were as follows: relational aggression ($M = 12.02$, $SD = 3.91$); physical aggression ($M = 10.03$, $SD = 3.21$). The classroom-level relational and physical aggression scales were significantly correlated ($r = .43$, $p = .003$). For classrooms with more than five children ($n = 34$), an aggregate of the children's PSBS-OR aggression scores within that classroom was calculated, and then this score was correlated with the PSBS-C scales. The PSBS-C relational aggression scale was moderately correlated with the classroom aggregate of the PSBS-OR for relational aggression ($r = .40$, $p = .03$) but weakly and nonsignificantly correlated with physical aggression ($r = .14$, $p = .44$). The PSBS-C physical aggression scale was moderately correlated with the classroom aggregate of the PSBS-OR for physical aggression ($r = .39$, $p = .03$) but was weakly and nonsignificantly correlated with relational aggression ($r = .21$, $p = .26$). Additionally, as an exploratory analysis, we evaluated mean differences in the aggregate and classroom-level assessments of aggressive behavior. The mean of the PSBS-C classroom-level scale was higher than the mean of the classroom aggregate of the PSBS-OR for relational aggression, $t(30) = 4.52$, $p < .001$, $d = -0.81$, and physical aggression, $t(30) = 2.75$, $p = .01$, $d = -0.49$, although it should be noted that these metrics are not directly comparable given that not all children in each classroom participated in the study and different informants were used for individual- and classroom-level reports.

Multilevel Model—In the empty model, the severity (ICC = .26, DEFF = 2.40) and directionality (ICC = .12, DEFF = 1.64) score statistics demonstrated that the hierarchical structure of the data could not be ignored. Next, a multilevel model was examined controlling for age, gender, cohort, and the number of children in the classroom. Age was regressed on cohort given the strong association between the two and to facilitate the FIML process. The multilevel multivariate regression exhibited a good fit to the data, $\chi^2(8) = 9.10$, $p = .33$, CFI = 1.00, RMSEA = .02, $SRMR_{within} = .03$, $SRMR_{between} = .01$; see Table 3 for standardized estimates and effect sizes. Regarding temperament, negative emotionality and daring were positively associated with severity scores, and daring was positively related to directionality scores, suggesting that children higher on daring have higher concurrent

levels of aggression and are more likely to display physical relative to relational aggression. Regarding the dyadic variables, female play partners and male play partners were positively associated with aggression severity. Additionally, classroom relational aggression was negatively associated with directionality, indicating that in classrooms with more relational aggression, children were more likely to display relational relative to physical aggression.

Consistent with the hypothesis that the temperament variables would be more strongly related to severity than directionality, a post hoc Wald test indicated that daring was more strongly related to severity than directionality, Wald $\Delta\chi^2(1) = 4.16$, $p = .04$.

Discussion

The present study examined the psychometric properties of a classroom measure of aggressive behavior and tested a concurrent social–ecological model to determine if temperament, dyadic risk variables, and classroom-level aggression were associated with individual-level aggression. Aggression severity and directionality scores were used to parse apart the overall levels of a child's aggression and their propensity toward physical versus relational aggression. Consistent with hypotheses, classroom-level relational aggression was correlated with directionality but not severity, whereas temperament was more strongly associated with severity than directionality.

The classroom-level teacher report of aggressive behavior demonstrated acceptable reliability. Additionally, the relational aggression classroom scale was moderately correlated with the individual relational aggression classroom aggregate, and the physical aggression classroom scale was moderately correlated with the individual physical aggression classroom aggregate, providing initial evidence for the measure's validity. The moderate strength of these associations suggests that classroom-level measures contribute unique variance to estimates of classroom-level aggression. More research is needed to evaluate the validity of this measure, particularly given the small sample size (i.e., 47 classrooms). Finally, the teacher-rated classroom-level means were higher than the observer-rated individual classroom aggregates, indicating that raters may be more willing to endorse classroom levels of aggressive behavior compared to individual aggressive behavior. Given the exploratory nature of this analysis and the use of different informants, these results await replication.

In addition, we evaluated associations between individual risk factors (temperament, the number of play partners), dyadic peer victimization, and classroom-level aggression with child aggression. As hypothesized, classroom-level relational aggression was associated with aggression directionality, such that children in classrooms with higher levels of relational aggression were more likely to use relational relative to physical aggression. This finding is consistent with prior work with elementary school children indicating that classroom relational aggression is related to individual relational aggression (e.g., Kuppens et al., 2008) as well as the specificity hypothesis of aggression and social learning theory (Bandura & Walters, 1977; Ostrov, 2008).

At the individual level, negative emotionality was associated with aggression severity but not directionality, consistent with conceptualizations of negative emotionality as a general indicator of psychopathology (Tackett et al., 2013). Interestingly, daring was associated with aggression directionality, indicating that children high on daring were more likely to use physical relative to relational aggression. The unique association between daring and physical aggression is consistent with some prior work documenting unique associations between temperament and forms of aggression (e.g., fearlessness and physical aggression, Ojanen et al., 2012; Schmitz et al., 1999), and extends this prior work using the severity and directionality approach. That said, daring was more strongly related to aggression severity than directionality, consistent with study hypotheses, which suggests that the developmental propensity model may be especially relevant to more severe manifestations of externalizing behavior (Lahey & Waldman, 2003, 2005; Waldman et al., 2006).

At the dyadic level, neither relational nor physical victimization was associated with aggression severity or directionality. Congruent with the specificity hypothesis, there were significant bivariate correlations between the forms of victimization and aggression (e.g., relational victimization was associated with relational aggression). These findings underscore the importance of including predictors across levels of influence to identify which factors may be most important in predicting concurrent preschool aggressive behavior. Finally, the number of male and female play partners were both associated with the severity of a child's aggressive behavior, extending prior research which has found that play with peers is a risk factor for being victimized in preschool (Hanish et al., 2005).

Implications

Importantly, classroom-level relational aggression emerged as a predictor of aggression directionality, over and above the individual- and dyadic-level factors, suggesting that the normative form of aggression in a classroom may drive how children display aggressive behavior within that classroom. As classroom relational but not physical aggression emerged as a predictor, it may be especially important for school psychologists to assess relational aggression at the classroom level when implementing broad social skill–based prevention or intervention programs within a classroom and modify the curriculum accordingly. In fact, there are a number of classroom-level interventions focused on relational aggression that have demonstrated that interventions at the classroom level can have a positive impact on children's relational and physical victimization and aggression (e.g., Leff et al., 2010). Findings from the present study further support these programs. In addition, consultation between school psychologists and teachers to address aggression within the classroom may be an initial important step for reducing aggressive behavior (Shernoff et al., 2017). Consultation coaching models have been found to increase positive classroom qualities over a relatively short period (e.g., 8 weeks; Stoiber et al., 2023) and may be particularly useful for problems at the classroom level.

The temperament findings in the present study are consistent with previous recommendations that school psychologists assess children's temperament when conceptualizing the function of their aggressive behavior (Rothbart & Jones, 1998). Children with a daring or negative emotionality temperament may receive greater benefits from

intervention efforts targeting aggressive behavior. In preschool settings, school psychologists should also assess the frequency of a child's play with peers when conceptualizing the function of a child's aggression.

Results from this study and prior research (e.g., Hanish et al., 2005) indicate that highly social children may be at a greater risk for aggression or victimization in preschool, due to increased proximity to peers. Therefore, during preschool, sociable children may also benefit from intervention efforts targeting aggressive behavior to gain skills to navigate challenging peer interactions. However, conclusions cannot be drawn about whether modifying classroom-level or individual-level behavior influences individual aggression over time given this study's cross-sectional design. Nevertheless, results are consistent with the suggestion that interventions targeting individual-level factors and classroom-level factors may be important for reducing preschool children's aggressive behavior.

Constraints on Generality, Limitations, and Future Directions

The present study was conducted in accredited or recently accredited childcare centers, which limits the generalizability of the findings to other populations, such as unaccredited childcare centers or clinical samples, where other factors may be more important in the prediction of children's aggressive behavior. Even though participants' racial and ethnic backgrounds were similar to the larger county from which the sample was drawn, results may not be generalizable to other geographic regions or cultures. Moreover, observers and teachers in the study were predominately female, which could potentially influence how they observe and rate aggressive behavior. Data on the number of assistant teachers in each classroom were not collected, which may influence the overall level of aggression within a classroom. Additionally, race/ethnicity data were not collected for observers and teachers. Research has demonstrated that Black and Latinx students receive higher ratings of externalizing behavior when assigned to a teacher of a different race/ethnicity (for a review, see Redding, 2019). Nationwide data suggest that approximately 80% of teachers are White (Redding, 2019), and a recent news article indicated that 98% of public school teachers from prekindergarten to high school are White in the county where the study was conducted (Buckley, 2022). Therefore, in the present study, classrooms with more Black and Latinx students may have teachers that endorsed higher levels of classroom aggression, a type of externalizing behavior. Future research should examine how race and ethnicity in a classroom may influence teacher ratings of classroom-level aggressive behavior. Finally, we relied on a four-cohort sample to obtain the sample size necessary for this multilevel, multimethod study. There were differences between the cohorts and we controlled for cohort and age to minimize these differences. Nonetheless, the cohort may have exerted additional effects that were not examined here. We have no other reason to believe that the results depend on other characteristics of the participants, materials, or context.

The cross-sectional design limits our ability to make inferences about the directionality of findings or the long-term effects of classroom-level aggression. Future research should examine the longitudinal relations between classroom-level aggression and individual-level aggression, as well as potential cognitive (e.g., hostile attribution biases; Crick & Dodge, 1994) and emotional (e.g., sympathy for victims; Waasdorp et al., 2019) mechanisms

underlying these associations. Additionally, future research should assess functions of aggressive behavior (i.e., why children use aggression; Moore et al., 2018) and include additional temperamental risk factors for aggression (e.g., callous-unemotional traits; Moore et al., 2018). Given the novelty of the assessment of classroom-level aggression, future research needs to replicate the reliability findings observed in the present study and provide further evidence for the validity of the measure before it is used in school settings.

Conclusions

Despite these limitations, the present study demonstrated favorable reliability and validity of a classroom-level measure of aggressive behavior and provided support for the social–ecological model of aggression. Over and above individual- and dyadic-level variables, classroom-level relational aggression emerged as a correlate of aggressive directionality, predicting greater use of relational aggression relative to physical aggression. Additionally, temperament appeared more strongly associated with aggression severity than directionality. These findings can inform school-based interventions that aim to reduce aggression in the classroom by highlighting the importance of including classroom-level measures to ensure that prevention/intervention efforts are impacting classroom-level aggression in addition to individual-level aggression. Future research should examine classroom-level aggression, as the current literature focuses on examining aggression at the individual level. Results provide insight for teachers and school psychologists regarding the importance of taking into account classroom-, dyadic-, and individual-level factors when identifying children at risk for high aggression.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Impact and Implications

The present study addressed gaps in the school psychology literature by evaluating the association between preschoolers' classroom-level aggression and their individual aggression while controlling for child temperament and dyadic peer experiences. Results demonstrated that classroom relational aggression was associated with the type of aggressive behavior a child uses (i.e., relational aggression), whereas temperament was more strongly related to the severity of a child's aggressive behavior. These findings indicate that school psychologists should consider individual-, dyadic-, and classroom-level factors when considering children's aggressive behavior.

Table 1

Demographic Data by Cohort

Demographic variable	Cohort 1	2	3	4	Total
Race/ethnicity					
Black/African American	4 (5.00%)	1 (1.43%)	7 (6.14%)	1 (2.33%)	13 (4.23%)
Asian/Pacific Islander	10 (12.50%)	5 (7.14%)	9 (7.89%)	7 (16.28%)	31 (10.10%)
White/non-Hispanic	49 (61.25%)	53 (75.71%)	82 (71.93%)	24 (55.81%)	208 (67.75%)
Hispanic/Latinx	4 (5.00%)	2 (2.86%)	0 (0%)	0 (0%)	6 (1.95%)
Multiracial	11 (13.75%)	6 (8.57%)	9 (7.89%)	9 (20.93%)	35 (11.40%)
Missing	2 (2.50%)	3 (4.29%)	7 (6.14%)	2 (4.65%)	14 (4.56%)
Gender					
Boys	37 (46.25%)	46 (65.71%)	61 (53.51%)	23 (53.49%)	167 (54.40%)
Girls	43 (53.75%)	24 (34.29%)	53 (46.49%)	20 (46.51%)	140 (45.60%)
Age *M (SD)*	52.15 (7.14)	56.87 (4.22)	43.96 (4.21)	43.43 (3.86)	48.99 (7.51)
Cohort *n*	80	70	114	43	307

Note. For race/ethnicity and gender, the *n* for each group is included with the percentage for each group, which is included in brackets.

Table 2

Descriptive Statistics and Correlations of Level 1 Variables

Variable	1	2	3	4	5	6	7	8	9	10
1. Age (in months)										
2. Rel agg-OR	.30**	—								
3. Phy agg-OR	17**	.62**	—							
4. Rel vict-TR	.13*	.18**	.11	—						
5. Phy vict-TR	.12*	.10	.19**	.65**	—					
6. Prosociality-TR	.09	−.06	−.18**	−.10	−.14*	—				
7. Neg emot-TR	.05	.17**	.30**	.56**	.48**	−.29**	—			
8. Daring-TR	.12*	.14*	.28**	.27**	.30**	.03	.33**	—		
9. Female play partners-OBS	.10	.22**	−.02	.24**	.06	.22**	.02	−.01	—	
10. Male play partners-OBS	27**	.14*	.28**	.06	.15**	.06	.10	24**	−.04	—
M	48.99	9.36	8.84	1.93	1.62	2.87	1.93	2.33	2.71	3.32
SD	7.51	4.15	3.64	0.82	0.61	0.66	0.74	0.80	1.53	2.15
Range	33.83–65.37	6.00–22.28	6.00–20.28	1.00–4.00	1.00–3.45	1.18–4.00	1.00–4.00	1.00–4.00	0.17–7.83	0.00–11.38

Note. Rel agg = relational aggression; Phy agg = physical aggression; Rel vict = relational victimization; Phy vict = physical victimization; OBS = observations; OR = observer report; TR = teacher report; Neg emot = negative emotionality. Female and male play partner values reflect the average play partners per observation session.

* $p < .05$.

** $p < .01$.

Table 3

Multilevel Regression Model Parameter Estimates

Predictor	Severity β	*p*	R^2	Predictor	Directionality β	*p*	R^2
Individual-level predictors			.23	Individual-level predictors			.21
Gender	−.04	.63		Gender	.27**	<.001	
Age	.05	.66		Age	−.05	.50	
Prosociality	−.08	.25		Prosociality	−.01	.90	
Daring	.18**	.003		Daring	.09*	.04	
Negative emotionality	.22**	.003		Negative emotionality	.15	.06	
Physical victimization	−.19	.09		Physical victimization	.09	.38	
Relational victimization	.05	.67		Relational victimization	−.10	.39	
Female peers	.12*	.047		Female peers	−.10	.07	
Male peers	.21*	.046		Male peers	.08	.30	
Classroom-level predictors			.16	Classroom-level predictors			.45
Children in classroom	.14	.49		Children in classroom	−.18	.44	
Classroom physical aggression	.41	.07		Classroom physical aggression	.24	.33	
Classroom relational aggression	−.10	.67		Classroom relational aggression	−.65**	.005	

Note. Cohort was also controlled using three dummy-coded variables. Gender was coded as —1 = girl, 1 = boy. Directionality scores were coded such that positive scores reflect a greater likelihood of displaying physical relative to relational aggression and negative scores reflect a greater propensity for relational relative to physical aggression. Severity scores are coded such that higher levels indicate higher general scores of aggression. Children in the classroom is the teacher's report of the number of children in the classroom on an average day.

*$p < .05$.

**$p < .01$.