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A Statewide Scale Up of Positive Behavioral Interventions and Supports: A Description of the Development of Systems of Support and Analysis of Adoption and Implementation

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Abstract. This study describes the process by which a statewide support system was developed in Maryland to promote high-quality implementation of a school-wide prevention model called Positive Behavioral Interventions and Supports (PBIS). PBIS (Sugai & Horner, 2006) aims to prevent disruptive behavior problems and promote a positive school climate through the application of practices and systems consistent with the three-tiered public health prevention framework. We summarize the statewide scale-up process and examine school- and district-level contextual factors that influenced the schools' training, adoption, and implementation quality of PBIS within the scale-up effort. Data come from 810 Maryland elementary schools, of which 316 were trained in PBIS. A series of multilevel analyses indicated that several school- and district-level factors were associated with both receipt of training and program adoption; however, only school-level factors were related to implementation quality. Findings are discussed within the context of statewide efforts to scale up evidence-based programs in schools.

Growing pressure on schools to provide a safe and orderly learning environment has contributed to the increased adoption of prevention models at the district and state levels. These scale-up efforts require considerable coordination and resources to ensure high-quality program implementation across multiple schools (Adelman & Taylor, 1997). Several models for widespread program dissemination and implementation have been proposed (e.g., Adelman & Taylor, 1997; Cheung & Cheng, 1997; Fixsen, Naoom, Blasé, Friedman, & Wallace, 2005; Wandersman et al., 2008; Zins & Illback, 1995), yet there are few published

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empirical examples of the application of these models to the successful implementation of statewide prevention efforts. This issue is particularly important in school settings, where there is a growing number of efficacious prevention programs, but little formal guidance on how to develop the systems to support their implementation at a district or state level (Adelman & Taylor, 1997).

The current article seeks to accomplish two purposes: (1) to describe the process by which the state of Maryland scaled-up a school-wide prevention model called Positive Behavioral Interventions and Supports (PBIS; Sugai & Horner, 2006), which aims to improve school climate and student behavior; and (2) to evaluate contextual factors at the school and district levels that are associated with training, adoption, and implementation. The implementation framework outlined by Adelman and Taylor (1997) was used to guide the formation of a statewide support system for PBIS and is applied in the current article. In describing the implementation and scaling-up process, we highlight the necessary resources and systems needed to support high-quality implementation of the prevention model. Because few published studies have empirically examined the factors associated with the dissemination and implementation process (Domitrovich et al., 2008), we present data on school- and district-level contextual characteristics that predict schools' receipt of training in PBIS, adoption of the model, and fidelity of implementation. This work aims to inform future research on dissemination science and effectiveness research, which has remained largely unspecified in school psychology.

Overview of PBIS

PBIS (Sugai & Horner, 2006) is a noncurricular universal prevention model that draws upon behavioral, social learning, and organizational principles, targeting staff behavior to promote positive change in students. The PBIS prevention model aims to alter the school environment by creating improved systems (e.g., discipline, reinforcement, and data management) and procedures (e.g., office referral, training, leadership) to promote positive changes in staff and student behavior in all school contexts (i.e., classroom and nonclassroom). PBIS follows the three-tiered public health model, with the goal of preventing disruptive and problem behavior by developing universal, targeted, and intensive systems of positive behavior support (Walker et al., 1996). Consistent with a response to intervention approach to the prevention of behavior problems (Hawken, Vincent, & Schumann, 2008), children who do not respond adequately to the universal system of PBIS will require individual assessment of their concerns and additional supports to meet their needs (Walker et al., 1996). For example, it is anticipated that the majority of the student population (approximately 80%) will respond positively to the universal PBIS model, but the remaining 20% will require targeted or intensive supports and services.

There is a growing evidence base for PBIS (Horner, Sugai, & Anderson, 2010), particularly the universal element, referred to as school-wide PBIS. Two recent randomized trials of school-wide PBIS were conducted in elementary schools and provided evidence of effectiveness of school-wide PBIS in reducing student office discipline referrals, suspensions, and behavior problems, and in improving school climate (Bradshaw, Koth, Bevans, Ialongo, & Leaf, 2008; Bradshaw, Koth, Thornton, & Leaf, 2009; Bradshaw, Mitchell, & Leaf, 2010; Bradshaw, Waasdorp, & Leaf, 2011; Horner et al., 2009; Waasdorp, Bradshaw, & Leaf, in press). In addition to evidence of the effectiveness of school-wide PBIS demonstrated in randomized controlled trials, statewide evaluations have also demonstrated favorable outcomes (e.g., Barrett, Bradshaw, & Lewis-Palmer, 2008; Muscott, Mann, & LeBrun, 2008).

PBIS is a particularly appropriate prevention model to examine with regard to a statewide scale-up effort, as it is estimated that over 14,000 schools in the United States have received training in school-wide PBIS, with over 44 states developing statewide systems for training and coordination (PBIS, 2011).

There are likely a number of factors contributing to the wide dissemination of PBIS (Rogers, 2002). For example, PBIS is relatively low cost, given that many of the training and implementation materials are free through the National PBIS Technical Assistance Center (PBIS, 2011), which is funded by the U.S. Department of Education's Office of Special Education Programs. In addition, the PBIS framework is flexible, and therefore compatible with the culture and climate of each implementing school. Furthermore, its behavioral focus is attractive to many schools and districts that are implementing complementary strategies, such as functional behavioral assessments.

Maryland has developed a coordinated system for implementing PBIS, and has the fourth largest dissemination of school-wide PBIS nationwide. Over the nearly 12-year statewide PBIS Initiative, a total of 819 schools across all grade levels (e.g., elementary, middle, high, alternative, special) have been trained in school-wide PBIS. PBIS has been implemented through a collaboration between the Maryland State Department of Education (MSDE), Sheppard Pratt Health System, and Johns Hopkins University, working in close partnership with the state's 24 local school systems (Barrett et al., 2008). Next, we describe the four-stage process outlined by Adelman and Taylor (1997), which the collaborative followed in developing a statewide support system to scale up PBIS.

Overview of the Program Diffusion Model and Application to PBIS Maryland

Applying research and theories from the fields of community psychology and organizational change, the Adelman and Taylor (1997) model outlines four stages of implementing programmatic change across multiple educational settings. The first phase focuses on *Creating Readiness;* it stresses the importance of obtaining community and stakeholder "buy-in" (i.e., community support) and preparing the environment for change. With regard to the implementation of the statewide PBIS initiative, Maryland created readiness by holding a conference to carefully review state data on school safety (Hogan et al., 2003) and to review and discuss different prevention models that might be a good fit for the state's priorities and resources. PBIS was one of the models reviewed at the conference, and through input from multiple stakeholders (e.g., teachers, administrators, district leadership), it was selected for implementation, in part because its flexibility ensured that the program would be contextually and culturally appropriate for local schools and school systems (Hogan et al., 2003).

An additional consideration for the readiness phase is that the adoption of new programs typically necessitates other pragmatic or fundamental changes in the district's or school's culture and organization (Adelman & Taylor, 1997). Building readiness requires reallocation of time, staff, resources, and materials. A series of materials, modeled in part on the PBIS National Technical Assistance Center's Implementation Blueprint, were developed to describe the readiness and buy-in requirements at both the district and school levels (PBIS, 2011). For example, readiness requirements for initial training included the formation of a school-level PBIS leadership team and the identification of a team leader. Without agreeing to these expectations, which also included a three-year commitment to implementing PBIS and the identification of a behavior support coach, schools could not be eligible for training. With regard to the selection of schools to participate in the PBIS initiative, administrators received an invitation from the State Superintendent of Schools to attend an annual state-coordinated information session on PBIS. After attending the session, administrators interested in volunteering for training completed the readiness requirements and registered for the summer training.

Consistent with the Adelman and Taylor model (1997), a foundation was also laid for the integration of PBIS with other existing programmatic efforts or policies, as integration is critical to both high fidelity implementation and sustainability (Domitrovich et al., 2010). In Maryland, PBIS is implemented

through the student support services division, and typically uses school psychologists or guidance counselors as coaches. This, in turn, provides access to the general education population of students and helps link the universal program with the student support teaming process, which is a state-required service. Other strategies, such as training in as functional behavioral assessments, which is also required by state and federal law, were linked with and reinforced through PBIS. Consistent with the three-tiered framework, efforts were made to integrate other state-level prevention and services activities with PBIS, including interagency planning related to the more specialized tiers. This integration has also occurred on a policy level, as illustrated by two laws passed by the state legislature that mandate implementation of PBIS for schools with high truancy and suspension rates. In terms of programmatic integration, the three-tiered PBIS model has been adapted, generalized, and integrated with other statewide prevention efforts, such as response to intervention (Hawken et al., 2008) and bullying prevention. A conceptual model (Domitrovich et al., 2010) has also been developed and a series of pilot projects are in progress that integrate PBIS with other preventive interventions, including social-emotional learning curricula (e.g., Promoting Alternative Thinking Strategies; Kusche & Greenberg, 1994), classroom management strategies (e.g., Good Behavior Game; Barrish, Saunders, & Wolf, 1969), as functional behavioral assessments (i.e., PBIS-*plus* model; Hershfeldt, Rosenberg, & Bradshaw, 2011), and cultural proficiency and student engagement activities (i.e., Double Check; Hershfeldt et al., 2009). For example, a recent initiative was launched to address statewide concerns about disproportionality, based on race and ethnicity, by integrating training in PBIS with enhanced classroom management and student engagement strategies, and professional development in cultural proficiency.

The second phase (*Initial Implementation*) of Adelman and Taylor's (1997) model focuses on providing staff with support and guidance as they begin implementing the program. The Maryland PBIS Initiative has developed a relatively extensive multilevel infrastructure, or "support system," to promote dissemination of the model (Domitrovich et al., 2008; Fixsen et al., 2005). For example, the consortium includes various stakeholders (e.g., educators, practitioners, researchers, policy makers) who jointly coordinate, train, and support schools and districts in the implementation of school-wide PBIS. All 24 Maryland school districts collaborate with the state to provide the initial 2-day summer PBIS training, annual 1- or 2-day regional booster trainings, and ongoing support to schools and implementation coaches. Much of the state and district coordinated training occurs for a core set of PBIS team members (typically 4–6 members attend the training events, including an administrator). Consistent with the literature (Elliott & Mihalic, 2004), it is a requirement in Maryland that each school have a building-specific coach, who, together with the district leadership, provides technical assistance, aids in problem solving, and maintains momentum and enthusiasm for the program within the school. It is advantageous if the coach is a local expert and has prior experience with the program. The coaching role was originally conceptualized as someone external to the school (e.g., school psychologists or counselors would coach a school they were not otherwise assigned to), although this external coaching model proved difficult to sustain when districts went to scale. Most PBIS schools now have internal coaches, and some districts have written PBIS coaching responsibilities into the school psychologists' job descriptions. The coaches and core members of the PBIS team who attend the district and state training events then lead the training of the other school staff back at the school. This training model, whereby the core PBIS team trains the rest of the school staff, is one element of PBIS that has facilitated the state's ability to rapidly scale the model. For additional information on training, see Barrett et al. (2008).

The third phase, *Institutionalization*, focuses on maintaining the changes made to the system through encouraging ownership of the

new program and responding to potential roadblocks to sustaining the program (Adelman & Taylor, 1997). An extensive training infrastructure was developed to promote the sustainability of PBIS in the face of such challenges and potential roadblocks. As described earlier, the training schedule includes multiple professional development events held throughout the year to ensure the proper delivery of training and services, promote sustainability, and disseminate other evidence-based programs through the network (for details, see Barrett et al., 2008). As Adelman and Taylor (1997) noted, the leadership roles typically shift from external sources (i.e., the state) to members of the community (i.e., the districts) during the institutionalization stage. However, they highlight the importance of maintaining the core agency or partnership (i.e., PBIS Maryland Management Team and PBIS Maryland State Leadership Team), which continues to serve a centralized leadership role in providing overall coordination. The partnership has also developed the necessary scaffolding to encourage and guide local leadership and problem solving.

In the case of PBIS Maryland, the implementation was initially financed, managed, and led by the state team. This included funding, coordination, and staffing by the MSDE and in-kind staffing, coordination, and evaluation support provided by Sheppard Pratt Health System. Johns Hopkins University became a partner in 2001 and has provided in-kind training, coordination, and evaluation support. Funding was also provided by the National PBIS Technical Assistance Center for a full-time staff member to help coordinate the PBIS Maryland initiative. However, as the initiative expanded to include over half of the schools in the state, it was no longer feasible to maintain centralized leadership for the effort at the state level; the 24 local school districts took on considerably greater responsibility for sustaining previously trained schools, while the state-level team focused on expansion to new schools and to more advanced tiers. This type of multilevel leadership and coordination structure is considered a key component of scaling-up efforts (Fixsen et al., 2005; Rohrbach, Grana, Sussman, & Valente, 2006; Spoth, 2008).

Therefore, approximately 3–5 years into the Maryland initiative, there was an intentional shift toward creating greater capacity, coordination, and resource allocation at the district level. Each district is now required to have some type of district-level PBIS coordinator, although there is considerable variation in the amount of full-time effort that this person specifically dedicates to PBIS. That coordinator provides local leadership for the PBIS effort, participates on the PBIS State Leadership Team, and coordinates local and state PBIS training events. Many of the districts now have their own PBIS Leadership Team, a budget for PBIS, and other resources allocated for local support of the initiative.

The final phase of this model, *Ongoing Evolution and Renewal,* stresses the importance of continued program development and integration of new knowledge, as accomplished through ongoing program evaluation and data-based decision making. Consistent with the PBIS model's emphasis on data-based decision making (Irvin et al., 2006; Sugai & Horner, 2006), a critical element of the PBIS Maryland Initiative has been developing and maintaining a comprehensive data system to monitor and evaluate PBIS statewide. There has been a focus on monitoring both implementation fidelity and student and staff outcomes (Patton, 1997).

In fact, the PBIS model is unusual in the sense that the National PBIS Technical Assistance Center and other researchers have created a series of validated, research-based measures of PBIS fidelity, which are freely available for use by schools, districts, and states. This is not the case with most school-based prevention models. The statewide evaluation activities are chiefly Web based and coordinated by Sheppard Pratt Health System and Johns Hopkins University. Schools are required to submit core fidelity indicators on a biannual basis; these data are used, in turn, for multiple purposes, including recognizing schools for high-fidelity implementation and outcomes of PBIS, monitoring the statewide initiative, determining state and local effects

of PBIS, and identifying targets for additional support and training. The statewide scale-up efforts have also provided the opportunity to conduct effectiveness research on PBIS, which has been supported through grants from the Centers for Disease Control and Prevention, the Institute of Education Sciences, the National Institute of Mental Health, and the William T. Grant Foundation. Finally, these partnership-focused research efforts have enabled the development and application of innovative statistical methods to determine the generalizability of findings from randomized trials to the state (Stuart, Cole, Bradshaw, & Leaf, 2011).

Examination of School- and District-Level Predictors of Training, Adoption, and Implementation

Although the Adelman and Taylor (1997) model holds promise as a framework for guiding the formation of a support system for the statewide dissemination of a school-based prevention model, there has been limited empirical research documenting the effect of contextual factors at the district-and school level on training, adoption, and implementation. As a second purpose of the current study, data from elementary schools involved in the PBIS Maryland initiative were used to examine school- and district-level factors associated with the schools' receipt of training, their adoption of the model, and the fidelity with which they implemented PBIS. Specifically, we aimed to identify school- and district-level characteristics that predicted initial receipt of training in the universal school-wide PBIS model, adoption (i.e., active participation based on the submission of implementation data), and the quality with which PBIS was implemented.

In selecting potential contextual predictors of the implementation process, we drew upon the empirical and theoretical literature examining the association between school contextual factors and the implementation of school-based programs (for a review, see Domitrovich et al., 2008). For example, the available literature suggests that certain contextual factors can impede successful implementation of programs (Bradshaw, Koth et al., 2009; Domitrovich et al., 2008; Gottfredson, Jones, & Gore, 2002), and that these factors may affect sustainability. Therefore, we empirically examined whether school-level indicators of disorder (i.e., student enrollment, rates of suspensions, truancy, mobility, special education, teacher certification, students per teachers, and student achievement) were associated with the initial training, adoption, and quality implementation of PBIS. It was hypothesized that schools in greater need (e.g., with higher rates of discipline problems, poor student achievement) would be more likely to receive initial training in PBIS, but would then struggle to adopt or implement it with high fidelity. We also hypothesized that greater student achievement and teacher qualifications would be associated with less need, and therefore a reduced likelihood of being trained or adopting PBIS, but with better implementation among those who did receive training. Finally, we hypothesized that schools implementing PBIS for a longer period of time would have higher levels of implementation (Doolittle, 2006; Rogers, 2002; Rohrbach et al., 2006).

It is also important to consider district-level factors, as the available research suggests that the district's sustained interest in and support for a program would influence schools' implementation (Rohrbach, Ringwalt, Ennett, & Vincus, 2005), as would the district's ability to build capacity for PBIS specifically (Doolittle, 2006; McIntosh, Filter, Bennett, Ryan, & Sugai, 2009; McIntosh et al., 2011). Therefore, we examined a number of district-level factors (i.e., number of schools, district expenditures, the percent of schools in the district receiving Title I funds, the percent of schools in the district actively participating in the PBIS state initiative, and the amount of support provided by the district PBIS coordinator) hypothesized to be associated with initial training, adoption, and quality implementation of PBIS. We hypothesized that indicators of hardship at the district level (Domitrovich et al., 2008) would be associated with schools being trained in PBIS (i.e., because these district's schools would have

greater need), but with poorer adoption and implementation, because there would be less infrastructure to support implementation (McIntosh et al., 2009; McIntosh et al., 2011). Greater infrastructure and wealth at the district level also were hypothesized to be associated with a greater likelihood of being trained in, adopting, and successfully implementing PBIS. The overall goal of these analyses was to enhance our understanding of the variables associated with statewide training, adoption, and implementation quality of the widely used PBIS prevention model. These findings should also inform the broader literature regarding the dissemination and implementation of other large-scale prevention initiatives (Society for Prevention Research Mapping Advances in Preventions Science Task Force, 2008).

Method

Sample Eligibility

Data for the current study come from a statewide evaluation of school-wide PBIS collected during the 2006–2007 and 2007–2008 school years. Within the state of Maryland, there are 24 districts, all of which participate in the PBIS Initiative. For the initial PBIS training analyses, 810 traditional elementary schools across 23 districts (i.e., clusters and approximately 35 schools per cluster) in the state were eligible for inclusion. One district, although involved in the state initiative, only had one elementary school trained in PBIS, which was an insufficient number of schools with which to estimate the parameters with confidence. A "traditional" elementary school is defined in the current article as a school that educates both regular and special education students, is not an alternative school or one that only provides services to special education students, and serves kindergarten through fifth or sixth grade. Among the 810 traditional elementary schools, 807 had data on all school-level covariates of interest (greater than 99% of schools), and thus were available for analysis. In the case of the 3 schools with missing data, all were charter schools in a single urban district; they were missing data on only one variable (i.e., either the percent of certified teachers or students receiving special education). These 807 schools were located in 23 districts; 316 of these schools had been trained in PBIS. Districts without any schools submitting implementation data ($n = 6$ districts) could not be included in the adoption or the implementation analyses, as there were no outcomes for these districts. Therefore, 17 districts (i.e., clusters) were included in the adoption and implementation analyses. All traditional elementary schools in these 17 districts (i.e., 764 schools) were included in the adoption analyses. We also examined adoption among only the trained schools; this analysis included the subset of 298 trained schools across the 17 districts. Lastly, the 227 schools (i.e., 76% of the trained sample) in the 17 districts that submitted implementation were included in the implementation analyses.

Measures

School-level outcomes

Training in school-wide PBIS. A school was considered "trained" if it had a school team of at least four individuals, including an administrator, who attended the state's initial training event. As described earlier, this event was hosted by the MSDE, Johns Hopkins University, and the Sheppard Pratt Health System prior to or during the summer of 2007. The initial training occurred during the summer (i.e., in July/August) over the course of 2 consecutive days. Schools in Maryland cannot be formally trained in PBIS by another method, as the state initiative is linked into the National PBIS Technical Assistance. No other formal, initial PBIS training systems are available in the state. The school team then trains the remainder of the school staff in the implementation of PBIS. A dichotomous indicator of whether or not a school was trained was created.

Adoption of school-wide PBIS. A school was coded as having "adopted" PBIS if it had been trained in PBIS *and* submitted implementation data in the spring of 2008 (i.e., the year selected to examine implementation). Data regarding training and adoption status

were available for all eligible schools within the state. The adoption analyses were conducted with two samples: all schools within the state and those trained.

Implementation of school-wide PBIS. The Implementation Phases Inventory (IPI; Bradshaw, Debnam, Koth, & Leaf, 2009) assesses the presence of 44 key elements of school-wide PBIS following a "stages of change" theoretical model, whereby schools move through a series of four stages: *preparation* (Cronbach's alpha [α] = .65, e.g., "PBIS team has been established," "School has a coach"), *initiation* (α = .80, e.g., "A strategy for collecting discipline data has been developed," "New personnel have been oriented to PBIS"), *implementation* (α = .90, e.g., "Discipline data are summarized and reported to staff," "PBIS team uses data to make suggestions regarding PBIS implementation"), and *maintenance* (α = .91, e.g., "A set of materials has been developed to sustain PBIS," "Parents are involved in PBIS related activities"). The IPI is completed by the PBIS coach, who indicates the extent to which each core feature is in place at the school on a 3-point scale from 0 (*not in place*) to 2 (*fully in place*). Approximately 96% of the IPIs were completed by unique coaches, such that one coach completed one IPI; therefore, the IPI ratings are largely independent of one another. Schools receive a percentage of implemented elements for each stage, such that a higher score indicates greater implementation. Consistent with the IPI validation study conducted in Maryland (Bradshaw, Debnam et al., 2009), a total score (α = .94) was calculated. The psychometric properties of the IPI have been previously examined. For example, the test–retest reliability is r = .80 (Bradshaw, Debnam et al., 2009). IPI scores from the spring of 2008 were used in the current study. The preparation and initiation scales focus on precursors to implementation, and thus there tends to be less variability in these scales, attributable to most schools achieving very high scores (Bradshaw, Debnam et al., 2009). As a result, we focused on the latter two phases of implementation (i.e., implementation and maintenance), along with the overall IPI score.

School-level predictors. At the school level, baseline data regarding level of disorder (e.g., suspensions, mobility, truancy), school size (e.g., enrollment, student-to-teacher ratio), teacher qualifications (i.e., percent of teachers with a standard certification), special education rates, and student achievement were obtained for the 2006–2007 school year (i.e., in the year prior to collection of the PBIS outcomes) from the MSDE. These data were available for all schools in the sample. We did not include indicators of students' family income (e.g., percent of students receiving free and reduced-price meals) at the school-level models because of multicollinearity concerns—specifically related to high correlations with truancy (r = .79) and mobility (r = .67).

District-level predictors. Proxies for family income were included at the district level, including education expenditures and the percent of schools receiving Title I funding; these data were also obtained from the MSDE. The amount of dedicated effort by the districts' PBIS coordinator and the percent of schools within a district that submitted implementation data were obtained from the PBIS Maryland Management Team and also modeled as district-level predictors. See Table 1 for a full listing of demographic and PBIS information for all Maryland traditional elementary schools and for schools implementing PBIS.

Procedure

As a requirement of the PBIS Maryland Initiative, the IPI is completed biannually (fall and spring) by a district-appointed technical assistance provider (i.e., a PBIS Coach, which in Maryland is often a school psychologist or counselor) and submitted electronically to the PBIS Maryland Consortium through the www.PBISMaryland.org Web site. Annual data on suspensions and academic performance are publicly available through the state department's Web site. The nonidentifiable school- and district-level data have been ap-

Table 1
School and District Demographic Characteristics

	All Maryland Elementary Schools (n = 810)		Maryland Elementary Schools with IPI Data (n = 227)	
School Characteristics	Mean (SD)		Mean (SD)	
IPI Scale Scores (0–100%)	N/A			
Implementation			88.60 (16.11)	
Maintenance			76.08 (22.87)	
Total Score			88.03 (12.79)	
Years Since Initial PBIS Training	N/A		3.63 (2.26)	
Suspensions (%)	4.38 (5.47)		6.06 (6.72)	
Student Mobility (%)	25.08 (16.78)		27.10 (16.45)	
Student to Teacher Ratio	20 (4.64)		20.01 (3.57)	
Enrollment	458 (153.2)		473 (150.46)	
Truancy Rate (%)	6.00 (4.59)		6.60 (4.36)	
% Students in Special Education	11.81 (4.91)		12.21 (4.35)	
% Certified Teachers	36.89 (14.99)		41.60 (14.93)	
Academic Performance (% Reading)	80.16 (12.11)		78.28 (9.92)	
	n = 23		n = 17	
District Characteristics	Mean (SD)	N (%)	Mean (SD)	N (%)
% of Active PBIS Schools	N/A		44.52 (25.21)	
Per Student Expenditures	$10,087.13 (1019.22)		$10,143.82 (1,075.28)	
District PBIS Coordinator		13 (56.5)		13 (76.5)
District Size	36 (41.51)		46 (44.31)	
% Title I Schools	44.48 (27.23)		17.47 (23.75)	

Note. Total score indicates the average of four Implementation Phases Inventory (IPI) subscales. The academic performance variable indicates the percent of students scoring in the advanced or proficient ranges on the state reading assessment (Maryland State Assessment). Active PBIS Schools indicate the percentage of schools within the district that were trained in PBIS and submitted IPI data in 2008. District size indicates the number of elementary schools within the district.

proved for analysis in this study by the Johns Hopkins Bloomberg School of Public Health's institutional review board.

Analyses

Modeling approach for all outcomes. We performed preliminary analyses in SPSS 17.0 to explore for potential collinearity among the school and district covariates; however, the variance inflation factor and tolerance did not indicate collinearity among the variables (Tabachnick & Fidell, 2001). Although some correlations with reading achievement scores appear high (e.g., greater than .50), the highest variance inflation factor was 2.35 and tolerance .43, placing it in the acceptable range (Tabachnick & Fidell, 2001). All HLM models were built one variable and level at a time to ensure that changes in the direction of effects did not occur; this approach is also recommended to detect collinearity (Raudenbush & Bryk, 2002). At the district level, only two correlations were significant. Specifically, the number of schools

was correlated ($r = .59$, $p < .01$) with coordinator effort and the percent of active PBIS schools ($r = -.65$, $p < .01$); however, a series of sensitivity analyses indicated that the inclusion and exclusion of this variable did not alter the findings. To test for randomly varying slopes, each Level 1 variable was entered as group-mean centered and freed, as this approach best quantifies the between-cluster variation (Enders & Tofighi, 2007). Those that were statistically significant were left as free, whereas other variables were changed to grand-mean centering with fixed slopes. Given the interest in both Level 1 and 2 predictors, simultaneously, the use of either group- or grand-mean centering is appropriate and will yield the same results (Enders & Tofighi, 2007); therefore, the approach taken was to match the centering technique to the existence (or absence) of between-school variability. Variables at Level 2 were grand-mean centered.

Predictors of school training in PBIS. A two-level model was fit in HLM 6.01 (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2004) to examine the influence of 2006–2007 school- and district-level variables on the training in PBIS as of the summer of 2007. This model used a Bernoulli sampling model and logit link, to account for non-normality of this binary outcome (Raudenbush & Bryk, 2002). Therefore, adjusted odds ratios are reported. School-level data were modeled at Level 1; this included school-level indicators of disorder and data regarding school size, teacher certification, and student achievement. The school-level indicators of disorder included the percent of *out-of-school suspensions* (i.e., the total number of out-of-school suspension incidents divided by total enrollment, times 100), *mobility* (i.e., the total number of entrants and withdrawals from the school divided by total enrollment, times 100), and *truancy,* or the percent of students who missed more than 20 days in a school year (i.e., truancy). The number of *students per teacher* and total school *enrollment* were included to reflect school size. Finally, the percent of teachers with the state's "*standard certification,*" the percent of *students receiving special education*, and the percent of students who passed the *state reading assessment* (i.e., the Maryland Student Assessment) were included as school-level predictors.

At Level 2, the following district-level variables were modeled for each outcome: the approximate amount of full-time-equivalent (i.e., effort) that a *district PBIS coordinator* dedicates toward PBIS (0 = *less than 25%*, 1 = *25% effort*, 2 = *50% effort*, 3 = *75% effort*, and 4 = *100% effort*), the *expenditures* per student on education (i.e., the total money spent on education divided by district enrollment), the *district size* (i.e., the number of traditional elementary schools in the district), and the percent of schools receiving *Title I funding*.

Predictors of school adoption of PBIS. Two-level models were fit in HLM (Raudenbush et al., 2004) to examine the influence of 2006–2007 school- and district-level variables on the adoption of PBIS in the spring of 2008, examined two ways, including all schools in the state and only trained schools. We include analyses of adoption across the entire state and among only trained schools, as these models answered two different questions. Specifically, the first analysis assessed whether school and district characteristics predicted whether a school would be trained in and subsequently submit data on PBIS when comparing all the schools in the state. The second analysis determined, among those schools that were trained, which school and district characteristics predicted submitting data. This model also utilized a Bernoulli sampling model and logit link to account for non-normality of this binary outcome (Raudenbush & Bryk, 2002). School-level data were modeled at Level 1, including all of the same variables used in the training model: school disorder as indicated by *out-of-school suspensions*, *mobility*, *truancy*; school size as indicated by *students per teacher* and *enrollment*; *standard teacher certification*; *students receiving special education*; and the *state reading assessment*. At Level 2, the same district-level variables were modeled: *district*

PBIS coordinator, *expenditures*, *district size*, and *Title I funding*. The adoption analyses also included the *percent of active PBIS schools* (i.e., percent of schools that submitted IPI data in 2008) as a Level 2 predictor.

Predictors of quality of implementation of PBIS. Two-level models were fit in HLM (Raudenbush et al., 2004) to examine the influence of 2006–2007 school- and district-level variables on three measures of implementation of PBIS in the spring of 2008. The three indicators of implementation quality were three scales on the IPI: Implementation, Maintenance, and Total score. The implementation variables were continuous and modeled using the standard HLM framework (Raudenbush & Bryk, 2002). School-level data were modeled at Level 1, including all of the same variables used in the other two models: school disorder as indicated by *out-of-school suspensions*, *mobility*, *truancy*; school size as indicated by *students per teacher* and *enrollment*; *standard teacher certification*, *students receiving special education*, and *state reading assessment*. The implementation analyses also included the *number of years since the initial training in PBIS* at the school level. At Level 2, the same district-level variables were modeled: *district PBIS coordinator*, *expenditures*, *district size*, and *Title I funding*. Like the adoption analyses, the three implementation models also included the *percent of active PBIS schools* as a Level 2 predictor.

Results

Predictors of Training in PBIS

At the school level, suspensions, mobility, and student achievement were associated with the odds that a school was trained in PBIS. For example, a 1% increase over the district average (i.e., group mean) suspension rate was associated with a 10% increase in the school's likelihood of being trained in PBIS (adjusted odds ratio [AOR] = 1.10, $p < .01$). A 1% increase over the average (i.e., grand mean, 25.1%) rate of mobility was associated with a 1% increase in the odds that a school was trained in PBIS (AOR = 1.01, $p = .03$). Finally, a 1% increase over the district average (i.e., group mean) in the percent of students scoring proficient or advanced on the standardized Maryland Student Assessment reading test was associated with a 6% decrease in the odds that a school was trained in PBIS (AOR = 0.94, $p < .01$). None of the other school-level predictors (i.e., truancy, school enrollment, students per teacher, special education rates, or percent of teachers certified) were significantly associated with training in PBIS. At the district level, the district size was negatively associated with schools' likelihood of receiving training in PBIS, such that the odds of a school receiving training decreased as the number of elementary schools in the district increased over the average of 36 elementary schools (AOR = 0.98, $p = .01$). None of the other factors examined were associated with being trained in PBIS (see Table 2).

Predictors of Adoption of School-Wide PBIS

When examining the adoption of PBIS across all traditional elementary schools, mobility and academic performance were associated with the adoption of PBIS. Specifically, a 1% increase in the mobility rate over the district average was associated with a 5% increase in schools likelihood of adopting PBIS (AOR = 1.05, $p = .02$). However, a 1% increase in the rates of reading proficiency above the average (i.e., grand mean of about 80% proficiency) was associated with a 3% decrease in a school's likelihood of adopting (AOR = 0.97, $p < .01$). None of the other school-level predictors (i.e., suspensions, truancy, enrollment, students per teacher, special education rates, or percent of teachers certified) were significantly associated with the adoption of PBIS, when examining all schools in the state. At the district level, a 1% increase over the average (i.e., 44.5%) in the proportion of active PBIS schools in the district was associated with 6% increase in the odds of schools adopting PBIS (AOR = 1.06, $p < .01$). None of the other district factors (i.e., the expenditures per student, percent of Title I

Table 2
School- and District-Level Predictors of Training in and Adoption of School-wide PBIS

	Training		Adoption (All Schools in State)		Adoption (Among Only Trained Schools)	
Predictor Variables	AOR	CI	AOR	CI	AOR	CI
School Level						
Suspensions (%)	1.10**	1.03–1.18	1.07	0.97–1.19	1.01	0.95–1.07
Student Mobility (%)	1.01*	1.00–1.03	1.05*	1.01–1.09	1.00	0.98–1.03
Student to Teacher Ratio	1.02	0.97–1.08	1.01	0.95–1.07	1.00	0.93–1.08
Enrollment	1.00	1.00–1.00	1.00	1.00–1.00	1.00	1.00–1.00
Truancy Rate (%)	1.03	0.98–1.09	1.03	0.98–1.09	1.01	0.93–1.10
% Special Education	1.02	0.99–1.06	1.01	0.97–1.05	1.00	0.93–1.07
% Certified Teachers	1.00	0.99–1.01	1.01	0.99–1.02	1.02	0.99–1.04
Academic Performance	0.94**	0.90–0.98	0.97**	0.94–0.99	1.00	0.97–1.05
District Level						
Expenditures per Student	1.00	0.98–1.03	1.00	1.00–1.00	1.00	1.00–1.00
% Active PBIS Schools	N/A	N/A	1.06**	1.04–1.07	1.05*	1.01–1.10
Amount of Effort by PBIS Coordinator	1.30	0.81–2.08	0.96	0.75–1.22	0.98	0.52–1.84
District Size	0.98*	0.96–0.99	1.00	0.99–1.01	1.01	0.98–1.03
% Title I Funding	1.00	0.98–1.03	0.99	0.98–1.01	0.99	0.96–1.02
Indicators of Model Fit and Variance Reduction						
AIC	30.00		34.00		25.96	
BIC	100.40		112.79		73.97	
Explained variance in the intercept	.28		.99		.49	

Note. AOR = Adjusted Odds Ratio, CI = Confidence interval. The academic performance variable indicates the percent of students scoring in the advanced or proficient ranges on the state reading assessment (Maryland State Assessment). The percent of active PBIS schools (district level) were not included in the training model and represent the percentage of schools within the district that were trained in PBIS and submitted IPI data in 2008. District size indicates the number of elementary schools within the district. The training analyses were conducted using 807 traditional elementary schools in 23 districts; the adoption analyses were conducted on 764 traditional elementary schools in 17 districts.
*$p < .05$.
**$p < .01$.

schools, the amount of effort that the district-level coordinator put towards PBIS, and the district size) were significantly associated with PBIS adoption (see Table 2). For the examination of adoption among only schools that were trained in PBIS, none of the school-level factors were significant. Like the adoption analysis examining all schools, the percent of active PBIS schools in the district was associated with an increase in the odds that an individual school adopted PBIS (AOR = 1.05, $p = .03$).

Predictors of the Implementation Quality of PBIS

The number of years since a school was trained in PBIS was significantly associated with all three measures of implementation quality (where the possible scores ranged

Table 3
School- and District-Level Predictors of Implementation of School-wide PBIS on the Implementation Phases Inventory (IPI)

	IPI Implementation		IPI Maintenance		IPI Total Score	
Predictor Variables	Coeff.[a]	Standard Error (SE)	Coeff.	SE	Coeff.	SE
School Level						
Years Since PBIS Training	1.33**	0.48	2.15**	0.69	0.91*	0.38
Suspensions (%)	−0.20	0.19	−0.22	0.28	−0.16	0.15
Student Mobility (%)	0.08	0.08	0.12	0.11	0.06	0.06
Student to Teacher Ratio	0.12	0.38	−0.27	0.57	0.05	0.31
Enrollment	−0.02*	0.01	−0.01	0.01	−0.01	0.01
Truancy Rate (%)	−0.16	0.31	−0.68	0.44	−0.33	0.24
% Special Education	0.09	0.25	−0.21	0.36	0.08	0.20
% Certified Teachers	0.26**	0.08	0.38**	0.11	0.22**	0.06
Academic Performance	0.12	0.14	−0.12	0.21	0.01	0.11
District Level						
Expenditures per Student	0.00	0.00	0.00	0.00	0.00	0.00
% Active PBIS Schools	0.09	0.08	0.10	0.13	0.06	0.06
Effort by PBIS Coordinator	−1.12	1.07	−1.02	1.71	−0.64	0.87
District Size	−0.04	0.04	−0.06	0.07	−0.08	0.05
% Title I Funding	−0.07	0.06	0.03	0.09	−0.05	0.05
Indicators of Model Fit and Variance Reduction						
AIC	27.91		28.00		29.91	
BIC	75.86		75.95		81.29	
Pseudo R^2	.99		.85		.98	
Explained variance for level 1	.03		.06		.02	
Explained variance in the intercept	.99		.87		.98	

Note. Coefficients reported are unstandardized beta coefficients from HLM.
AOR = Adjusted Odds Ratio, CI = Confidence interval. The academic performance variable indicates the percent of students scoring in the advanced or proficient ranges on the state reading assessment (Maryland State Assessment). The percent of active PBIS schools (district level) were not included in the training model and represent the percentage of schools within the district that were trained in PBIS and submitted IPI data in 2008. District size indicates the number of elementary schools within the district. All analyses were conducted with 227 schools with implementation data in 17 school districts.
[a]Coeff. = Coefficient.
*$p < .05$.
**$p < .01$.

from 0 to 100). The results indicated that the number of years since training (above the grand mean of 3.6) was associated with a score of 1.33 points higher on the IPI Implementation subscale (coefficient = 1.33, $p < .01$), 2.15 points higher on the IPI Maintenance subscale (coefficient = 2.15, $p < .01$), and a score of 0.91 points higher on the IPI Total score (coefficient = 0.91, $p = .02$; see Table 3). A higher concentration of teachers with a standard certification was also associated with better implementation, such that each 1% increase above the grand mean (i.e., 41.6%) in the certified teachers was as-

sociated with an increase of one-fifth to one-third of a point on the Implementation, Maintenance, and IPI Total scores. Therefore, a 5% increase in teachers with certification would be associated with slightly greater than a 1 point increase in the IPI Implementation (coefficient = 0.26, $p < .01$) and IPI Total scores (coefficient = 0.22, $p < .01$). Similarly, a 3% increase in teachers with certification would be associated with a slightly greater than 1 point increase in the IPI Maintenance score (coefficient = 0.38, $p < .01$). Enrollment was only significantly related to IPI Implementation (coefficient = −0.02, $p = .05$). None of the other school-level factors were significantly associated with the IPI scale scores. Similarly, none of the five district-level variables examined were significantly associated with any of the three IPI scale scores.

Discussion

Consistent with the growing interest in implementation and dissemination research (Society for Prevention Research Mapping Advances in Preventions Science Task Force, 2008), the current study documented the process by which the state of Maryland scaled-up the PBIS model and examined factors related to the training, adoption, and implementation of PBIS. The first aim of this study was to describe the model that guided the PBIS scaled-up effort in Maryland. Specifically, the Adelman and Taylor model (1997) guided the process of selecting PBIS, integrating it with the existing programs and policies, training, and institutionalization of PBIS. It appears that this model was effective, as evidenced by the high concentration—over half—of schools trained in PBIS throughout the state. It is important to note, however, that although each of the four stages outlined by Adelman and Taylor was implemented, the process was not linear. Rather, there were often times that the collaborative looped back to an earlier stage to integrate with emerging concerns, programs, and priories. Similarly, the evaluation activities were ongoing and played an important role in all phases of the implementation process.

Using these statewide evaluation data, we also were able to empirically examine contextual factors associated with the training, adoption, and implementation of PBIS (Domitrovich et al., 2008). Generally speaking, several school-level and some district-level factors predicted schools' likelihood of receiving training in PBIS and their adoption of the model. As hypothesized, schools with greater need were more likely to receive training. Specifically, higher rates of suspensions, as well as mobility, were positively associated with training, whereas a higher rate of academic achievement was inversely associated with training. This suggests that the lower-performing schools were more likely to access PBIS than were other schools. It is important to note that schools in Maryland self-identify for PBIS training, and thus it appears that many of the lower-performing schools were seeking training as a way of improving the school. At the district level, the number of schools (or district size) was inversely related with training, such that schools within larger districts were less likely to be trained.

When examining the likelihood that schools adopted PBIS compared to all schools in the state (i.e., an analysis analogous to the training model), similar findings to the training model were found; student mobility was associated with increased odds of adoption and a higher rate of student academic performance was associated with lower odds of adoption. At the district level, schools within districts with a greater percentage of IPI-submitting schools were more likely to adopt (i.e., be trained in *and* submit IPI data). Interestingly, when examining adoption only among trained schools, none of the school-level predictors were significant. The percent of schools submitting the IPI was significant at the district level for both adoption analyses. The finding that training and adoption were associated with district-level predictors is consistent with literature suggesting that the district has the most influence in determining the involvement of schools in a particular initiative (Rohrbach et al., 2005).

As hypothesized, the number of years since a school was trained in PBIS was posi-

tively associated with implementation, as measured by all three IPI scales. This finding is consistent with prior literature suggesting that programs often require multiple years of implementation to achieve their intended goals (Doolittle, 2006; Rogers, 2002; Rohrbach et al., 2006). Similarly, the concentration of qualified teachers also predicted implementation quality, suggesting that the better prepared the teachers are, the greater the program implementation will be (Domitrovich et al., 2008). Although we expected the indicators of school disorganization to be associated with implementation quality, the findings suggest that these factors do not serve as obstacles to successful implementation of PBIS (also see Bradshaw, Reinke, Brown, Bevans, & Leaf, 2008).

District factors appeared to be more closely related to training in and adoption of PBIS than to implementation quality. Surprisingly, the amount of district coordinators' effort dedicated to PBIS was not significantly associated with the outcomes examined; however, this may be from a lack of precision in full-time effort as an indicator of level of support provided by the coordinator. Additional research is needed to better estimate the effect of district-level coordination and support on the adoption and implementation process.

It is important to note some limitations when reviewing these findings. For example, we only examined data from elementary schools trained within a particular time span. It is possible that the pattern of findings may differ for secondary schools, or those schools that were so-called early adopters versus late adopters of PBIS (Fixsen et al., 2005). Additional longitudinal analyses are needed to examine factors associated with sustainability of PBIS as well as outcomes for students and staff, as we expect a similar set of contextual factors will influence these outcomes. We were somewhat limited in the number of potential school- and district-level contextual predictors that could be examined in this study. Multiple indicators of the current set of predictors, as well as more information on the district infrastructure (such as a budget for PBIS or dedicated coaching time) should be examined in subsequent studies. For example, research by Doolittle (2006) and others highlights the importance of leadership and buy-in at both the district and school levels (Domitrovich et al., 2008; McIntosh, Filter, Bennett, Ryan, & Sugai, 2009; McIntosh et al., 2011). Unfortunately, detailed data on these constructs are not available in the current study.

Although it is likely that schools not trained in PBIS would achieve implementation scores above 0% (Bradshaw, Reinke et al., 2008), it was not feasible to obtain implementation data from the nontrained schools; this is a common limitation of scale-up studies. Given that some elements of PBIS reflect best practice in behavior supports generally, it can be assumed that nontrained schools would have some of the implementation elements in place and could potentially receive scores higher than zero on the total score. However, the later phases of the IPI included in this study (i.e., Implementation and Maintenance) were specifically chosen for this reason, as nontrained schools are less likely to be implementing elements on these scales than on the earlier phases of the IPI (i.e., Preparation and Initiation). It is also important to note that the state carefully monitors PBIS training activities; therefore, we do not believe that outside trainers were conducting initial PBIS training sessions within the state. Outside trainers, particularly those affiliated with the National PBIS Center, are often contracted to participate in the state- and district-coordinated training events, most of which are booster trainings for active PBIS schools, rather than initial trainings in PBIS.

The IPI was conducted by a within-district representative and may suffer from rater bias. We also explored using fidelity data from another measure, the School-wide Evaluation Tool (SET; Sugai, Lewis-Palmer, Todd, & Horner, 2011), which is typically completed by a district coordinator or coach from another school. Within the state of Maryland, the SET is not a required data element and is generally administered to schools participating in specific research projects, such as those led by

Johns Hopkins University, and those schools that have applied for statewide recognition for exemplary implementation of PBIS. Therefore, there is a limited sample of schools (i.e., 147 traditional elementary schools in 16 school districts) that have SET data; there also is a restriction of range (i.e., range 70–100 for the 147 SETs available) and potential bias in these data, as the overall SET scores tended to be very high (i.e., $M = 95.74$, $SD = 2.21$). Thus, the SET was not included in the current study. Rather, we focused on the IPI because it is completed by the larger pool of schools in the state, it is not linked with recognition, and it had greater variability in the scores. Future research should consider using externally and universally collected measures of implementation. Additional research also is needed to examine contextual factors associated with other aspects of the implementation process, such as getting buy-in, preparation, initiation, and sustainability (see McIntosh et al., 2011).

Implications

The current study both illustrates the utility of the Adelman and Taylor (1997) model for guiding the formation of systems to support the scale up of prevention programs and provides data regarding contextual factors associated with different aspects of the implementation process. The empirical contextual findings suggest that school-level indicators of need (e.g., suspension, mobility, and academic achievement rates) are generally associated with both receipt of training and adoption of PBIS. Therefore, schools with these particular characteristics should be prioritized for training, as they may be more motivated to adopt PBIS. With regard to district factors, large districts may naturally struggle to scale up programs, and therefore may need special support from the state. Building a district culture of active participation in a state initiative also appears to be an important factor associated with adoption.

In terms of implementation quality, only school-level predictors were significant (i.e., district-level predictors were not) in this study. Both the number of years since training and the percent of certified teachers were significantly associated with implementation quality. This finding implies that teacher qualifications and training are important areas to attend to; previous research on PBIS implementation echoes the significance of these particular factors (Doolittle, 2006; McIntosh et al., 2011).

There are also important policy implications of this work, because the current study highlights the critical role of developing an infrastructure to support and sustain implementation quality; however, this is often a challenge during a time of limited resources to support such activities, as the emphasis typically shifts to program implementation and reach of programs, rather than infrastructure development and sustainability. There appears to be some recognition of the role of these systems of support, as illustrated by federal initiatives, such as systems of care, the Safe Schools/Healthy Students Initiative, and the U.S. Department of Education's Safe and Supportive Schools initiative. All of these efforts place an emphasis on the formation of a system of support at the state and/or district level, and in turn allow for better integration of support services and evaluation activities. Future research should take into account the longitudinal nature of the scaling-up process, should include more diverse measures of school practices and culture, and should examine scaling-up across all school levels. Similarly, further empirical work is needed to determine whether the effects of such coordinated efforts are in fact better than when individual schools adopt programs independent of a state- or district-level support system (Fixsen et al., 2005).

Practicing school psychologists also play an important role in the implementation of school-based prevention efforts like PBIS; as noted earlier, many serve as coaches and facilitate the integration of PBIS with other processes, like response to intervention, as functional behavioral assessments, and student support teaming/consultation. The quantitative findings from this study suggest that school psychologists and other professionals working to implement programs like PBIS should carefully consider issues of school need that might

help motivate the training and adoption process, and the importance of collaboration and participation in state initiatives and activities (e.g., fidelity monitoring) that support adoption. Schools should also be reminded that quality implementation of school-based programs often takes time (Bradshaw, Koth et al., 2009; Rogers, 2002; Rohrbach et al., 2005). The field at large can be instrumental in promoting training for school psychologists in the systems framework and implementation science.

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