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Higher Childhood Peer Reports of Social Preference Mediates the Impact of the Good Behavior Game on Suicide Attempt

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Abstract

The Good Behavior Game (GBG) is a universal classroom-based preventive intervention directed at reducing early aggressive, disruptive behavior and improving children's social adaptation into the classroom. GBG is one of the few universal preventive interventions delivered in early elementary school that has been shown to reduce the risk for future suicide attempts. This paper addresses one potential mechanism by which the GBG lowers the risk of later suicide attempt. In this study we tested whether the GBG, by facilitating social adaptation into the classroom early on, including the level of social preference by classmates, thereby lowers future risk of suicide attempts. The measure of social adaptation is based on first and second grade peer reports of social preference ("which children do you like best?"; "which children don't you like?"). As part of the hypothesized meditational model, we examined the longitudinal association between childhood peer social preference and the risk of future suicide attempt, which has not previously been examined. Data were from an epidemiologically-based randomized prevention trial, which tested the GBG among two consecutive cohorts of first grade children in 19 public schools and 41 classrooms. Results indicated that peer social preference partially mediated the relationship between the GBG and the associated reduction of risk for later suicide attempts by adulthood, specifically among children characterized by their first grade teacher as highly aggressive, disruptive. These results suggest that positive childhood peer relations may partially explain the GBG-associated reduction of risk for suicide attempts and may be an important and malleable protective factor for future suicide attempt.

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Keywords

Suicide attempt; Good Behavior Game; Peer relations; Developmental epidemiology; Universal prevention programs

In the United States suicide was the second leading cause of death among 15 to 19 year olds in 2013 (Centers for Disease Control and Prevention [CDC], 2015). According to estimates extrapolated from the CDC's national Youth Risk Behavior Surveillance System, well over one million high school students are treated by a nurse or doctor annually for a suicide attempt (National Action Alliance for Suicide Prevention [NAASP], 2014). Suicide has been a fairly intractable public health problem as annual suicide rates have been stable over the past 60 years at around 10 to 12 per 100,000 (WISQARS), irrespective of advances in the diagnosis and treatment of associated psychiatric disorders or increases in funding for suicide prevention (NAASP, 2014). Increased rates have been seen in subgroups based on age, sex, race and profession (Bachynski et al. 2012; Hu et al. 2008). One goal of the NAASP Research Prioritization Task Force, charged with establishing a prioritized suicide prevention research agenda, is to reduce suicide attempts and suicides each by at least 20% in five years and 40% or greater in 10 years. The task force has prioritized the prevention of "the emergence of suicidal behavior by developing and delivering the most effective prevention programs to build resilience and reduce risk in broad-based populations" (NAASP, 2012).

Wilcox and colleagues (2008) have reported that the Good Behavior Game, which is directed at reducing early aggressive, disruptive behavior by improving children's social adaptation into the classroom, reduces risk for later suicide attempts. Using data from an epidemiologically-based randomized trial and longitudinal follow-up involving the first cohort of 1196 first graders from 19 Baltimore city schools and 41 classrooms, the authors found that those assigned to the GBG in first grade were 50% less likely to report a suicide attempt by young adulthood. These results clearly warrant further research in order to assess possible mechanisms by which the GBG impacts future suicide attempt risk. In this study, we test whether the GBG, by facilitating social adaptation in classrooms, thereby lowers future risk of suicide attempts.

The GBG is a classroom-based preventive intervention targeting aggressive, disruptive behaviors by directly intervening within the social context of the classroom. The goal of the GBG is to create an integrated classroom social system that is supportive of all children being able to learn with little aggressive, disruptive behavior within the classroom. Thus, the GBG works by organizing students into teams balanced by aggressive and disruptive behavior and systematically rewarding teams as a whole for each child's socially adaptive student behavior. Through this, the GBG hypothetically facilitates positive peer interactions among students and provides opportunities to enhance their own and their classmates' social adaptation and integration to classrooms and peer groups.

Several studies have reported the impact of the GBG on peer social relations. Witvliet and colleagues (2009) examined the impact of the GBG on peer relations in a randomized controlled trial of 758 children followed from kindergarten to the end of second grade and

reported significant improvements in peer acceptance among children assigned to the GBG. The authors also reported a positive impact on aggressive, disruptive behavior and that this impact appeared to be partly mediated by improvements in peer acceptance. Similarly, Leflot and colleagues (2013) reported that, among children characterized as aggressive at baseline and at risk for the further development of aggression, those randomized to the GBG condition had a significantly greater reduction in aggression compared with those in the control group, and that this reduction was mediated by decreases in peer rejection. Therefore it is worth testing whether improvements in social adaptation may explain the GBG-impact on risk for suicide attempt.

Indeed, social factors such as social support are among the most robust and widely replicated protective factors for suicidal behaviors (Borowsky et al. 2001; Kaminski et al. 2010). In 2009, the CDC identified social connectedness, loosely defined as relationships and support from families, friends and communities, as a key strategic direction for suicide prevention (CDC Strategic Direction for the Prevention of Suicidal Behavior, 2009). However, there is a research gap on peer relations in childhood and risk for suicide attempt later in life. Prinstein and colleagues (2000) found that greater levels of perceived peer rejection and lower levels of close friendship support were associated directly with more severe suicidal ideation in 12-17 year old inpatients. Given that it is well established that peer relations play an important role in childhood development and affect long-term outcomes (Coie et al. 1990; 1992; Kupersmidt et al. 1991), early childhood peer relations may be related to risk for future suicide attempts.

Aggressive behaviors have been shown to be an important aspect of both peer rejection (Coie et al. 1992; Kupersmidt et al. 1991; Lansford et al. 2010) and suicide attempt risk (Gvion et al. 2011). According to Mann and colleagues' (1999) stress–diathesis model of suicidal behavior, suicide is the result of an interaction between state-dependent (environmental) stressors and a trait-like diathesis or susceptibility to suicidal behavior, independent of psychiatric disorders. Aggression, impulsivity and childhood trauma are components of the diathesis for suicidal behavior. If GBG reduces aggressive, disruptive behaviors, it is possible that, in the context of future acute stressors, risk of suicide attempt will be reduced. According to the life course/social field theory (Kellam et al. 1975), aggressive, disruptive behavior is viewed not as residing merely in the individual but also reflecting the results of social interactions within and across social fields—between child and teacher, classmates/peers, family, and the broader community and societal context. Life course/social field theory postulates that adapting or maladapting to earlier social task demands in specific social fields leads to later adaptation or maladaptation in the same field and in other social fields (Cicchetti et al. 1984). The theory also suggests that psychological well-being, the internal dimension that reflects the psychological status of an individual, may be an antecedent and/or a consequence of social maladaptation, since social maladaptation is reciprocally related to psychological well-being.

In summary, based on the results described above between the GBG and suicide attempt, GBG and peer acceptance, and GBG and aggression, in this study, we explore whether first and second grade peer social preference mediates the GBG effect on risk for future suicide attempts. Additionally, based on theory and prior studies (Kellam et al. 2008), we

hypothesized that the GBG will be especially impactful for children who were reported by teachers to have high classroom aggressive, disruptive behavior, the specific proximal target of the GBG. As part of the hypothesized meditational model, we examine the longitudinal association between childhood peer social preference and the risk of suicide attempts by adulthood, which has not previously been examined.

Methods

Developmental Epidemiological Study Population

This study draws upon longitudinal data gathered from developmental epidemiologically-based randomized preventive trials conducted by the Johns Hopkins Prevention Research Center's (PRC) partnership with the Baltimore City Public Schools (BCPS). Participants were from two consecutive cohorts of first graders totaling 2311 students, 1151 boys and 1160 girls. During the first year of recruitment for each cohort, only 5% of first graders eligible for participation declined to participate (Kellam et al. 2008). The trial was a classroom-based, universal preventive intervention encompassing a total of 19 schools, 41 classrooms within five urban areas. Three or four schools were matched in each of five urban areas by socioeconomic factors, size of school, and ethnicity. These five urban areas varied in socioeconomic status from very poor to lower-moderate income, as well as in ethnicity. The three or four matched schools within each of the five urban areas were then randomly assigned as schools where the GBG (Barrish et al. 1969) would be tested (six), schools where a reading curriculum intervention called Mastery Learning (ML; Block et al. 1976) would be tested independently of the GBG (seven), or schools where no intervention would be tested (six; external control schools). All schools that implemented the GBG had either two or three first-grade classrooms. At the start of the school year, all first grade students were assigned to classrooms in a balanced manner and then all general education (i.e., non-special education) first-grade classrooms, along with their teachers, were randomly assigned to one of the three intervention conditions. Children remained in their intervention condition (GBG n=452; ML n=520 or the standard school program n=1339) for two consecutive years (first and second grades), although their second-grade teachers were different. Teachers in the first cohort of GBG classrooms received 40 hours of training, most of which occurred at the beginning of the program, followed by coaching and mentoring during the course of the first-grade school year. A comparable amount of training, coaching and monitoring was spent with the ML and control classroom teachers but without a focus on classroom behavior management. In the trial's second year, while the first cohort of children was in second grade, a new cohort of first graders was assigned in the same balanced fashion to intervention condition and classroom. For this second cohort, the first-grade teacher remained in the same intervention condition as in the prior year and the intervention first-grade teachers received little retraining, support, or further mentoring and monitoring. The second grade teachers received a similar level of training as the first grade teachers had previously received. More emphasis was placed on training the second-grade teachers new to the GBG who were now teaching the first cohort of children. For more details on the trial design see Kellam et al. (2008) and the Substance Abuse and Mental Health Services Administration's National Registry of Evidence-Based Prevention Programs (NREPP) review of the GBG (http://www.nrepp.samhsa.gov/). These children have been

followed up annually grades 1-8 and again with two complete waves of data collection in young adulthood (approximate ages of 19 and 22). The most recent assessment was at the approximate age of 30-32 years.

The sample for the present study was limited to children who had both peer nomination data in early childhood and data on suicide attempt from young adulthood or adulthood. For childhood participation in assessments, written informed consent was obtained from parents. Consent was again obtained from each participant at the time of the young adult and adult interviews. Of the 2311 participants who consented to participate in the original study, 1552 had peer nomination data (67% of the baseline sample). A total of 2000 participants (86% of the baseline sample) were interviewed during young adulthood and/or adulthood to assess the occurrence of lifetime suicide attempt. Females, African Americans, and children receiving free or reduced school lunches were more likely to have follow-up data. Ten individuals who reported a suicide attempt prior to age 12 were excluded. Therefore our final analytic sample consisted of 1385 participants (60%) out of the original 2311, 71% of whom were African-American, 28% were non-Hispanic white, and almost half (48%) were male. These characteristics are found in Table 1 and are explained in more detail in the results section. The final sample did not differ from those excluded with regard to gender ($p = 0.11$); however, the final sample was more likely to be African American ($p<0.0001$), to receive free or reduced school lunches ($p<0.0001$), and to be in an intervention condition ($p=0.0001$).

The Good Behavior Game (GBG)—The GBG was developed by Barrish et al. (1969) with the purpose of creating a classroom environment that is conducive to learning for all students. The goal is to reduce early aggressive, disruptive behavior at the classroom and individual level, as it is a frequently reported antecedent of later problem outcomes (Kellam et al. 1998; Kellam et al. 2008; Kellam et al. 1994). The Good Behavior Game teachers initially received training and assigned children to one of three heterogeneous teams that contained equal numbers of boys and girls, equal numbers of aggressive, disruptive children, and equal numbers of shy, socially isolated children based on baseline measurements of classroom behavior. The teacher made explicit classroom rules of student behavior and teams were rewarded if, during a particular game period, the team members committed four or fewer infractions of these classroom rules. The GBG was played during those periods of the day when the classroom environment was less structured, such as when the teacher was working with one student or a small group while the rest of the class was instructed to work on assigned tasks independently. During the first weeks of the intervention, the GBG was played three times each week for a period of 10 minutes. The duration of the game increased approximately 10 minutes per game period every 3 weeks, up to a maximum of 3 hours. Initially, the teacher announced game periods, and the rewards were delivered immediately after the game. Later, the teacher initiated the game periods without announcement, and the rewards were delayed until the end of the school day or the end of the week. Over time, the game was played at different times of the day and during different activities. In this manner, the GBG evolved from a procedure that was highly predictable and visible, with a number of immediate rewards, to a procedure with an unpredictable occurrence and location, with deferred rewards. The intervention lasted for 2 years (grades 1 and 2).

Measures

Peer nominations of social preference—Peer social preference was assessed in the spring of second grade for cohort 1 and in the fall and spring of first grade for cohort 2 by peer nomination using two questions modified from the Peer Assessment Inventory (PAI; Pekarik et al. 1976): “Which children do you like best?” and “Which children don't you like?” Both questions were read aloud to the class by trained research staff and children circled pictures of their classmates described by the questions. The PAI was modified to allow children to choose unlimited nominations of classmates for each question. Four-month test-retest reliability coefficients for these items were strong (“like best” $\propto$= 0.69 and “don't like” $\propto$= 0.70). Only the spring measure was used unless only the fall was available (this occurred for only 2 children). The two items were then transformed at the classroom level into percent of nominations received (for example, a score of 0.30 for “don't like” indicates that the child was nominated by 30% of his or her classmates for this item). In accordance with the procedure developed by Coie et al. (1982), these items were then standardized and a continuous measure of social preference was calculated by subtracting the “don't like” score from the “liked most” score. These social preference scores were then standardized again by gender because scores were significantly different between males and females.

Teacher reports of early aggressive, disruptive behavior—Teacher-rated aggressive, disruptive behavior was collected using the Authority Acceptance Scale of the Teacher Observation of Classroom Adaptation – Revised (TOCA-R; Werthamer-Larsson et al. 1991), a structured interview administered by a trained assessor. The authority acceptance subscale contains the following items: 1) breaks rules, 2) harms others and property, 3) breaks things, 4) takes others’ property, 5) starts fights, 6) lies, 7) has trouble accepting authority, 8) yells at others, 9) acts stubbornly, and 10) teases classmates. Items were rated on a 6-point scale (never true to always true) with higher scores reflecting more aggressive, disruptive behaviors. The TOCA-R was administered in the fall and spring of first grade and in the spring of second through seventh grades. In this study, we used the TOCA-R averaged across grades 1 through 3 and then transformed using the log scale due to a positively skewed distribution. A more extensive discussion of the background and psychometric properties are discussed in prior literature (Kellam et al. 1975; Kellam et al. 2008; Werthamer-Larsson et al. 1991). Children were classified as highly aggressive, disruptive or not highly aggressive, disruptive based on a TOCA-R score rating of greater than 2 on the non-transformed scale.

Child self-report of depressive symptoms—The Child Depression Index (CDI; Kovacs 1992) was administered in the fall and spring of first grade for cohort 1. The Baltimore How I Feel - Child Version (BHIF; Ialongo et al. 1999) was administered in the spring of second and third grade for cohort 1 and grades 1 and 2 for cohort 2. At each time point, a mean score of depressive symptoms was generated for each individual. For these analyses, mean depressive scores were averaged across grades 1 through 3. Multiple imputations were used to generate depressive symptoms for five children who were missing CDI data.

Assaultive trauma—Lifetime retrospective report of assaultive trauma exposure was assessed via the Detroit Area Survey (Breslau et al. 1998), which asked participants at ages 22 and 30-32 if have experienced 18 events following the DSM-IV stressor criterion. The events were grouped into two categories: 1) those involving assaultive violence (i.e., raped, badly beaten up, held captive, tortured, or kidnapped, shot, stabbed, mugged, threatened with a weapon, and sexual assault other than rape), and 2) those not involving assaultive violence (e.g., serious car accident, natural disaster, life-threatening illness, learning of a close friend or relative who was attacked, raped or sexually assaulted, learning of the sudden unexpected death of a close friend or relative). Endorsement of an event resulted in questions about number of times experiencing the event and age at each time. Only traumatic events involving assaultive violence were considered in our analyses as was reported earlier in this sample (Wilcox et al. 2009).

Young adult and adult report of suicide attempts—Suicide attempts were assessed as part of the Affective Disorders module of the National Institute of Mental Health Diagnostic Interview Schedule for Children Version 2.3 (NIMH DISC-2.3; Robins et al. 1981; Robins et al. 1994) at the first wave in young adulthood (approximate age of 19). Participants were asked, “Have you ever in your whole life tried to kill yourself? By this I mean actually did something to try to commit suicide, not just talked about it.” At the following two waves (approximate ages of 22 and 30 years), participants were asked the following question from the Composite International Diagnostic Interview (CIDI WHO, 1990): “Have you ever attempted suicide?” Age of suicide attempt was also collected at these two waves. Interviews were conducted by extensively trained assessors. Individuals who reported at least one suicide attempt at any of the three waves were considered to have made an attempt. The youngest age at which a participant reported an attempt was considered the age of attempt.

Analytic procedures

Using the general mediation framework proposed by Baron and Kenny (1986), we followed a set of steps to test the hypothesized meditational model. As part of our analytic plan, we first explored the relations between the proposed mediator (childhood peer social preference) and the outcome (suicide attempt by adulthood). Discrete-Time Survival Analysis (DTSA) methods were used to estimate the relative hazard (RH) of time to suicide attempt, as age of attempt was collected in years (Cox, 1972; Singer et al. 1994; Willett et al. 1993). All survival analyses were conducted using the STATA version 11.0 (StataCorp, 2009) *clogit* command, conditioning on school to account for study design, which clustered students within first grade schools and urban areas. Conditioning on school in this way accounts for non-independence of data within schools, therefore enabling direct comparison of the GBG and ML interventions with their internal controls located within the same school. This approach was employed by the paper on the impact of the GBG on suicide ideation and attempts (Wilcox et al. 2008), and after conditioning many baseline variables have little variability at the classroom level (Brown 1993; Kellam et al. 2008). Accounting for this variation is particularly important when outcomes such as suicide may be influenced by shared social norms and beliefs in a given community that are difficult or impossible to measure.

An investigation of the Kaplan-Meier curves for time to attempt in our sample revealed 10 reported attempts occurring in childhood, prior to the age of 12. Because previous studies have demonstrated that suicide attempts occurring prior to age 12 could be representative of a clinically different subpopulation than attempts occurring in adolescence or later (Tishler et al. 2007), these 10 cases were excluded from our final sample. These early attempts had a mean age at time of attempt of 9.3 (SD=1.34) and were 60% male, 90% black, and 60% with reduced/free meal status (data not shown). Therefore, participants entered the risk set at age 12 and either exited at age of first attempt or, for individuals who did not report an attempt at one of the three follow-up visits, were censored at age at last follow-up interview. The final sample of 1385 participants generated a total of 20,216 person-years.

Univariate DTSA models were run for peer social preference scores predicting suicide attempt. Additional models were run to adjust this univariate estimate for sociodemographic variables and intervention status (i.e., GBG, ML or control). To investigate whether the peer preference association with suicide attempt was not explained by other child characteristics known to be related to suicidal behavior, we then adjusted separately for depressive symptoms, aggressive- disruptive behaviors, and assaultive trauma on the basis of previous research on suicide-related behavior (Brent 1995; Ialongo et al. 2002; Lewinsohn et al. 1994; Wilcox et al. 2008). The purpose of entering these established potential confounders into the prior model separately was to determine whether the estimate of peer preference scores relating to time to first attempt would change significantly or in a meaningful way. For each potential confounder that was found to be influential, we further explored how to best include it in the final model. In this way, we move on to the mediation analysis with the most parsimonious model possible. A final model was run for peer social preference scores predicting suicide attempt adjusting for average depressive symptoms in grades 1-3 and lifetime report of assaultive trauma.

Next, we tested the mediation between GBG effects and suicide attempt by childhood peer preference scores. To test for the significance of the mediation effect, we applied the product of coefficients approach. In our model, path A relates treatment condition (GBG versus control condition) to preference and path B relates preference to hazard of first suicide attempt. Based life on course/social field theory and previous research, an interaction term between GBG and highly aggressive, disruptive status was included to evaluate moderation in the path A along with the main effects. The test requires significance of both A and B paths of the mediation pathways as well as the product of the two coefficients. A significant indirect effect would imply a causal relation in which the treatment impacted the mediating variable, which in turn impacted the outcome variable. To account for the non-normal distribution nature of the estimate of the product of the two regression coefficients, an R program named PRODCLIN coupled with an external macro compiled in Fortran, both developed by MacKinnon and colleagues (MacKinnon et al. 2007), were used. If the 95% confidence interval estimate generated by the program does not contain zero, it would indicate a significant mediation pathway at the level of significance of 0.05.

Results

Characteristics of the sample

Table 1 presents characteristics of the baseline, follow-up, and the final analytic sample – including the cumulative incidence of suicide attempt by the time of the adulthood interview, as well as unadjusted relative risk estimates for all covariates. In our sample, 120 participants (9%) made a suicide attempt by adulthood. The average age of first suicide attempt was 16, with reported age ranging from 12 to 30. Seventy five percent of attempts were prior to age 18, with only ten percent occurring after age 20. The mean age of attempt for males was 17.4 years and 15.8 years for females. Females were 1.65 times more likely to make a suicide attempt compared to males ($p = 0.008$), with the mean reported age being over 1.5 years younger than males (1.63 years difference, 95% CI [0.20-3.05]; t=2.28, 64.7df, $p = 0.026$). Suicide attempt rates among African Americans were 38% lower than other racial groups ($p = 0.021$). Rates did not vary significantly by free or subsidized lunch status ($p = 0.081$) or cohort ($p = 0.159$). Four participants from the entire sample died by suicide; however, none of these individuals were included in our final analytic sample because they were missing peer preference information, follow-up self-report information on suicide attempts, or both. Of these four participants, none were assigned to the GBG as first graders, one was assigned to the ML condition and three were assigned to the control condition. Nearly 40% of participants were characterized as highly aggressive, disruptive according to their average scores across first, second, and third grades. These children were not more likely to make a suicide attempt than their non-aggressive, disruptive counterparts by adulthood ($p = 0.073$) although this could be considered ‘marginally’ significant.

Peer social preference scores and suicide attempt risk

Mean scores and standard deviations of percent positive nominations, percent negative nominations and peer social preference scores for the overall sample and by gender are presented in Table 2. The average child received positive (“like best”) nominations from 30% of his or her classmates and negative (“don't like”) scores from 25%. Because these distributions were highly skewed to the right, peer social preference scores were calculated from the standardized nomination measures with a mean of approximately zero and a standard deviation of 1.74, prior to being standardized by gender.

Nominations and peer preference scores differed by gender. For males, mean scores and standard deviations for percent positive nominations, percent negative nominations and social preference scores were: 0.27 (0.17), 0.29 (0.19), −0.38 (1.68), respectively. For females, mean scores and standard deviations for percent positive nominations, percent negative nominations and social preference scores were: 0.32 (0.19), 0.21 (0.17), 0.38 (1.71), respectively. Therefore, in our analyses we standardized the peer preference scores reported in Table 2 by gender, both to incorporate gender differences and to make the estimates in the models more interpretable.

We estimated relative risk of a suicide attempt in relation to peer social preference scores. Three models are presented in Table 3. Model 1 is unadjusted for covariates; Model 2 adjusts for gender, race, free or subsidized lunch status, cohort, and intervention assignment;

Model 3 is adjusted for covariates in Model 2 as well as average depressive symptoms in grades 1-3 and lifetime report of assaultive trauma.

The unadjusted relative risk estimate for suicide attempt was 0.80 (95% CI [0.67, 0.96], p = 0.014) for Model 1. After adjusting for socio-demographic covariates, cohort and intervention status, estimates indicate that for one standard deviation increase in social preference scores, odds for first suicide attempt significantly decreased by 21% (RR = 0.79, 95% CI [0.66, 0.94], p = 0.007; Model 2). We then included potential confounders related to suicide risk in Model 2 (i.e., depressive symptoms, assaultive trauma, and aggressive, disruptive behaviors). The relationship between peer social preference scores and relative risk of suicide attempt remained statistically significant after adding depressive symptoms (RR = 0.80, 95% CI [0.67, 0.96], p = 0.016) and assaultive trauma (RR = 0.79, CI [0.67, 0.94], p = 0.009) separately to Model 2; however, when aggressive, disruptive behaviors was included, the estimate for peer preference became non-significant (RR = 0.83, 95% CI [0.67, 1.02], p = 0.080; data not shown in Table 3). Therefore Model 3 examining peer preference scores and suicide attempt risk was adjusted for covariates in Model 2 as well as average depressive symptoms in grades 1 through 3 and lifetime report of assaultive trauma, but not aggressive, disruptive behavior as we wished to investigate a possible interaction. Estimates in Model 3 indicate that for one standard deviation in peer social preference scores, odds for first suicide attempt significantly decreased by 19% (RR = 0.81, 95% CI [0.68, 0.96], p = 0.017). The parameter estimate of one unit increase in average depressive symptoms over grades 1 through 2 and the relative risk of suicide attempt was not significant (RR = 1.50, 95% CI [0.78, 2.88], p = 0.222); however, lifetime report of assaultive trauma was significantly related to risk for suicide attempt (RR = 2.44, 95% CI [1.65, 3.61], $p < 0.001$).

To examine the role of aggressive, disruptive behavior in the relationship between peer social preference and suicide attempt, we stratified the model by characterizing individuals as highly aggressive, disruptive or not based on their TOCA-R scores (n=510; Table 4, Model 4). The relationship between peer social preference scores and suicide attempt was statistically significant in the fully adjusted model among those characterized as highly aggressive, disruptive in grades 1-3 (RR = 0.72, 95% CI [0.53, 0.98], p = 0.038), but was not significant among individuals not characterized as aggressive, disruptive (RR = 0.95, 95% CI [0.72, 1.25], p = 0.702).

Due to the results from Model 4, we included an interaction term to capture differences in the impact of peer social preference scores on time to attempt by level of aggressive, disruptive behavior (Table 4, Model 5). The interaction term itself was non-significant (RR = 0.76, 95% CI [0.51, 1.13], p = 0.175); however, the estimated decrease in the risk of suicide attempt among those characterized as highly aggressive, disruptive with one standard deviation increase in preference score was 29% (RR = 0.71, 95% CI [0.54, 0.96], p = 0.025; see table footnote). The relationship was not significant among those not characterized as highly aggressive, disruptive with one standard deviation increase in preference score (RR = 0.94 [0.72, 1.23], p = 0.667; Table 4). Again, as in Model 4, this finding indicates that the relationship between peer social preference scores and suicide attempt is limited to aggressive, disruptive children.

Peer social preference scores as a mediator in the relationship between the GBG and suicide attempt

The mediation analyses were conducted on the entire sample and included an interaction term with the dichotomous highly aggressive, disruptive variable and social preference scores when estimating the regression coefficient relating social preference to hazard of first attempt. Because we estimated that the decrease in risk of suicide attempt was significant only in the highly aggressive, disruptive children, we focus here on the estimates for this high-risk group. Additionally, we included an interaction term between GBG and highly aggressive, disruptive status, whereas the ML condition was entered alone. The estimate of the A-path regression coefficient, which relates treatment condition (GBG versus control condition) to preference, was 0.25 with a standard error of 0.12 ($p = 0.049$), indicating that children assigned to the GBG had social preference scores approximately 0.25 standard deviation higher than controls. The estimate of the B-path regression coefficient (on a log scale), which relates preference to hazard of first suicide attempt, was −0.39 with a standard error of 0.16 ($p = 0.013$). In other words, for one standard deviation increase in social preference scores, odds for first suicide attempt significantly decreased by 32% (RR=0.68). These values were entered in the PRODCLIN program (MacKinnon et al., 2007) to obtain the lower and upper 95% confidence limits of −0.2418 and −0.0006 for the unadjusted model conditioning on school. The model adjusting for sociodemographic characteristics and conditioning on school was not statistically significant by conventional standards (confidence limits of −0.2150, 0.0032). Since the confidence interval for the unadjusted model did not contain zero, it indicated a statistically significant mediation impact with peer preference partially mediating the relation between GBG exposure and time to first suicide attempt.

Discussion

The Good Behavior Game (GBG), an early elementary school universal preventive intervention, has been shown to reduce future risk for suicide attempt (Wilcox et al., 2008). The GBG targets aggressive, disruptive behaviors through socializing children into the student role and providing opportunities to enhance their own and their classmates' social adaptation to classrooms and peer groups. The findings from this study suggest that being socially integrated and accepted in early development may be an important mechanism underlying the lower risk for suicide attempts later in life. This appears to be the case among highly aggressive, disruptive children. This study suggests that the GBG mechanism inducing greater social acceptance and integration plays an important underlying role in GBG impact among aggressive disruptive children although other GBG mechanisms may also be at work. The mediation results were relatively modest and focused on suicide attempts, a relatively rare outcome. Given that GBG is currently being broadly implemented, conducting future studies with larger samples is important for the replication of our results.

The impact of the GBG on reducing aggressive, disruptive behavior has received much attention yet our work points to possible social benefits of the GBG in terms of peer relations. The GBG is specifically directed at aggressive disruptive classroom behavior, a maladaptive response to the social task demands of the first grade classroom. However, an

essential element of GBG is the social integration of children into teams. The analyses reported here suggest that the social integration of aggressive disruptive children may have long-lasting importance to their life course.

The GBG intervention implemented in first grade is very early along the life course and appears to reduce future risk for suicide attempts. Our results also suggest that at least some suicide attempts have an etiology extending back to childhood. These results point to 1) the need to examine the etiology of suicide earlier in the life course; 2) the potential for suicide prevention can be realized much earlier than the immediate stage of life when suicide attempts occur. The NAASP, the public-private partnership advancing the National Strategy for Suicide Prevention, developed a prioritized research agenda for suicide prevention that provided estimates of the effects of wider deployment of existing or hypothetical evidence-based interventions in reducing suicide. The GBG was one of a few evidence-based interventions included. Using a model based on data from Wilcox and colleagues (2008), Francis Lynch estimated the potential population health outcomes related to suicidal behaviors that could be achieved through expanded implementation of the GBG. It was projected that if 25% of all first grade children in the United States (~ 1 million children) received the GBG with optimal effects and this is repeated for 15 first grade cohorts 12% of attempts will be averted, or 542,096 attempts requiring medical care (ages 13-22). Of relevance to the findings reported here, it was also noted that “The precise modeling of mediating effects could be conducted with GBG for future population benefits.”

Aside from the modest magnitude of the mediation association, a few other study limitations merit attention. First, peer social preference (liked minus disliked nominations received) was used to operationalize peer sociometric status because it incorporates both positive and negative nominations received from peers. Social peer preference is commonly used in developmental research to capture peer status (Coie et al. 1982; Newcomb et al. 1983). This construct of peer sociometric status tends to be stable over time (Jiang et al. 2005) and can be incorporated easily in advanced statistical analyses (Cillessen et al. 2004). However, the categorical approach, which characterizes children into five mutually exclusive groups – popular, rejected, socially neglected, controversial or average (for reviews see Cillessen et al. 2000; 2004) – may better capture nuances in peer relations. This categorical approach was considered; however, due to low frequencies in several categories, analyses were not possible. It is worth noting that ‘socially neglected’ children who do not have friends but are not necessarily disliked are not differentiated from ‘controversial’ children who have high social visibility because they receive both liked and disliked nominations (Bukowski et al. 2000). Assessment of suicide attempt risk of individuals characterized as socially neglected and controversial as children may be important, but this type of an approach lends itself to a larger sample size in order to determine the nuances that might exist. Second, while results suggest that highly aggressive, disruptive children assigned to the GBG intervention had higher peer social preference scores than children assigned to the control group, pre- and post-intervention comparisons were not possible given that peer social preference was only assessed at one point for a large portion of the sample. Third, it is unclear if the social gains were maintained throughout development.

Despite these limitations, the study makes several contributions to the literature. This is the first study to identify, using mediation analyses, a possible mediator (peer social preference) in the association between the GBG and suicide attempt. This is also the first study to identify a link between childhood social adaptation and risk for suicide later in life. While a large body of literature consistently demonstrates the impact of childhood peer relations on later development, previous studies have not examined the role of childhood peer social preference and the risk for suicide attempt later in life. It is believed that social integration represents a malleable risk factor for suicide attempt and an important target for suicide prevention interventions (see the CDC's 2009 Strategic Direction for Suicide Prevention).

The GBG was mentioned in the 2012 revision of the National Strategy for Suicide Prevention as “An example of a coordinated approach addressing multiple issues that share risk and protective factors...” Our results show that directing a universal intervention at the first grade classroom to improve socializing children into the role of student and classroom behavior management has both immediate and long-term benefits on a range of outcomes including suicide attempt (Kellam et al. 2008). This is especially true for those at higher levels of aggressive, disruptive behavior early in first grade, a group at high risk for continuing later problem behavior (Kellam et al. 1998; 2008). Providing teachers with methods for classroom behavior management as well as tools to socialize children to the student role appear to reduce risk at least through early adulthood which underlines the importance to public health of this early universal intervention.

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Table 1

Sample description and estimated relative risk and lifetime suicide attempt

-	Baseline	Follow-Up	Final Sample	Suicide Attempt among Final Sample				
	(*n*= 2311)	(*n*= 2000)	(*n*= 1385)	Incident cases	Incidence Rate (per 10,000 pys)[a]	RR[a]	95% CI	*p*-Value
Gender								
Male	1151 (50%)	942 (47%)	671 (48%)	43	44.33	1.00		
Female	1160 (50%)	1058 (53%)	714 (52%)	77	73.22	1.65	(1.14-2.40)	0.008**
Race								
Non-Black	797 (34%)	621 (31%)	399 (29%)	47	87.00	1.00		
Black	1514 (66%)	1379 (69%)	986 (71%)	73	49.28	0.57	(0.39-0.82)	0.021**
Free or partially subsidized lunch								
No	1095 (47%)	922 (46%)	599 (43%)	61	71.97	1.00		
Yes	1216 (53%)	1078 (54%)	786 (57%)	59	50.25	0.74	(0.52-1.04)	0.081*
Cohort								
1 (1985-1986)	1196 (52%)	1020 (51%)	630 (45%)	66	56.03	1.00		
2 (1986-1987)	1115 (48%)	980 (49%)	755 (55%)	54	43.79	0.78	(0.55-1.10)	0.159
Intervention Status								
Control	1339 (58%)	1163 (58%)	781 (56%)	80	57.15	1.00		
ML	520 (22%)	437 (22%)	296 (22%)	19	36.58	0.64	(0.40-1.03)	0.065*
GBG	452 (20%)	400 (20%)	308 (22%)	21	42.70	0.75	(0.48-1.17)	0.199
Highly aggressive, disruptive children								
No	1362 (59%)	1180 (65%)	875 (63%)	70	43.58	1.00		
Yes	805 (35%)	708 (35%)	510 (37%)	50	59.72	1.37	(0.97-1.94)	0.073*

[a]Relative risk estimates are not adjusted for covariates (gender, race, free or subsidized lunch status, and intervention status).

*$p<0.10$

**$p<0.05$.

Table 2

Peer preference descriptives

	Overall Sample			Males			Females		
	***n*=1385**			***n*=671**			***n*=714**		
	Mean (std)	**Median (min, max)**	**Interquartile Range**	**Mean (std)**	**Median (min, max)**	**Interquartile Range**	**Mean (std)**	**Median (min, max)**	**Interquartile Range**
Like Best[a]	0.30 (0.18)	0.27 (0.0, 0.89)	0.17, 0.43	0.27 (0.17)	0.25 (0.0, 0.89)	0.14, 0.38	0.32 (0.19)	0.29 (0.0, 0.88)	0.17, 0.45
Don't Like[a]	0.25 (0.19)	0.21 (0.0, 0.94)	0.12, 0.35	0.29 (0.19)	0.26 (0.0, 0.94)	0.15, 0.41	0.21 (0.17)	0.17 (0.0, 0.88)	0.08, 0.30
Preference[b]	0.01 (1.74)	0.01 (−5.32, 4.60)	−1.13, 1.19	−0.38 (1.68)	−0.42 (−5.32, 4.60)	−1.46, 0.75	0.38 (1.72)	0.41 (−4.70, 4.43)	−0.79, 1.59

[a] Percent nominations received from classmates for item.

[b] Calculated from subtracting standardized percent nominations for “Don't Like” from standardized percent nominations for “Like Best.”

Table 3

Relative odds of suicide attempt in relation to peer social preference scores, estimated using Discrete Time Survival Analysis (n=1385)

	Model 1[a]			Model 2[b]			Model 3[c]		
	Relative odds estimate	**95% CI**	***p*-Value**	**Relative odds estimate**	**95% CI**	***p*-Value**	**Relative odds estimate**	**95% CI**	***p*-Value**
Social Preference	0.80	(0.67-0.96)	0.014**	0.79	(0.66-0.94)	0.007**	0.81	(0.68-0.96)	0.017**
Gender									
Male	-	-	-	1.00			1.00		
Female	-	-	-	1.81	(1.24-2.65)	0.002**	1.84	(1.25-2.71)	0.002**
Race									
Non-Black	-	-	-	1.00			1.00		
Black	-	-	-	0.32	(0.14-0.71)	0.005**	0.30	(0.13-0.69)	0.004**
Free or partially subsidized lunch									
No	-	-	-	1.00			1.00		
Yes	-	-	-	0.82	(0.49-1.37)	0.453	0.78	(0.46-1.31)	0.344
Cohort									
1 (1985-1986)	-	-	-	1.00			1.00		
2 (1986-1987)	-	-	-	0.64	(0.44-0.93)	0.020**	0.56	(0.34-0.91)	0.021**
Intervention									
Control	-	-	-	1.00			1.00		
GBG				0.63	(0.34-1.16)	0.135	0.65	(0.35-1.20)	0.166
ML	-	-	-	0.80	(0.42-1.52)	0.504	0.79	(0.41-1.49)	0.463
Depressive symptoms		-	-	-	-	-	1.45	(0.76-2.74)	0.260
Assaultive trauma									
No	-	-	-	-	-	-	1.00		
Yes	-	-	-	-	-	-	2.50	(1.69-3.68)	<.001***
Missing	-	-	-	-	-	-	0.81	(0.29-2.25)	0.684

* $p<0.10$

[a] Unadjusted.

[b] Adjusted for gender, race, free or subsidized lunch status, cohort, and randomized intervention assignment.

[c] Adjusted for all variables in Model 2 as well as average depressive symptoms in grades 1 -3 and lifetime report of assaultive trauma.

** $p<0.05$

*** $p<0.001$

Table 4

Relative odds of suicide attempt in relation to peer social preference scores and aggressive, disruptive level, estimated using Discrete Time Survival Analysis (n=1385)

	Model 4[a]						Model 5[b]		
	Not Highly Aggressive (*n*=875)			Highly Aggressive (*n*=510)			(*n*=1385)		
	Relative odds estimate	95% CI	*p*-Value	Relative odds estimate	95% CI	*p*-Value	Relative odds estimate	95% CI	*p*-Value
Social Preference	0.95	(0.72-1.25)	0.702	0.72	(0.53-0.98)	0.038**	0.94	(0.72-1.23)	0.667
Highly Aggressive	-	-	-	-	-	-	1.05	(0.64-1.71)	0.859
Social Preference X Highly Aggressive[c]	-	-	-	-	-	-	0.76	(0.51-1.13)	0.175
Gender									
Male	1.00			1.00			1.00		
Female	1.41	(0.84-2.38)	0.194	2.68	(1.44-4.97)	0.002**	1.88	(1.26-2.81)	0.002**
Race									
Non-Black	1.00			1.00			1.00		
Black	0.50	(0.16-1.61)	0.246	0.16	(0.04-0.62)	0.008**	0.30	(0.13-0.69)	0.005**
Free or partially subsidized lunch									
No	1.00			1.00			1.00		
Yes	0.65	(0.32-1.34)	0.246	0.84	(0.37-1.92)	0.686	0.77	(0.46-1.30)	0.332
Cohort									
1 (1985-1986)	1.00			1.00			1.00		
2 (1986-1987)	0.51	(0.27-0.99)	0.046**	0.66	(0.29-1.46)	0.304	0.54	(0.33-0.90)	0.018**
Intervention									
Control	1.00			1.00			1.00		
GBG	0.77	(0.34-1.75)	0.534	0.63	(0.22-1.75)	0.372	0.66	(0.36-1.24)	0.197
ML	0.63	(0.28-1.40)	0.252	1.19	(0.35-4.11)	0.781	0.78	(0.41-1.49)	0.453
Depressive symptoms	1.75	(0.76-4.04)	0.190	1.04	(0.37-2.92)	0.948	1.50	(0.78-2.88)	0.222
Assaultive trauma									
No	1.00			1.00			1.00		

	Model 4[a]						Model 5[b]		
	Not Highly Aggressive (*n*=875)			Highly Aggressive (*n*=510)			(*n*=1385)		
Yes	2.95	(1.77-4.92)	<.001***	1.87	(0.99-3.54)	0.055*	2.44	(1.65-3.61)	<.001***
Missing	0.31	(0.04-2.26)	0.246	1.74	(0.48-6.30)	0.400	0.81	(0.29-2.26)	0.694

[a] Adjusted for gender, race, free or subsidized lunch status, cohort, randomized intervention assignment, average depressive symptoms in grades 1-3 and lifetime report of assaultive trauma and stratified by level of aggression.

[b] Interaction model, adjusted for gender, race, free or subsidized lunch status, cohort, randomized intervention assignment, average depressive symptoms in grades 1-3 and lifetime report of assaultive trauma.

[c] Relative odds estimate for effect of peer preference among highly aggressive children in Model 5 obtained using the *lincom* command in STATA: 0.71 (95% CI: 0.54-0.96, *p*-value = 0.025**).

* $p<0.10$

** $p<0.05$

*** $p<0.001$.