Assessing the Relationship Between the Positive Behavior Interventions and Supports Framework and Student Outcomes in High Schools

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Abstract: *The relationship between PBIS implementation fidelity and reductions in student office discipline referrals (ODR) has been relatively well-established in the literature; however, results related to other student outcomes such as suspensions, attendance, and academic performance are not well explored especially at the high school level. The purpose of this study was to examine the relations between PBIS implementation fidelity and student-level behavior (ODR, suspension), attendance (days absent, tardies), and academic (GPA) outcomes in a large sample of 12,127 students from 15 high schools implementing PBIS in a natural context without direct research support. Our findings suggest high schools implementing PBIS with fidelity may see improvements in student outcomes beyond reductions in ODRs. After controlling for student and school demographic variables, schools which were implementing with higher fidelity in this sample had fewer absences, unexcused tardies, ODRs, and suspensions. This study extends the current literature by exploring typical measures of academic achievement (i.e., GPA) rather than focusing upon only standardized assessments and by examining student-level rather than school-level aggregate outcomes. Notably, results from the current study focus entirely on high school settings and demonstrate desired changes in student-level outcomes in a large sample.*

The positive behavioral interventions and supports (PBIS) framework organizes the implementation of evidence-based practices within schools and districts to maximize student behavioral and academic outcomes (Horner, Sugai, & Anderson, 2010). PBIS is a framework grounded in behavioral principles for matching school and student needs within a tiered continuum of evidence-based practices (Horner & Sugai, 2015; OSEP Technical Assistance Center on PBIS, 2015). PBIS implementation is growing globally and the framework is currently being implemented in all 50 U.S. states and at least 29 countries (George, 2018). Tier 1 includes practices and systems which are available for all students and in all school settings (e.g., establishing, teaching, and reinforcing school-wide behavioral expectations) and meets the needs of most students (approximately 80%) when implemented with fidelity (Simonsen, Sugai, & Negron, 2008). Tier 2 includes more targeted approaches for small groups of at-risk students who could use additional supports (e.g., check in/check out or targeted social skills groups) and meets the needs of approximately 15% of students when implemented with fidelity (Fairbanks, Simonsen, & Sugai, 2008). Tier 3 includes interventions targeted to more intensive needs of those students needing individualized support (e.g., individualized functional assessments and behavioral intervention plans; Fairbanks et al., 2008).

PBIS relies upon four critical implementation elements to organize implementation and increase capacity development: (a) outcomes (e.g., clearly identified academic and behavioral goals), (b) data (e.g., data-based decision-making), (c) systems (e.g., support for staff), and (d) practices (e.g., a continuum of evidence-based strategies to support students; Simonsen et al., 2008). Furthermore, each of these critical areas is informed by contextual considerations which help support successful implementation and sustainability. In other words, the culture and context of the environment impact how these components work in a particular setting and the likelihood that implementation will be successful (Sugai, O'Keeffe, & Fallon, 2012). PBIS implementation fidelity is generally measured by one of three fidelity measures (Tiered Fidelity Inventory [TFI]; School-Wide Evaluation Tool [SET]; Benchmarks of Quality [BoQ]). Each of these measures assesses the extent to which a school team has implemented the core features of PBIS through team interviews and product reviews (Algozzine et al., 2014; Cohen, Kincaid, & Childs, 2007; Sugai, Lewis-Palmer, Todd, & Horner, 2001).

PBIS is recognized as an effective framework for selecting, organizing, and implementing evidence-based practices for reducing school discipline issues (e.g., ODRs) while improving school climate (Horner, Sugai, & Anderson, 2010). Results from randomized control trials show that schools that implement PBIS with fidelity experience reductions in disciplinary rule violations, aggressive behavior, bullying, concentration problems, and also show improvements in prosocial behavior, school climate, attendance, and some academic outcomes (Bradshaw, Koth, Bevans, Ialongo, & Leaf, 2008; Bradshaw, Koth, Thornton, & Leaf, 2009; Bradshaw, Pas, Debnam, & Linstrom Johnson, 2015; Bradshaw, Mitchell, & Leaf, 2010; Bradshaw, Reinke, Brown, Bevans, & Leaf, 2008; Bradshaw, Waasdorp, & Leaf, 2012; Horner et al., 2009; Lindstrom Johnson, Pas, & Bradshaw, 2015).While there is less research focusing on the impact of PBIS implementation on students at risk for failure (Bradshaw et al., 2015), these outcomes are conceptually related to risk factors for high school dropout (Freeman et al., 2015). These results provide promising and consistent evidence of the effectiveness of the PBIS framework for addressing behavioral concerns; the relationship between academic outcomes and behavior is more complex.

PBIS and Academic Outcomes

Lindstrom Johnson, Pas, and Bradshaw (2015) documented a positive overall school climate (i.e., Tier 1) may

contribute to improved school completion outcomes. Other researchers found improvements in behavior are associated with improved academic outcomes for students in general (Algozzine, Wang, & Violette, 2011) and for students with emotional or behavioral disorders (Sanford & Horner, 2013). PBIS has been associated with increases in overall attendance, time spent on classroom instruction, and student engagement during instruction (Horner et al., 2009; Scott & Barrett, 2004), suggesting the relationship between academic performance and PBIS implementation may be an indirect one, related to improvements in behavior and attendance (Lassen, Steele, & Sailor, 2006).

Increasingly, researchers have focused on the connection between behavioral outcomes and students' academic performance, with encouraging results indicating improved academic outcomes when schools implemented PBIS with fidelity (e.g., Kelm, McIntosh, & Cooley, 2014; Madigan, Cross, Smolkowski, & Strycker, 2016; Muscott, Mann, & LeBrun, 2008). In all of these studies, academic achievement was measured only through standardized assessments. It is important to note that only two of these studies (Madigan et al., 2016; Muscott et al., 2008) included high schools in the sample and none exclusively examined high school outcomes.

Unfortunately, other results have been mixed or not as promising (e.g., Caldarella, Shatzer, Gray, Young, & Young, 2011; Freeman et al., 2015; Gage, Sugai, Lewis & Brzozowy, 2015; Horner et al., 2009; LaFrance, 2011; Lane, Wehby, Robertson, & Rogers, 2007). For example, LaFrance (2011) reported there was not an overall statistically significant relationship between the fidelity of implementation of PBIS and school-level achievement in reading and math, but there was an association between academic outcomes and fidelity of implementation for middle schools in reading. Similarly, Gage, Sugai, Lewis, and Brzozowy (2015) examined the relationship between PBIS implementation fidelity and academic achievement across states using propensity score matching. They found no statistically significant relationship between implementation fidelity and academic achievement as measured by statewide tests for math, reading, and writing. Caldarella, Shatzer, Gray, Young, and Young (2011) compared outcomes from two middle schools (one implementing PBIS with fidelity and one not implementing) and found no statistically significant difference in GPA across schools.

A few of these studies (Freeman et al., 2015; Gage et al., 2015; Lane et al., 2007) included high schools in the sample and two (Caldarella et al., 2011; Lane et al., 2007) included GPA as an indicator of academic achievement. In all, the findings on academic gains of PBIS schools are mixed and have often used only statewide standardized achievement tests to measure academic outcomes. Although GPA has limitations with respect to research and is therefore used infrequently in research, it is among the most commonly available indicators of academic performance in high schools, is linked to important long-term outcomes for students, and lends itself to meaningful interpretations of results in high schools.

The High School Context

Overall, the evidence supporting the positive impact of PBIS on student outcomes is promising. However, the vast majority of this research has been conducted in elementary or middle schools. The number of high schools implementing PBIS has grown steadily and now spans 35 states and represents about 13% (3,138) of all U.S. schools implementing PBIS (Freeman, Wilkinson, & VanLone, Nov 2016). Evidence suggests it may take high schools longer to reach fidelity and sustaining strong implementation may be more challenging than in elementary schools (Flannery, Frank, Kato, Doren, & Fenning, 2013; Swain-Bradway, Pinkney, & Flannery, 2015). Researchers have identified unique contextual characteristics that influence the adoption of the PBIS framework at the high school level. Incorporating and expanding on some of the contextual differences originally described by Bohanon and colleagues (2006), Flannery and Kato (2017) suggested three overarching contextual differences: school size, student developmental level, and an organizational culture prioritizing academic growth. These factors directly affect PBIS implementation by impacting the key foundational systems of data, leadership, and communication. For example, the larger size of a typical high school can make the logistics of teaching school-wide expectations and data collection more difficult. The developmental level of the students requires that school leadership teams consider student input and participation in the development of teaching and reinforcement practices. A school culture focusing on academic growth may make it more difficult for teachers to buy in to the need to teach behavioral skills. Therefore, it is critical that outcomes associated with PBIS are carefully examined at the high school level.

PBIS Research in High Schools

The most frequently examined student outcome associated with PBIS implementation fidelity at the high school level is the amount of office discipline referrals (ODR). A number of studies have documented reductions in overall ODRs and in the proportion of students with multiple ODRs (Bohanon et al., 2006; Flannery, Fenning, Kato, & McIntosh, 2014; Muscott et al., 2008). Of these studies, two (Bohanon et al., 2006; Muscott et al., 2008) were non-experimental and involved only a small number (2–4) of high schools. The third study (Flannery et al., 2014) was a large-scale research-supported study. Flannery et al. (2011) found (a) the majority of infractions resulting in ODR at the high school level included tardiness, defiance/disrespect, and skip/truancy; (b) freshman may be more likely to receive an ODR; and (c) students receiving excessive ODRs (more than six) typically receive several early in the school year, suggesting the possibility of early intervention. Using aggregate school-level data rather than student-level outcomes, Freeman et al. (2015) reported schools implementing PBIS with fidelity can expect to see both reductions in ODR rates and increases in average daily attendance.

Other outcomes associated with PBIS implementation fidelity have been reported with less frequency at the high school level. Freeman et al. (2016) examined school-level academic performance and dropout rates, finding that there were not statistically significant relationships between these variables and PBIS implementation, although descriptive data indicated schools implementing PBIS with fidelity for longer periods of time may have lower dropout rates. Bohanon and colleagues (2006) reported reductions in the numbers of in- and out-of-school suspensions in four high schools. A recent randomized, controlled trial at the high school level indicates PBIS implementation is associated with improvements in student perceptions of school climate and school safety (Bradshaw et al., 2014). Additionally, there is some evidence that at the individual level, PBIS practices may be more effective for students with internalizing behavior characteristics and may take more time to be effective for students with comorbid behaviors (Lane et al., 2007).

Gap in the Literature

Overall, the bulk of the experimental research on student outcomes related to PBIS has been conducted in elementary schools. At the high school level, researchers have demonstrated encouraging initial results with respect to the association between PBIS implementation fidelity and reductions in student ODR rates; however, only two of these studies (Flannery et al., 2014; Freeman et al., 2015) were conducted with a larger sample size and only one (Flannery et al., 2014) utilized student-level data. Further, none of these studies included both a larger sample and evaluated the outcomes associated with PBIS under typical (nonresearch supported) implementation conditions.

Findings related to other student outcomes such as suspensions, attendance, and academic performance, especially at the high school level, are not as frequently reported. One nonexperimental study (Bohanon et al., 2006) reported improvements in suspensions in four high schools. Only one high school study (Freeman et al., 2015) included attendance outcomes but used aggregate school-level attendance rather than student-level outcomes. In five studies, authors examined academic outcomes associated with PBIS at the high school level (Freeman et al., 2015; Gage et al., 2015; Lane et al., 2007; Madigan et al., 2016; Muscott et al., 2008) but with mixed results. Of these, four studies included standardized test outcomes (Freeman et al., 2015; Gage et al., 2015; Madigan et al., 2016; Muscott et al., 2008); one also included GPA as an indicator of academic performance (Lane et al., 2007). Only one study (Freeman et al., 2015) focused exclusively on high school outcomes; however, this study examined school-level aggregate measures rather than student-level outcomes. As the implementation of PBIS expands in high schools, it is important to have a complete understanding of the student-level outcomes associated with this framework. In sum, there is a clear need for additional research at the high school level that (a) examines ODR outcomes in larger sample sizes and under typical implementation conditions, (b) reviews other behavioral outcomes such as suspensions, (c) examines outcomes associated with attendance, and (d) examines academic outcomes beyond standardized tests.

Given these gaps in the literature, the purpose of this study was to examine the relationship between PBIS implementation fidelity and student-level behavior, attendance, and academic outcomes in a large sample of 12,127 students from 15 high schools implementing PBIS in a natural context without direct research support. Specifically, we addressed the following research questions:

1. What is the relationship between PBIS implementation fidelity and student ODR and suspension outcomes at the high school level?
2. What is the relationship between PBIS implementation fidelity and student absence and tardy outcomes at the high school level?
3. What is the relationship between PBIS implementation fidelity and student GPA outcomes at the high school level?

Data and Methods

Data

Data were collected on a total of 12,127 students from 15 high schools serving Grades 9–12 located in one midwestern U.S. state. Twelve of the schools were located in the same urban school district and the other three were in separate districts; two were located in rural areas and one in a suburban community. Table 1 details school enrollments and demographic characteristics (i.e., % minority, % free or reduced lunch, % of students with Individualized Educational Programs) for each school.

Procedures

We recruited participating schools through contacts within the Office of Special Education Programs National PBIS Technical Assistance Center and at regional and national conferences. Recruitment flyers were distributed in person at conferences and electronically via email to technical assistance and school-based contacts. Interested schools were invited to email the principal investigator (lead author) for enrollment details. Initial recruitment contacts were made in April 2014 and follow-up emails and phone calls with interested schools took place between April and June 2014.

School principals were asked to sign letters agreeing to participation and a data use agreement. Schools were provided with an Excel spreadsheet template for reporting deidentified extant school data. Once complete, school personnel were asked to upload the spreadsheet via a Qualtrics online survey platform. We asked schools to share the following school-level data: total school enrollment for 2015-2016, Title I status, geographic location, and score on one or more PBIS fidelity monitoring tools (i.e., SET, BoQ, TFI), along with the following student-level data: number of office

Table 1

Frequencies and Percentages of Students Within Each Demographic Group by School

School ID	# of Students	9th Grade	10th Grade	11th Grade	12th Grade	Native American	Asian	African American	Hispanic/ Latino	White	Female	FRL	SPED
1	795	22.9 (182)	27.5 (219)	24.0 (191)	25.5 (203)	2.1 (17)	2.0 (16)	1.1 (9)	2.0 (16)	92.7 (737)	45.4 (361)	37.1 (295)	14.7 (117)
2	343	25.9 (89)	26.5 (91)	23.6 (81)	23.9 (82)	2.3 (8)	3.5 (12)	13.7 (47)	58.9 (202)	21.6 (74)	45.8 (157)	64.7 (222)	22.4 (77)
3	679	37.6 (255)	26.7 (181)	22.5 (153)	13.3 (90)	0.7 (5)	0.7 (5)	76.4 (519)	17.1 (116)	5.0 (34)	36.5 (248)	82.6 (561)	31.2 (212)
4	223	23.8 (53)	27.8 (62)	22.0 (49)	26.5 (59)	27.4 (61)	1.3 (3)	0.4 (1)	0.9 (2)	70.0 (156)	45.3 (101)	43.0 (96)	13.9 (31)
5	1,572	37.5 (589)	24.7 (388)	21.2 (334)	16.6 (261)	1.7 (27)	4.6 (72)	34.9 (548)	43.3 (681)	15.5 (244)	43.0 (676)	70.0 (1,101)	26.0 (409)
6	175	52.0 (91)	17.7 (31)	16.0 (28)	14.3 (25)	2.3 (4)	4.6 (8)	69.1 (121)	9.7 (17)	14.3 (25)	43.4 (76)	68.6 (120)	32.0 (56)
7	879	26.3 (231)	26.5 (233)	23.5 (207)	23.7 (208)	0.7 (6)	7.4 (65)	63.8 (561)	13.2 (116)	14.9 (131)	63.0 (554)	62.6 (550)	17.4 (153)
8	569	30.6 (174)	23.9 (136)	22.0 (125)	23.6 (134)	0.9 (5)	6.3 (36)	54.0 (307)	11.1 (63)	27.8 (158)	53.3 (303)	46.0 (262)	18.5 (105)
9	773	30.9 (239)	23.5 (182)	20.4 (158)	25.1 (194)	- (0)	8.5 (66)	79.9 (618)	3.1 (24)	8.4 (65)	45.1 (349)	73.2 (566)	32.5 (251)
10	1,264	25.6 (323)	24.9 (315)	26.9 (340)	22.6 (286)	1.2 (15)	5.9 (75)	10.2 (129)	51.0 (645)	31.6 (400)	53.4 (675)	56.7 (717)	14.9 (188)
11	1,478	29.3 (433)	24.8 (367)	22.6 (334)	23.3 (344)	0.4 (6)	9.5 (140)	68.3 (1,010)	16.6 (245)	5.2 (77)	50.4 (745)	62.1 (918)	16.9 (250)
12	1,192	38.8 (462)	20.5 (244)	23.4 (279)	17.4 (207)	0.5 (6)	12.9 (154)	28.0 (334)	53.1 (633)	5.5 (65)	49.0 (584)	84.3 (1,005)	23.7 (283)
13	548	25.7 (141)	28.3 (155)	22.4 (123)	23.5 (129)	2.9 (16)	3.8 (21)	11.1 ()61	22.1 (121)	60.0 (329)	47.6 (261)	45.3 (248)	12.6 (69)
14	1,044	33.3 (348)	24.7 (258)	23.3 (243)	18.7 (195)	- (0)	2.2 (23)	92.9 (970)	2.1 (22)	2.8 (29)	45.0 (470)	78.9 (824)	24.3 (254)
15	593	31.2 (185)	27.2 (161)	24.6 (146)	17.0 (101)	0.2 (1)	5.7 (34)	90.4 (536)	1.2 (7)	2.5 (15)	43.2 (256)	85.7 (508)	26.8 (159)
All	12,127	31.3 (3,795)	24.9 (3,023)	23.0 (2,791)	20.8 (2,518)	1.5 (177)	6.0 (730)	47.6 (5,771)	24.0 (2,910)	20.9 (2,539)	48.0 (5,816)	65.9 (7,993)	21.6 (2,614)

Note: FRL = Free/Reduced Lunch. SPED = Special Education.

discipline referrals, number of in- and out-of-school suspensions, number of days absent, total number of excused and unexcused tardies, overall GPA, student grade level, gender, race, free/reduced lunch status, and disability status. Parent and student consents were not required because all data were deidentified. All recruiting, data collection, storage, and analysis procedures were approved by our institutional review board.

Measures

To assess the relationships between PBIS implementation fidelity and student behavior, absences, and academics, we used the measures detailed by school in Table 2 and described below.

Implementation fidelity. All participating schools submitted the Benchmarks of Quality (BoQ; Cohen, Kincaid, & Childs, 2007; Kincaid, Childs, & George, 2005) as their PBIS fidelity measure. The BoQ is a self-report measure completed by the school leadership team and school and district coaches. The measure includes 53 items related to areas of faculty commitment, establishing expectations, development of lesson plans, procedures for acknowledgement of positive behavior and handling inappropriate behavior, data entry and analysis, an overall implementation plan, crisis plan, and evaluation. Team members complete the team member rating form independently and the coach or facilitator completes the scoring form using the scoring guide and rubric (Kincaid, Childs, & George, 2010). The BoQ has the following psychometric properties: internal consistency a = .96; test-retest reliability r = .94; inter-rater agreement averaged 89%. Schools that meet 70% of criteria on the overall BoQ are considered to be implementing with fidelity

Table 2

Means and Standard Deviations for BoQ and Each Outcome Variable by School

School ID	# of Students	BOQ Score	GPA	Absences	ODRs	Excused Tardies	Unexcused Tardies	Suspensions
1	795	0.83	-	9.776 (12.161)	4.140 (8.141)	-	-	-
2	343	0.92	2.236 (0.813)	14.528 (17.656)	0.430 (1.727)	1.230 (2.442)	3.660 (9.673)	0.100 (0.414)
3	679	0.32	1.701 (0.868)	45.193 (38.271)	7.700 (12.389)	0.570 (1.510)	22.080 (19.724)	1.120 (2.000)
4	223	0.88	2.861 (0.861)	15.092 (15.608)	2.020 (5.351)	-	-	-
5	1,572	0.90	1.744 (0.877)	27.606 (28.763)	1.180 (2.539)	0.950 (1.937)	0.820 (2.291)	0.330 (0.891)
6	175	0.82	1.818 (0.880)	17.786 (20.474)	3.310 (5.638)	0.660 (1.117)	12.440 (19.881)	0.510 (1.039)
7	879	0.90	2.483 (0.814)	16.976 (20.258)	0.760 (2.160)	2.380 (5.403)	9.810 (14.105)	0.100 (0.494)
8	569	0.94	2.483 (0.793)	10.529 (13.221)	0.430 (1.833)	1.710 (2.750)	3.620 (8.230)	0.090 (0.413)
9	773	0.86	1.841 (0.937)	24.846 (27.151)	0.890 (2.183)	0.960 (2.066)	6.140 (9.003)	0.230 (0.653)
10	1,264	0.90	2.809 (0.867)	9.699 (14.049)	0.350 (1.976)	0.310 (1.553)	6.430 (10.900)	0.070 (0.515)
11	1,478	0.87	2.155 (0.837)	14.676 (18.874)	1.040 (2.509)	0.500 (1.186)	3.760 (6.023)	0.150 (0.524)
12	1,192	0.66	1.680 (1.032)	37.779 (39.890)	1.640 (3.437)	0.270 (0.687)	5.690 (7.962)	0.670 (1.610)
13	548	0.81	-	11.154 (13.759)	1.100 (6.167)	-	-	-
14	1,044	0.61	1.483 (0.835)	39.909 (34.176)	3.230 (5.263)	0.260 (0.667)	6.930 (9.444)	0.840 (1.531)
15	593	0.51	1.695 (0.795)	42.084 (35.357)	1.350 (2.217)	0.140 (0.524)	6.790 (9.754)	0.570 (1.077)

Note: After the second column, numbers outside of parentheses are means and numbers inside of parentheses are standard deviations. ODRs = Office Discipline Referrals.

(Cohen et al., 2007). The mean BoQ score in this sample was 78.2% (SD = 17.841; Min = 32.0, Max = 94.0), with 11 schools scoring above 70%.

Absence. Student absence was measured using the total number of days absent per student. In this sample, the mean number of absences was 23.514 (SD = 29.078; Min = 0, Max = 169, ICC = 0.190). As a secondary measure of attendance, we also collected and analyzed tardies per student. In 12 schools, we were able to differentiate between excused (Mean = .760, SD = 2.248, Min = 0, Max = 63, ICC = 0.087) and unexcused tardies (Mean = 6.330, SD = 11.213, Min = 0, Max = 150, ICC = 0.230). These measures were all positively skewed, as most students do not have a high numbers of tardies/absences. The students with high numbers of tardies/outcomes were retained in the sample for the analyses because the number of outliers was not negligible. Additionally, these students were retained to maintain the generalizability of the results, at the cost of potentially worsening model fit.

Behavior. The primary measure of student behavior was the number of ODRs received per student. The mean number of ODRs per student was 1.800 (SD = 5.046, Min = 0, Max = 116, ICC = 0.146)). In 12 schools, we were also able to examine school suspensions per student (combined in- and out-of-school; Mean = .380, SD = 1.105, Min = 0, Max = 15, ICC = 0.096). Similar to the absence outcomes, these outcomes were positively skewed due to most students not having a high number of ODRs/suspensions. The number of students with high numbers of ODRs/suspensions was again not trivial, so were retained in these models to preserve generalizability.

Academics. To assess student academic achievement, we used the student's cumulative grade point average (GPA), an indicator of a student's current academic performance, college and career readiness, and predictor of postschool outcomes (Geiser & Santelices, 2007; Hodara & Lewis, 2017). Cumulative GPA was recorded on a scale ranging from 0.0 = F to 4.0 = A. The mean GPA in our sample was 2.034 (SD = .974, Min = 0, Max = 4.000, ICC = 0.216). While all schools reported GPA, two schools reported a weighted GPA and were excluded from the model.

Demographics. To reduce potential bias in our model estimates due to omitted confounding variables (such as differences in demographic information), we used five demographic variables as controls (see Table 1). All demographic data were obtained directly from school records. The first demographic variable was student grade level (e.g., 9^{th}–12^{th} grades). The second demographic variable was race (e.g., American Indian/Alaskan Native, Asian, African American, Hispanic/Latino, White). The third demographic variable was gender (dichotomously as reported to the school). The fourth demographic variable, used here as a proxy for socioeconomic status, was free and reduced lunch status. The final demographic variable was special education status, used to control for the effects of individualized educational supports or challenges on the relation between PBIS implementation and student-level outcomes.

Analysis

To assess the relationship between school-wide PBIS fidelity and student-level outcomes, multilevel modeling was performed using Stata 15 software (StataCorp, 2017). We used restricted maximum likelihood (REML) estimation with the Kenward-Roger correction to reduce the bias in model estimates and standard errors that can occur with full information maximum likelihood (FIML) estimation when there are fewer than 30 clusters (McNeish & Stapleton, 2016). In total, six different student-level outcomes were included in the analyses. The outcomes available from all 15 schools included number of absences and number of ODRs. GPA data were included from 13 schools, and the outcomes available from only 12 schools included number of excused tardies, number of unexcused tardies, and number of suspensions. Table 2 provides descriptive summaries of all analysis variables. Multilevel modeling was utilized because the intraclass correlation coefficients (ICCs) for each of the outcome variables were nonzero (see descriptives above), indicating the observations on each of the outcomes may not be independent (Raudenbush & Bryk, 2002).

Student-level demographic variables were included in the first level of each model to serve as control variables. These were all treated as fixed effects, while the intercept was allowed to randomly vary across clusters (schools). Grade was represented by three dummy-coded binary variables indicating whether the student was in 10^{th}, 11^{th}, or 12^{th} grade (with 9^{th} grade specified as the referent group). Race was represented by four dummy-coded binary variables indicating whether the student was American Indian/Alaskan Native, Asian, African American, Hispanic/Latino (with White specified as the referent group). Gender was represented by a dummy-coded variable indicating whether the student was female (with male specified as the referent group). Free or reduced lunch was represented by a dummy-coded binary variable indicating whether the student was eligible for free and reduced lunch (FRL; with the baseline being not eligible), and special education status was represented by a dummy-coded binary variable indicating whether the student had an individualized education program (IEP; with the baseline being not having an IEP).

At the second level (the school level) of each model, the school-wide PBIS fidelity score (BoQ) was included as a predictor of the randomly varying intercept. The fidelity variable was centered to aid in interpretation of the regression coefficients because the original range of scores did not include zero. The value of 70% was used to center the fidelity variable rather than the grand mean (78.2%) so the variable was centered on the BoQ score used as the cutoff to indicate satisfactory fidelity of implementation had been achieved. In addition, school size and percentage of students eligible for FRL were considered as school-level covariates.

Preliminary models, which included only one level-two predictor at a time, were evaluated for each outcome (still including all of the student-level covariates) to assess whether the level-two covariates were related to each

of the outcomes. School size did not have a statistically significant relationship with any of the outcomes in these preliminary models. Percentage of students eligible for FRL had a statistically significant relationship with GPA, number of absences, number of excused tardies, and number of suspensions. The cluster level correlations were also evaluated between the BoQ scores, school size, and percentage of students eligible for FRL. The BoQ scores were not correlated with school size ($r = 0.045$, $p = 0.875$), but they were correlated with the percentage of students eligible for FRL ($r = -0.653$, $p = 0.008$). Based on these results, it did not seem likely that school size was a confounder of the relationship between BoQ scores and the outcomes, and so it was not included as a level-two covariate in the final models. However, the percentage of students eligible for FRL was included as a grand-mean centered level-two covariate predicting the random intercept in the final models for those outcomes.

Equation 1 represents the general form of the first level of the final multilevel models used in this study, and Equation 2 represents the second level of the multi-level models.

$$Y_{ij} = \beta_{0j} + \beta_1 G10_{ij} + \beta_2 G11_{ij} + \beta_3 G12_{ij} + \beta_4 Eth1_{ij} + \beta_5 Eth2_{ij} + \beta_6 Eth3_{ij} + \beta_7 Eth4_{ij} + \beta_8 Gender_{ij} + \beta_9 FRL_{ij} + \beta_{10} SPED_{ij} + r_{ij} \quad (1)$$

$$\beta_{oj} = \gamma_{00} + \gamma_{01} Fidelity_j + \gamma_{02} PercFRL_j + u_{0j} \quad (2)$$

The only model with a notable amount of missing data was the model for GPA. In the model for GPA, 147 students were excluded due to missing data on either the outcome or the demographic variables (leaving 10,637 of the original 10,784 students in those 13 schools). The reason for missing GPA for these students' data is unknown. For the remaining two models for outcomes in all 15 schools, there were only three students excluded in each model due to missing data (leaving 12,124 students). For the three models for outcomes in 12 schools, there were no missing data (10,561 students).

The conceptual model suggests academic improvements related to PBIS implementation would be due to increased instructional time gained from fewer behavioral incidents and improved attendance. However, it was not possible to conduct a mediation analysis to examine the indirect effects of PBIS fidelity on academic outcomes through attendance and behavioral outcomes because academic, attendance, and behavioral variables were measured concurrently.

Results

To test the hypothesis that school-wide PBIS implementation fidelity was related to each behavioral, attendance, and academic student-level outcome, we examined the linear regression coefficient corresponding to the fidelity score in each of the models for statistical significance. Results are presented by research question here and in Table 3 below.

> Research Question 1: What is the relationship between PBIS implementation fidelity and student ODR and suspension outcomes at the high school level?

We found statistically significant relationships for both behavioral outcome variables (ODRs: $\gamma_{01} = -0.060$, $p = 0.022$; suspensions: (ODRs: $\gamma_{01} = -0.011$, $p = 0.018$). Results suggest for each one unit increase in PBIS fidelity, students received 0.060 fewer ODRs and 0.012 fewer suspensions.

The practical significance of our findings can be evaluated by applying our findings to the mean values in our sample. The mean PBIS fidelity score in our sample was 78.2%. Our results predict increasing 10 points in fidelity would result in a reduction of .6 office discipline referrals per student. The mean ODR per student in our sample was 1.800, indicating that a 10-point increase in fidelity would predict a mean ODR of just 1.200 per student. Similarly, the mean number of suspensions per student in our sample was 0.380. A 10-point increase in fidelity would predict a reduction in this mean to 0.260. Given the significant impact suspensions can have on a student's academic career, this is likely a meaningful change.

Table 3

Model Results for the Multilevel Linear Model Estimated Separately for Each Outcome Variable

	Intercept			Fidelity			% FRL			Intercept Variance		Level-1 Variance	Number of Students (Schools)
Outcome	γ_{00}	*SE*	*p*	γ_{01}	*SE*	*p*	γ_{02}	*SE*	*p*	τ_{00}	*p*	σ^2	
GPA	2.196	0.071	<0.001	-0.004	0.004	0.284	-0.027	0.006	<0.001	0.028	<0.001	0.588	10,637 (13)
Absences	22.733	1.383	<0.001	-0.342	0.076	<0.001	0.416	0.087	<0.001	13.522	<0.001	668.465	12,124 (15)
ODRs	2.355	0.464	<0.001	-0.060	0.023	0.022	-	-	-	2.357	<0.001	20.940	12,124 (15)
Excused Tardies	0.767	0.288	0.026	0.008	0.015	0.582	-0.021	0.024	0.407	0.333	<0.001	4.623	10,561 (12)
Unexcused Tardies	5.843	1.361	0.002	-0.187	0.065	0.017	-	-	-	18.192	<0.001	100.037	10,561 (12)
Suspensions	0.484	0.081	<0.001	-0.011	0.004	0.018	0.002	0.006	0.717	0.022	<0.001	1.027	10,561 (12)

Research Question 2: What is the relationship between PBIS implementation fidelity and student absence and tardy outcomes at the high school level?

We found some statistically significant relationships for student attendance variables (number of absences: γ_{01} = -0.342, $p < 0.001$; number of unexcused tardies: γ_{01} = -0.187, $p = 0.017$). The relationship between PBIS fidelity and the number of excused tardies was not statistically significant ($\gamma_{01} = 0.008$, $p = 0.582$). These results indicate for each one unit increase in PBIS fidelity, students were absent 0.342 fewer days, and had 0.187 fewer tardies.

Again, applying our findings to the mean values in our sample suggests the practical significance of our findings. The mean number of absences in our sample was 25.514 and tardies was 8.220. A 10-point increase in fidelity predicts a reduction of these numbers to 18.37 absences and 6.35 tardies per student per year.

Research Question 3: What is the relationship between PBIS implementation fidelity and student GPA outcomes at the high school level?

We did not find a statistically significant relationship between PBIS fidelity and the student academic outcome variable (GPA: γ_{01} = -0.004, $p = 0.284$) after controlling for student and school level characteristics. However, because of the concurrent measurement of academic outcomes with absence and behavior outcomes, it was not possible to evaluate whether this relationship would be fully mediated by the absence and/or behavior outcomes because there was no time between the measurement of the outcomes to allow a change in absences or behavior outcomes to lead to changes in the academic outcome.

Discussion

The purpose of this study was to examine the relationship between PBIS implementation fidelity and student-level behavior, attendance, and academic outcomes at the high school level under typical implementation conditions. Our findings suggest high schools implementing PBIS with fidelity may see improvements in student outcomes beyond reductions in ODRs. After controlling for student and school demographic variables, schools that were implementing with higher fidelity in this sample had fewer absences, unexcused tardies, ODRs, and suspensions. This study extends the current literature by exploring typical measures of academic achievement (i.e., GPA) rather than focusing upon only standardized assessments (e.g., Gage et al., 2015) and by examining student-level rather than school-level aggregate outcomes (e.g., Freeman et al., 2015, 2016). Notably, results from the current study focus entirely on high school settings and demonstrate desired changes in student-level outcomes in a large sample.

Our results support and strengthen previous research findings which showed reductions in behavior referrals at the high school level as measured by both ODRs (Bohanon et al., 2006; Bohanon et al., 2012; Flannery et al., 2013; Freeman et al., 2016; Muscott et al., 2008) and suspensions (Muscott et al., 2008) with a large sample of students, and after controlling for student and school-level characteristics. PBIS implementation has been associated with improved attendance across grade levels (e.g., Caldarella, Shatzer, Gray, Young, & Young, 2011; Horner et al., 2009) and at the high school level (e.g., Freeman et al., 2015, 2016). The findings from this study build upon these previous studies by measuring attendance at the student level, examining both number of absences and tardies, and examining these outcomes specifically at the high school level in a large sample.

The results from this study help to clarify previous research on the relationship between PBIS and academic outcomes. Prior research showing a positive relationship between academics and PBIS implementation at the high school level has been limited (e.g., Madigan et al., 2016; Muscott et al., 2008) and measured only by standardized tests. Only one prior study, showing mixed effects (Lane et al., 2007), has examined the relationship between PBIS outcomes and GPA at the high school level. Our findings suggest the relationship between PBIS and academic performance may be a strictly indirect one, possibly resulting through mediating attendance and behavioral outcomes. This relationship has been suggested by prior research but not directly tested at the high school level (Lassen, Steele, & Sailor, 2006). Full mediation of the effects of PBIS fidelity on academic outcomes would lead to academic outcomes measured concurrently with attendance and behavioral outcomes to show no relationship with PBIS fidelity because insufficient time has passed between the measurements of the different types of outcomes for the effects of PBIS fidelity to reach the academic outcomes. This full mediation hypothesis implies that if one were to have measured academic outcomes for each student in the following school year, positive indirect relationships would be found between PBIS fidelity and academic outcomes through the attendance and behavioral outcomes. Future research should attempt to test this hypothesis.

Limitations

The results of this study should be interpreted in light of several significant limitations First, this is not an experimental study and no causal conclusions should be drawn from these results. Although we attempted to control for multiple student-level and school-level demographic variables, there may be other unmeasured factors which contributed to these results. Second, this sample was collected in one Midwestern state and 12 of the 15 schools were located in the same large urban district. This may impact the generalizability of our results and the available statistical power at Level 2. Third, the majority of schools in our sample were implementing PBIS at or above the 70% criteria on the BoQ, therefore limiting our ability to predict outcomes at lower levels of fidelity. Finally, although the conceptual relationship between PBIS implementation and academic improvement is an indirect relationship (related to decreases in behavioral

disruptions and increases in attendance), we were unable to test directly for mediation with this cross-sectional data set.

Implications

Practice. Despite these limitations, these results have some important implications for our field in general and for high school implementation of PBIS in particular. First, high schools that are considering implementing PBIS may be encouraged to learn that other high schools have seen positive student outcomes in ODRs, suspensions, attendance, and tardies (Bohanon et al., 2006; Bohanon et al., 2012; Flannery et al., 2013; Freeman et al., 2015, 2016; Muscott et al., 2008).

High schools that are implementing PBIS may consider collecting and reviewing attendance and academic data in addition to behavioral data both to guide their practice and to evaluate their outcomes (e.g., early warning indicators). McIntosh and Goodman (2016) provide specific guidance on integrating academic and behavioral systems. Leadership teams looking for further information on implementing systems for academic and behavioral support can find examples and guidance at the websites for Michigan's Integrated Behavior and Learning Support Initiative (MIBLSI) or the Comprehensive Integrated Three-Tiered Model of Prevention (Ci3T).

Additionally, because PBIS implementation may only be indirectly related to academic achievement through attendance and behavioral outcomes, leadership teams may consider directly teaching and reinforcing behaviors which support academic achievement and college and career readiness (e.g., study skills, collaboration, advocacy, and organization). Competing initiatives such as PBIS, college and career readiness, and academic improvements can have a negative impact on implementation unless careful attention is paid to integrating and aligning initiatives (Flannery, Sugai, & Anderson, 2009). Teams looking for guidance on integration of initiatives can find guidance in the Technical Guide for Alignment of Initiatives (National Technical Assistance Center, 2017).

Research. This study and the accompanying literature summary highlight the need for additional rigorous research on PBIS outcomes at the high school level. In particular, further longitudinal and experimental research is needed to explore the school- and student-level outcomes associated with PBIS implementation in high schools and the direct and indirect relationships to student outcomes. In addition, further research is needed exploring outcomes related to the impact of unique contextual characteristics of high schools, integrated systems of support, implementation of advanced tiers, the overall implementation process, and factors related to sustainability in high school.

Conclusion

This study examined the relationship between student behavior, attendance, and academic outcomes and PBIS implementation at the high school level. This study builds on the existing literature by demonstrating negative relationships with student-level ODRs, suspensions, absences, and tardies in a large high school sample and by demonstrating a lack of a direct relationship with student-level academic achievement, as measured by GPA. We provided suggestions for high school teams implementing PBIS with respect to integrating behavioral, attendance, and academic initiatives. Finally, we highlighted the critical need for more rigorous research to guide the work of implementing this framework at the high school level.

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