Scaling-up Behavioral Health Promotion Efforts in Maryland: The Economic Benefit of Positive Behavioral Interventions and Supports

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Abstract

Positive Behavioral Interventions and Supports (PBIS) has been shown to be a promising approach for improving a range of behavioral health and academic outcomes for youth. This study leveraged data from the scale-up of PBIS and a randomized controlled trial, both conducted in Maryland, to estimate the dollars saved per 100 students as a result of the reduced discipline problems, mental health concerns, and improved academic performance associated with PBIS. Shadow pricing results indicated that the largest cost savings was associated with improvements in standardized test scores ($138,658 for elementary and $71,444 for secondary). Reductions in elementary students' aggressive and disruptive behavior, as well as bullying behavior were also significant sources of cost savings ($166,028 in total). These cost-saving benefits are complemented by separate benefits associated with a reduction in suspensions ($33,415 for elementary and $11,361 for secondary). Other findings regarding student truancy, office discipline referrals, and mental health concerns are also reported. Taken together, these findings illustrate the broad cost savings associated with PBIS Tier 1 implementation and scale-up. We conclude by considering how the state-wide scale-up of PBIS can translate into cost savings across multiple agencies.

Impact Statement: This study documents the cost savings associated with Positive Behavioral Interventions and Supports (PBIS), a widely-used framework to prevent behavioral and mental health problems in schools and increase academic performance. The cost savings associated with improvements in standardized test scores ($138,658 for elementary and $71,444 for secondary) and reductions in aggressive and disruptive behavior ($166,028 in total) are sizable and illustrate the potential economic benefits of scaling-up Tier 1 PBIS in other states in the U.S.

Scaling-up Behavioral Health Promotion Efforts in Maryland: The Economic Benefits of Positive Behavioral Interventions and Supports

An increasing number of schools across the U.S. and globe are implementing an evidence-based prevention framework called Positive Behavioral Interventions and Supports (PBIS; Sugai & Horner, 2006). This multi-tiered prevention framework aims to build systems and structures to support the implementation of research-based practices, and leverages data to inform decisions about the use of various practices, with the goal of promoting positive student behavior through improved school climate and a reduction in discipline problems. Randomized controlled trials (RCTs) of school-wide PBIS (i.e., Tier 1 or the universal components of the multi-tiered framework) have demonstrated significant effects across a range of student behavioral, social emotional, and academic outcomes; reductions in student need for additional supports; and improvements in ratings of school climate (e.g., Bradshaw, Koth, Thornton, & Leaf, 2009; Bradshaw, Mitchell, & Leaf, 2010; Bradshaw, Waasdorp, & Leaf, 2012; Horner et al., 2009; Lee & Gage, 2020). Moreover, a recent quasi-experiment of the effectiveness of SW-PBIS scale-up across a single state demonstrated positive academic and behavioral outcomes when brought to scale and implemented as regular practice (Pas, Ryoo, Musci, & Bradshaw, 2019). Together, these two large-scale, rigorous, and outcome-focused studies provide compelling support for the potential benefits of PBIS regarding academic, behavioral, and mental health outcomes, which in turn could render considerable cost savings for states and school divisions.

Given its promising impact and widespread use, there is growing interest in how the effects of PBIS translate into cost savings. Although there are a few studies examining costs of PBIS implementation, as well as some studies examining the costs of PBIS in relation to benefits (e.g., Blonigen et al., 2008; Bradshaw, Debnam, Player, Bowden, & Lindstrom Johnson, in press; Horner et al., 2012; Lindstrom Johnson, Alfonso, Pas, Debnam, & Bradshaw, in press; Swain-Bradway, Lindstrom Johnson, Bradshaw, & McIntosh, 2017), few studies have systematically considered the actual cost savings associated with the various impacts of PBIS (e.g., delinquency, mental health, academic), particularly when scaled-up to the state level. This study sought to fill this critical gap in the literature by examining the costs saved when scaling PBIS to a state level by leveraging findings from two large-scale rigorous studies of the universal Tier 1 PBIS framework within a single state.

Economic Evaluation of Educational Interventions

Economic evaluation is an umbrella term to represent a family of methodologies including cost analyses, cost-effectiveness analyses, or a cost-benefit analysis (see Barrett, Gadke, & VanDerHeyden [in press] for an overview of the use of these methodologies in schools, and Crowley et al. [2018] for an overview of economic analysis of prevention programs). One common component across all of these approaches is the cost of the intervention. Best practices recommendations currently support the use of the ingredients method (Levin, McEwan, Belfield, Bowden, & Shand, 2017), whereby the resources needed to achieve high implementation fidelity are mapped onto the various "ingredients" or components of the intervention, which are then quantified and priced accordingly (see Bradshaw et al., in press). These intervention costs are important in their own right, as they represent the necessary investments for the target outcomes and can be elucidated across different stakeholder groups (Lindstrom Johnson et al., in press). They can then be compared with the outcomes of an intervention, either in the form of the effects of an intervention (i.e., cost-effectiveness analysis) or the monetary value of these effects (i.e., cost-benefit analysis).

In a cost-benefit analysis, shadow pricing is a commonly used method through which monetary benefits are calculated. Shadow prices reflect the amount of resource someone would be willing to pay to obtain an outcome, such as reduced suspensions or mental health problems (Blonigen et al., 2008; Levin et al., 2017). For example, Belfield and colleagues leveraged the existing literature on social and emotional learning (SEL) programs and their outcomes to extrapolate both the costs and benefits of six widely used SEL interventions. They found a positive return on investment – whereby the benefits exceeded costs - for all of the six SEL interventions examined. Another important contribution of this study was the creation of shadow prices that go beyond societal "ills" (e.g., drug use, delinquency) or academic outcomes to account for intervention effects on positive social behavior and emotional distress. However, this approach has yet to be applied to other school-based frameworks like PBIS, and thus serves as model for the current study.

Economic Evaluation of PBIS

While one of the proposed benefits of preventive efforts such as PBIS is a cost-savings, this type of data is often overlooked and is rarely utilized as a component of evidence-based decision-making (Crowley et al., 2018). In order to understand the return on investment for PBIS, it is necessarily to both understand the cost and the monetary benefits. Current economic analyses of PBIS have focused primarily on the cost of PBIS. For example, recent work suggests a per pupil cost of $48.67 per student per year (Lindstrom Johnson et al., in press); this cost estimate accounts for the cost to scale-up PBIS statewide and includes costs borne by schools, districts, and state-level supports. In this study, schools were found to bear the majority of the cost, primarily accounted for by the time dedicated by school personnel for training and implementation with an additional cost driver of coaching. This and other research suggests a per school annual cost of PBIS between $20,000 and $37,000; however, these annual costs may range based on various factors, such as the number of years implementing PBIS and the fidelity of PBIS implementation (Blonigen et al., 2008; Bradshaw et al., in press; Lindstrom Johnson et al., in press). District-level estimates of cost account for the role of training and day-to-day support of PBIS teams with a cost of the district of $143,000 per year. State-level supports include time dedicated by personnel to develop curriculum, assessment, and training as well as provide technical assistance for districts (Lindstrom Johnson et al., in press). Despite the emerging body of literature on the costs of PBIS, which is relevant to budgeting and suggests the possibility of a large return-on-investment, an important next step is to begin to quantify the known-benefits of PBIS.

Benefits of PBIS

The effects of PBIS have been well documented through a number of randomized controlled trials (RCTs), mainly at the elementary level, as well as by quasi-experimental studies. Lee and Gage (2020) provided a recent comprehensive review of the benefits of PBIS across multiple studies. However, in the current study, we focus on a single elementary school RCT and a quasi-experimental study including elementary and secondary schools, both of which were conducted in Maryland. We leveraged these two studies to estimate the cost saving associated with the outcomes achieved using shadow pricing. Specifically, we utilize findings from a 37 elementary school RCT testing the universal or Tier 1 components of PBIS. Data were collected at baseline, and three years post-PBIS training, for a total of four waves of data. The results, which are published in detail elsewhere, demonstrated impacts of PBIS on reductions in student office discipline referrals and suspensions, and improvements in state standardized tests (Bradshaw, Mitchell, & Leaf, 2010). In addition, there were small but signficaint improvements in teacher-ratings of students' behavior in PBIS schools; specficially, teachers rated each student using a valid checklist style measure of student behavior and social-emotional functioning (Bradshaw, Waasdorp, & Leaf, 2012). The results indicated that schools randomized to implement Tier 1 PBIS had students displaying fewer behavioral problems, including aggressive behavior, concentration problems, bullying, and peer rejection, as well as more prosocial behavior and better emotion regulation (Bradshaw, Waasdorp et al., 2012; Waasdorp, Bradshaw, & Leaf, 2012). Additional details on the design of the RCT and the specific outcomes, as well as information demonstrating that the PBIS trained schools achieved high fidelity implementation of the school-wide elements of the program, are reported in Bradshaw et al. (2010).

The second study we draw upon used a quasi-experimental design to test the impact of PBIS scale-up in elementary and secondary schools; this study leveraged administrative records data, with the goal of examining the longitudinal effects of school-wide PBIS across six years. This study used propensity score weights to allow for PBIS trained schools in the state to be contrasted with non-trained schools. Specifically, the study examined the effects of PBIS in elementary and secondary (i.e., middle and high) schools across an entire state (i.e., a total of 1,316 schools; 879 elementary schools and 427 secondary schools) and was conducted seven years after the initial state-wide scaling efforts began (i.e., building a state-wide infrastructure for annual training and data collection to evaluate the scaling of PBIS; see Pas et al., 2019 for additional details). The propensity score weights were calculated using the average treatment effect for the treated (McCaffrey et al., 2013) utilizing 10 school demographic and outcome variables (e.g., percent of students receiving services; racial composition; academic proficiency rates; and suspensions and truancy). This study demonstrated positive impacts on student suspensions and academic outcomes (Pas et al., 2019). For example, in elementary schools, PBIS schools had statistically significantly lower suspensions (i.e., small effect size) and higher reading and math proficiency rates (i.e., small to large effect sizes). Secondary PBIS schools similarly had statistically significantly lower suspensions and truancy rates and higher reading and math proficiency rates (all but suspensions were medium size effects). Taken together, these two Maryland-based studies, along with the much larger set of PBIS findings from a recent meta-analysis (see Lee & Gage, 2020), indicate significant promise of PBIS and serve as a foundation for an analysis of the economic benefits of the outcomes of PBIS.

Current Study

The goal of the current paper was to utilize extant rigorous research regarding the significant impacts of PBIS on student outcomes from these two Maryland studies to understand both the immediate and long-term cost savings associated with state-wide scale-up of PBIS. Specifically, we calculated the dollars saved by combining findings from the Maryland-based RCT and the quasi-experimental study of PBIS and shadow prices of various effects on students' behavioral and mental health and academic performance, which were based on several other published economic studies (e.g., Belfield et al., 2015). This cost-related information has the potential to inform state-wide scale-up efforts, and funding related decisions at the state and local levels.

Method

Source of Benefits Data

As described above, the data on the benefits of PBIS come from two rigorous tests of PBIS in the state of Maryland. Specifically, we draw upon findings from a Tier 1, universal school-wide RCT of PBIS in elementary schools (Bradshaw et al., 2010; Bradshaw, Waasdorp et al., 2012; Waasdorp, Bradshaw, & Leaf, 2012) and a quasi-experimental effectiveness scale-up study of PBIS (Pas et al., 2019). Significant impacts on nine unique (i.e., non-overlapping) outcomes were pulled from the two studies and organized for efficiency together under the three outcome categories of delinquency, mental health, and academic achievement. Table 1 provides a benefit map, which includes the name of the measure or indicator and the citation for the specific PBIS effect, along with a range of possible effect sizes derived from the two PBIS studies, which were used in sensitivity analyses. This map and its organizational structure are critical, as it is important not to double-count benefits; for example, reading proficiency rate and math proficiency rate were averaged across years as an improvement in one area (i.e., academic performance), for it is likely that an improvement in reading may contribute to or at least be associated with improvements in math, as reflected by the correlation between these two performance indicators.

Source of Cost Data

In the absence of a market value for the delinquency, mental health, and academic achievement outcomes noted above, shadow prices were estimated based on a review of the cost literature. As noted above, shadow prices represent the amount of resources someone would be willing to pay to obtain a particular outcome (Levin et al., 2017). In the absence of a market (i.e., no buyers or sellers), it is necessary to estimate a value which often reflects what is currently spent to address or improve an outcome. These values (i.e., shadow prices) are present in the literature, calculated by a variety of methods (e.g., burden method, hedonic method; Boardman, Greenberg, Vining, & Weimer, 2011). Table 2 provides the shadow price as well as the source, year, and rationale for its valuation. Given the similar scope of outcomes of PBIS and SEL interventions, the shadow prices calculated by Belfield and colleagues (2015) were particularly relevant for this study. Other shadow prices (e.g., suspensions, academic outcomes, and the cost of office disciplinary referrals) came from known sources in the literature and are cited accordingly in Table 2. As noted above, specific attention was paid to ensuring that the shadow prices were based on unique costing explanations (e.g., “suspension rate” takes into account costs related to dropout whereas “aggression and disruptive behavior” is based on mental health costs). This is critical to avoid double-counting benefits; thus, as noted above, the effect sizes for reading and math proficiency rate were averaged together.

School and Sample Demographics

With regard to the sample for the quasi-experimental study in Maryland public schools, we focus on data from 1,316 schools. At the elementary level, approximately half of the students were male, 39.1% African American, and 46.8% Caucasian; 40.6% received free or reduced-priced meals, and 12.1% received special education services at baseline. At the school-level, the average school enrollment was 471.4 (*SD* = 158.0) and the student to teacher ratio was 19.3 (*SD* = 6.1). At the secondary level, approximately 33.8% African American, and 53.5% Caucasian; 28.5% received free or reduced-priced meals, and 11.6% received special education services at baseline. At the school-level, the average school enrollment was 1067.3 (*SD* = 532.6) and the student to teacher ratio was 20.8 (*SD* = 10.1). During the timeframe of this study, the average PBIS Tier 1 fidelity scores on both the School-wide Evaluation tool (SET) and the Implementation Phases Inventory (IPI), two commonly-used measures for schools in the state, were high (i.e., 80% or over in all years except the first year on the SET; see Pas et al., 2019 for additional details on the study design, fidelity, sample, and methodology).

For the RCT student-level outcomes, we focus on a sample of 12,344 children from the 37 elementary schools for whom the teachers completed ratings of individual students. Approximately 52.9% of the students were male, 45.1% African American, and 46.1%

Caucasian; 49.4% received free or reduced-priced meals, and 12.9% received special education services at baseline. At the school-level, the average school enrollment was 486.4 (*SD* = 157.8) and the student to teacher ratio was 11.3 (*SD* = 3.3); 48% of the schools were suburban, 41% were urban fringe, and 49% received Title I support. Importantly, a study by Stuart and colleagues documented that the schools in the RCT were representative of the elementary schools across the state, and thus the findings, have the potential to generalize to the state accordingly (Stuart, Cole, Bradshaw, & Leaf, 2011). The subsample of students in the RCT were in Kindergarten through grade 2 when the study started, and followed longitudinally, with teacher ratings completed at baseline (fall of first year) and spring of that year, and again in the spring of the following two years. All of the PBIS trained schools reached high fidelity Tier 1 implementation by the end of the trial, as indicated by their overall scores on the SET (Bradshaw et al., 2010). Additional details on the RCT sample, study design, fidelity, and methods are provided in Bradshaw et al. (2010), Bradshaw, Waasdorp et al. (2012), and Waasdorp et al. (2012).

Analyses

Total benefits of each outcome per 100 students exposed to school-wide PBIS are calculated in Table 3. First, the difference in the outcome was estimated by using the base case effect size from the literature (Table 1). Second, the cost savings per outcome was estimated by multiplying the number of improved outcomes per 100 students and the corresponding shadow price (adjusted into 2019 dollars). Third, a discount rate of 3% was applied, which adjusted for the fact that money received in the future (e.g., benefits) is worth less than the present value of money (Levin et al., 2017). Shadow prices except “suspension rate” (i.e., a lifetime benefit) were annual benefits, and were accrued each year the student was exposed to PBIS. Additional analyses accruing these specific benefits an average of 10.5 years for elementary students and 4 years for secondary students were conducted. These represent the median number of years an elementary student (grades K-5) or a secondary student (6-12) in the above studies would be exposed to PBIS. These are presented as the total present value (i.e., accrued benefits discounted). For sensitivity analyses, maximum and minimum possible effects based on the range of benefits (e.g., multiple different effects and confidence intervals of effects) in the literature were applied instead of the base case (see Tables 1 and 4). These cost findings are presented in tornado diagrams in Figure 1 (also see Table 4 for specific dollar amounts).

Results

Program Benefits

Program benefits are reported in Table 1, in which we also note which of the two studies (i.e., RCT or quasi-experimental) the particular benefit was originally reported. This table reports benefits by three different outcome categories. Benefits for outcomes related to delinquency were reported by changes in suspension rates, aggressive and disruptive behavior, bullying behavior, truancy rate, and office discipline referrals. Benefits for outcomes related to mental health were reported for changes in concentration problems and prosocial behaviors. Benefits for outcomes related to academic achievement were reported by changes in reading and math proficiency rates. Table 2 maps known shadow prices to these specific outcomes. Effect sizes for delinquency benefits ranged from -.007 to -.045 (which was a negative valanced outcome), for mental health -.025 and .034 (which was a positively valanced outcome), and for academic achievement 1.188% to 1.192% (which was a positively valanced outcome). Measures included both administrative data collected by the state, as well as information from the PBIS data collection system (e.g., School-Wide Information System), and finally from teacher reports (e.g., Teacher Observation of Classroom Adaptation - Checklist; see Bradshaw et al., 2012). Table 3 combines these effect sizes with the corresponding shadow prices.

As summarized in Table 3, the largest cost savings resulted from long-term cost savings. Specifically, improvements in standardized test scores produced a cost savings of $138,658 for elementary students and $71,444 for secondary students per 100 students. Reductions in aggressive and disruptive behavior as well as bullying behavior were also significant sources of cost savings as estimated for elementary students ($166,028 in total per 100 students). These benefits are complemented by additional lifetime benefits from a reduction of suspension ($33,415 for elementary students and $11,361 for secondary students per 100 students). Concentration problems and prosocial behaviors, as estimated related to expenses for mental health care (Belfield et al., 2015), resulted in a cost savings of $107,887 per 100 students for elementary students. Our data suggested that student truancy and office discipline referrals represented the lowest monetary benefit, likely because of how the benefits were operationalized (i.e., willingness to pay for a day of school and administrator time respectively). As such, they likely reflect more immediate savings rather than long-term savings, like savings with regard to academic impacts.

Sensitivity Analyses

The diagrams in Figures 1a and 1b demonstrate the possible ranges of benefits based on the range of estimates presented in the literature and 95% confidence intervals, for elementary and secondary schools, respectively (see Table 4 for the specific values). The widest range of possible values were for reading and math proficiency rates in elementary school and suspension rates in secondary school. All other benefits had a narrower range of variability, with most falling within a range of +/- $100,000. It should be noted that the range of all possible benefits was positive.

Discussion

The current study aimed to summarize the cost savings associated with known benefits of school-wide (Tier 1) PBIS. Using a shadow pricing approach, we leveraged data from an RCT and a quasi-experimental study of PBIS in Maryland, both of which had demonstrated significant impacts on a range of behavioral and mental health outcomes. The findings from this study suggested that PBIS implementation has the potential for significant cost savings that can be realized by both school divisions and state agencies. Although the savings associated with some outcomes, such as academic performance and suspensions, were greater than for others, such as mental health concerns (see Table 1), together these findings are quite encouraging, given the widespread implementation of PBIS in over 26,000 schools across the United States and abroad.

It should be noted that some of the outcomes reflected more immediate cost savings as outputs of PBIS, such as time spent processing office disciplinary referrals or managing truancy, whereas others reflect long-term savings from student outcomes, such as improvements in academic performance that could translate into greater likelihood of high school completion and subsequent employment. Not surprisingly, the cost savings that accrue from longer-term benefits, such as improved mental health and employment, contribute a greater cost savings per outcome (Belfield, 2014; Belfield et al., 2015). Interestingly, these benefits may be realized by agencies and service sectors other than the education system, thereby illustrating the importance of taking a holistic approach toward funding prevention approaches (Webb, 2018).

Limitations and Future Directions

Although broad in scope and potential significance, there are some limitations of the current study. Specifically, we focused only on data from a single state, which was in fact an early adopter of the PBIS framework and actively engaged in a state-wide scale-up effort (Bradshaw, Debnam et al., 2014; Bradshaw, Pas et al., 2012). Yet Maryland, like other states, has largely focused on the universal or Tier 1 supports within the multi-tiered framework, and has done significantly less scaling and measurement of the more intensive Tier 2 and Tier 3 supports. As such, stronger impacts may be revealed through a more systemic approach to scaling-up these more intensive supports, which often yield larger effect sizes relative to universal programming and may particularly have a greater impact on areas such as mental health (O'Connell, Boat, & Warner, 2009). The effects on student outcomes were averaged across populations, although there is compelling evidence that the impacts of the school-wide framework are often stronger (i.e., larger effect sizes) for at-risk students (Bradshaw, Waasdorp, & Leaf, 2015). Estimating the impact for subpopulations of higher risk students is an important future direction, as it may yield an even larger cost savings for at-risk students or schools with a high concentration of at-risk students (Crowley et al., 2018; O'Connell et al., 2009).

It should be noted that the RCT was conducted in elementary schools, with a longitudinal focus on children first exposed to PBIS in kindergarten through grade 3; as such, these cost-related findings for elementary students may not generalize to students first exposed to PBIS in upper elementary school or beyond. We also lacked data on some of the RCT outcomes in the quasi-experimental study, and thus there are fewer outcomes reported for the secondary schools as compared to the elementary. It is possible, however, that additional benefits could be estimated for secondary schools based on other studies of PBIS outside of Maryland (see Lee & Gage, 2020); however, we relied exclusively on the findings from the Maryland-based quasi-experimental study for the outcomes among secondary school students. Future research could be conducted to similarly estimate the cost savings associated with implementing PBIS at the middle and high school level on a broader set of developmentally-relevant outcomes, such as high school completion, entry into post-secondary education, and workforce readiness.

It should be noted that the total present value is based on assumptions of continuous exposure to PBIS, which may be more appropriate in Maryland than other states, particularly for secondary schools (i.e., no decay rate). However, we also did not account for the possibility of an amplification of results based on continual exposure (i.e., no ratchet effect). Although the schools in both studies were on average implementing PBIS Tier 1 supports with high fidelity (based on SET and/or IPI data), there was likely some variability in the outcomes, and thus the financial benefits, as well as costs based on implementation fidelity (Bradshaw et al., in press). Finally, while we attempted to minimize double-counting of benefits, benefits should not necessarily be considered entirely additive, as it is possible that some of the benefits may be correlated (e.g., delinquency and academic achievement). There may also be subsequent benefits not assessed in this study, like reduced reliance on the juvenile justice system which may result from the positive and preventive impacts of PBIS.

The current study focused only on benefits of PBIS by conducting shadow pricing, however, we did not take into consideration the costs of implementation and scale-up. This would have required an analysis of the costs of the two interventions that formed the basis of our benefits estimates. However, utilizing data from a recent study, also from Maryland, suggests that implementation costs for scale-up to the state would cost $37 million or $48.67 per student per year (in 2018 dollars; Lindstrom Johnson et al., in press). Comparing the per student number with the estimate of yearly benefits per students indicates the potential for cost off-setting, particularly for the academic and delinquency benefits. While we used best possible estimates of shadow prices, we were reliant on available literature, both with regard to the benefits of PBIS as well as the economic implications of these effects (Belfield et al., 2015). Therefore, as noted earlier particularly for effects of PBIS in secondary schools, we were limited in the data available. Additionally, as we focused on the implementation of the universal PBIS framework only, it is possible that additional mental health benefits may accrue with implementation of more indicated and selected interventions within the broader multi-tiered systems of support model (Barrett, Eber, & Weist, 2013; Bradshaw, Debnam et al., 2014). Future studies should jointly consider these two sets of cost data through the conduct of a more formal pre-planned benefit-cost analysis for PBIS, and a more explicit focus on cost savings associated with implementation of other evidence-based programs at the advanced tiers.

Conclusions and Implications

Although the effects of PBIS are now well-established (Lee & Gage, 2020), and there have been some estimates of cost savings for discipline specifically (e.g., Scott & Barrett, 2004; Swain-Bradway et al., 2017), this is the first comprehensive examination of cost savings from PBIS across a range of grade levels and student outcomes, including behavioral and mental health concerns. While many school staff are often focused on the proximal benefits and impacts of reduced office disciplinary referrals and truancy, typically realized by the school in terms of staff time (Bradshaw et al., in press; Scott & Barrett, 2004), the cost savings associated with these near-term impacts pale in comparison to the longer-term impacts on academics and mental health, which yield a considerably higher return on investment. Specifically, we found a net total present day cost savings value of $450,000 per 100 students in elementary school and $86,000 for secondary school. This suggests a solid return on investment for PBIS under a variety of assumptions, with a particularly compelling case to be made based on the cost benefits for implementation at the elementary school level.

Regarding the scaling of PBIS, the wide range of cost savings indicates a clear rationale and need for partnership among multiple stakeholders and funding streams (Webb, 2018). At the federal level, funding for technical assistance for PBIS has come through the Office of Special Education Programs (OSEP), thereby providing a significant impact and likely return on investment at a national level. In fact, in Maryland where the outcomes research was conducted for this study, the state department funding for PBIS has come through the Divisions of Special Education and Student Support Services within the Maryland State Department of Education (Bradshaw, Debnam et al., 2014). Given the benefits for academic outcomes, this should also be a vested interest of multiple branches of state departments of education, including curriculum and instruction. Moreover, the findings from this study suggest that the benefits of PBIS in terms of dollars translated into a significant cost savings, not only for education but potentially for other federal and state agencies (e.g., juvenile justice, mental health). Recognizing that the investments in education-related programming, like PBIS, results in financial benefits by other agencies and service sectors illustrates the importance of taking a holistic approach toward funding prevention approaches (Webb, 2018). Moreover, many of the lifetime financial benefits were substantially higher for elementary schools than secondary schools (e.g., suspension, academic performance); this developmental finding highlights the critical role of early prevention and intervention, and the timing of PBIS-related supports (O'Connell et al., 2009). As such, there is a need for increased partnership and encouragement for the blending of funding across agencies to support quality implementation of PBIS and other such evidence-based approaches to prevent behavioral and mental health problems (Bradshaw, Debnam et al., 2014).

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Table 1. Benefit Map for PBIS Outcomes in Elementary and Secondary Schools

Outcome Categories	Specific Outcomes	Elementary School Effect (range)	Secondary School Effect (range)	Measures	Study (Reference)
Delinquency	Suspension Rate[a]	-0.485 % (-0.74, -0.36)	-0.168 % (-2.25, 0.64)	Maryland State Department of Education	Quasi-experimental; Pas, Ryoo, Musci, & Bradshaw, 2019
	Aggressive and Disruptive Behavior	-0.020 (-0.038, -0.002)	NA	Teacher Observation of Classroom Checklist	RCT; Bradshaw, Waasdorp, & Leaf, 2012
	Bullying Behavior	-0.023 (-0.041, -0.005)	NA	Teacher Observation of Classroom Checklist	RCT; Waasdorp, Bradshaw, & Leaf, 2012
	Truancy Rate[a]	-0.160 % (-0.41, 0.06)	-0.325 % (-1.33, 0.65)	Maryland State Department of Education	Quasi-experimental; Pas et al., 2019
	Office Discipline Referral	-0.007	NA	School-Wide Information System	RCT; Bradshaw, Mitchell, & Leaf, 2010
Mental Health	Concentration Problems	-0.025 (-0.050, -0.001)	NA	Teacher Observation of Classroom Checklist	RCT; Bradshaw, Waasdorp et al., 2012
	Prosocial Behaviors	0.034 (0.002, 0.065)	NA	Teacher Observation of Classroom Checklist	RCT; Bradshaw, Waasdorp et al., 2012
Academic Achievement	Reading Proficiency Rate[a, b]	1.192 % (0.04, 3.65)	1.603 % (-0.02, 6.10)	Maryland School Assessment	Quasi-experimental; Pas et al., 2019
	Math Proficiency Rate[a, b]	1.188 % (0.08, 2.38)	1.360 % (-0.19, 5.37)	Maryland School Assessment	Quasi-experimental; Pas et al., 2019

Note. [a] Reading proficiency, math proficiency, suspension and truancy rate effects were averaged across 2006-2012. To avoid double-counting benefits, reading and math proficiency effects were averaged (Washington State Institute for Public Policy, 2017). NA indicates that data were not available on these outcomes. This represents the limited information about the benefits of PBIS in secondary schools (Lee & Gage, 2020)

Table 2. Shadow Prices and Research-based Rationale

Benefits from changes to	Per outcome	Explanation	Year of Shadow Price	Reference
Suspension Rate	$62,361	A one percentage-point reduction in the suspension rate would reduce the number of suspended students by 35,279 and the number of dropouts due to suspensions by 4,233, yielding a fiscal benefit of $691 million and a social benefit of $2.2 billion.	2016	Rumberger & Losen, 2016
Aggressive and Disruptive Behavior	$4,470	Shadow prices for aggression are derived using the cost of conduct disorder (CD). This price represents the annual present value benefits of moving from the median burden to the 44th-45th percentile burden (effect size of .12).	2015	Belfield et al., 2015; Damon, Foster, Jones, & Conduct Problems Prevention Research Group, 2005
Bullying Behavior	$3,370	The economic consequences of bullying include: days of missed school; school personnel time to respond to bullying cases; school practices and training programs to mitigate bullying; parental time to resolve bullying; resources of social services; resources for alternative placement of perpetrators; and justice system expenditures for cases that involve the legal system.	2015	Belfield et al., 2015
Truancy	$2,380	Truancy is defined by missing 20 or more days of school across a given school year. Societal willingness to pay for a school day is estimated using average daily expenditures for a day of public school nationally in 2014 prices, which is $70 per day.	2015	Belfield et al., 2015
Office Discipline Referral (ODR)	$9	Taking 10 minutes as the measure of the average administrator time spent processing an ODR multiplied by an administrator's daily salary to indicate the cost of the time saved. School administrators' salary and wages were estimated at $55/hour in Maryland.	2019	Scott & Barrett, 2004; Pas, Lindstrom Johnson, Alfonso, & Bradshaw, 2020
Concentration Problems	$2,490	Shadow prices for prosocial behaviors is derived using the cost of ADHD. This price represents the annual present value benefits of moving from the median burden to the 44th-45th percentile burden (effect size of .12).	2015	Belfield et al., 2015; Damon et al., 2005
Prosocial Behaviors	$1,360	Shadow prices for prosocial behaviors is derived using the cost of oppositional defiant disorder (ODD). This price represents the annual present value benefits of moving from the median burden to the 44th-45th percentile burden (effect size of .12).	2015	Belfield et al., 2015; Damon et al., 2005
Reading and Math Proficiency	$12,307	The average cost of achieving national average outcomes for all districts in Maryland was estimated.	2018	Baker, Weber, Srikanth, Kim, & Atzbi, 2018

Table 3. PBIS Benefit per 100 Students by Outcome across Elementary and Secondary Schools

Outcomes	**Number of students Affected**	**Saving per outcome (adjusted to 2019 dollars)**	**Total Saving per 100 Students[b]**	**Total Present Value[c]**
Elementary Schools				
Suspension Rate[a]	0.5	$66,830	$33,415[a]	$33,415
Aggressive and Disruptive Behavior	2.0	$4,851	$9,702	$88,931
Bullying behavior	2.3	$3,657	$8,411	$77,097
Truancy	0.16	$2,567	$411	$3,767
Office Discipline Referral	0.7	$9	$6	$55
Concentration Problems	2.5	$2,702	$6,755	$61,918
Prosocial Behaviors	3.4	$1,475	$5,015	$45,969
Reading and Math Proficiency[d]	1.2	$12,606	$15,127	$138,658
Secondary Schools				
Suspension	0.17	$66,830	$11,361[a]	$11,361
Truancy	0.33	$2,567	$847	$3,244
Reading & Math Proficiency[d]	1.48	$12,606	$18,657	$71,444

Note. [a] Suspension rate estimates are lifetime benefits and therefore are not adjusted for a cumulative effect (Belfield, 2014).
[b] Total saving per 100 students = Number of students affected X Saving per outcome
[c] Total Present Value is the cumulative benefit (e.g., Totals savings X Years of Potential saving) with a discount rate of 3%
[d] To avoid double-counting benefits, reading and math proficiency effects, which were operationalized based on performance on the state's standardized test scores, were averaged (Washington State Institute for Public Policy, 2017).

Table 4. Sensitivity Analysis for the Cost of Benefits at Elementary and Secondary Schools

Parameter	**Model Parameter Values**			**Total Benefit**	
Elementary Schools	Base Case	Low	High	Low	High
Suspension Rate	-0.49	-0.74	-0.36	$466,517	$441,122
Aggressive and Disruptive Behavior	-2.02	-3.80	-0.20	$529,848	$369,772
Bullying Behavior	-2.30	-4.10	-0.50	$510,149	$389,473
Truancy	-0.16	-0.41	0.06	$455,690	$444,631
Concentration Problem	-2.50	-5.00	-0.10	$511,728	$390,369
Prosocial Behaviors	3.40	0.20	6.50	$406,545	$491,723
Reading and Math Proficiency	1.19	0.06	3.02	$318,085	$660,112
Secondary Schools					
Suspension Rate	-0.17	-2.25	0.64	$225,055	$31,917
Truancy	-0.33	-1.33	0.65	$95,879	$76,416
Reading and Math Proficiency	1.48	-0.11	5.74	$9,295	$291,690

Note. Low and high are reported to reflect the range of estimates, as a sensitivity analysis. To avoid double-counting benefits, reading and math proficiency effects, which were operationalized based on performance on the state's standardized test scores, were averaged (Washington State Institute for Public Policy, 2017).

Figure 1a. Tornado Diagram for Elementary Schools Depicting Cost Savings Associated with PBIS by Outcome

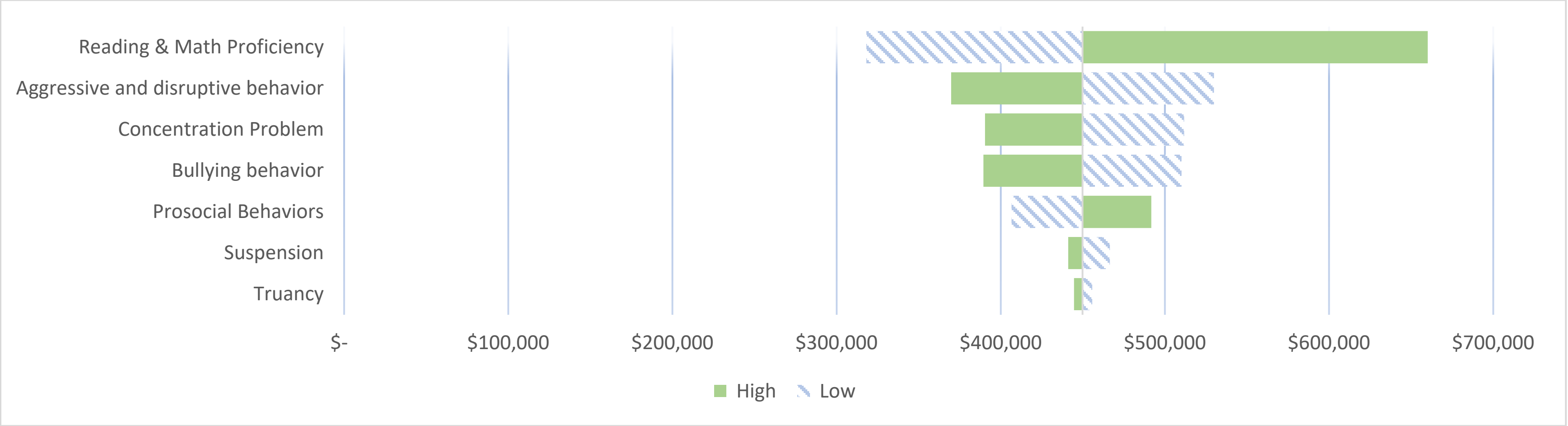
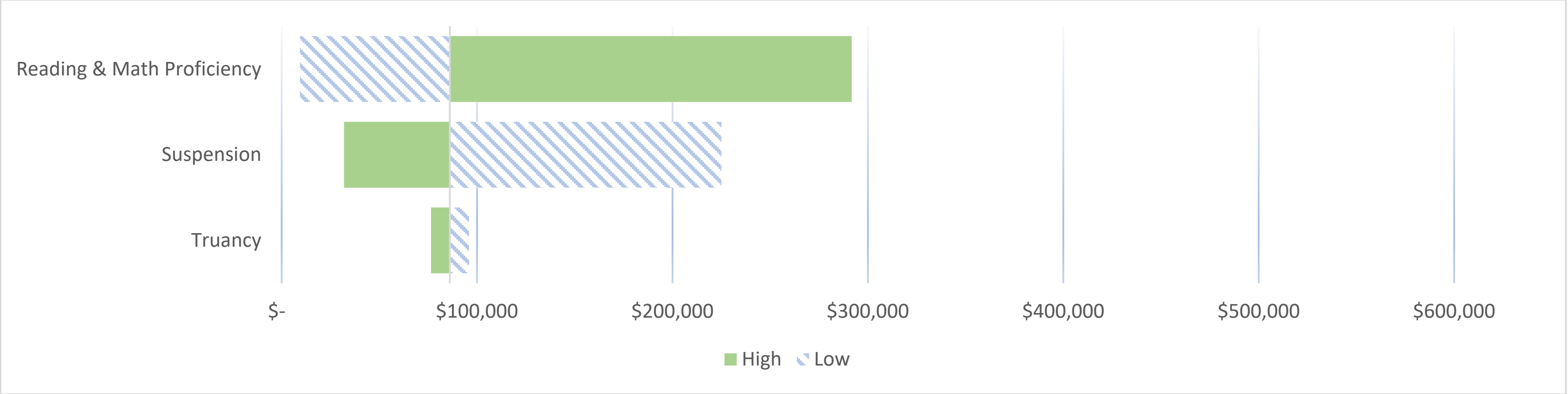


Figure 1b. Tornado Diagram for Secondary Schools Depicting Cost Savings Associated with PBIS by Outcome



Note. Given the lack of variability for the Office Discipline Referral estimate, no sensitivity analyses are presented. To avoid double-counting benefits, reading and math proficiency effects, which were operationalized based on performance on the state's standardized test scores, were averaged (Washington State Institute for Public Policy, 2017).