Boston School Yard Initiatives and School Performance: An Assessment
Russ Lopez. DSc, MCRP and Tamara Daly, MPH
2009

Introduction

There is growing interest in studying and evaluating the relationship between active living environments and health. Healthy places require more than fresh air, clean water and sewer systems, or the lack of pollution or toxins in the environment. The amount and quality of open space in the environment in particular may impact health and other outcomes. This study examines between Boston Schoolyard Initiative (BSI) improved open spaces in the Boston Public School (BPS) system and health, learning, and behavioral indicators for its children.

Schools with BSI projects tended to have improved math MCAS scores, fewer suspensions, and greater student and teacher attendance than schools without BSI projects after controlling for school demographics.

We previously published a study, based on data from 2004, which suggested there was an association between BSI-renovated schoolyards and performance on 4th grade standardized math test scores. That ecologic study (it used overall school measures, not individual information) controlled for school demographic data but was essentially focused on one point in time. It used 2004 data even though some schools had been renovated up to ten years previously. It also did not control for pre-renovation test score results. In other words, it was not possible to rule out the chance that BSI schools had outperformed non-BSI schools even before renovations took place. The previous study also only looked at two outcomes, math scores and English language arts scores (the later was not associated with renovated schoolyards).

This report updates the earlier study in several ways. It re-examines the math data using 2008 and other years' data, controls for pre-renovation school performance, and examines a broader set of school outcomes. Also, it assesses if there were pre-renovation tendencies towards higher test score performance at schools that were to have Boston Schoolyard Initiative renovation projects. We found that there was no pre-renovation bias at eventual BSI schools, the BSI-improved test score association continues when 2008 scores are examined, and that the effect of BSI projects can be found when scores two years after renovations are examined (T+2) and when pre-renovation scores are controlled for (T-2). Furthermore, we find that the renovations are associated with reduced suspensions and improved student and teacher attendance. We did not reassess English language scores; we will look at these scores at a later date.

Background

The Boston Schoolyard Initiative is a nationally recognized public private partnership which has renovated slightly more than half of the outdoor environments of schools in Boston, Massachusetts. The projects use a collaborative planning process that relies on extensive participation by teachers, school personnel, neighbors, students, city personnel and others. Each project is very site specific with all projects containing state of the art play equipment and many having outdoor classrooms. In addition, BSI provides training and support to all Boston schools to promote experiential science learning and writing programs.

Most of the Boston Public Schools were designed and built about a century ago and the way they were designed reflected the philosophy of education at that time. It wasn't till well after World War

II that schools were built with the whole child in mind along a more humane model and in a manner consistent with current educational theories. Many schoolyards declined during successive budget crises from the 1960s through the 1980s and it was not until the City of Boston, along with community representatives, took a new look at school conditions that a coalition began to develop to advocate for revived schoolyards.

It is important to consider that there is considerable turnover at all BPS schools. But the BSI schools continued to have better outcomes even years after projects were completed. This may suggest that the positive impacts on students accrue fairly quickly

The Boston Schoolyard Initiative (BSI) rose out of the demand by parents and communities to remodel the existing facilities, to create play spaces and a more welcoming environment. In 1994 the Mayor of Boston was approached by the Boston Green Space Alliance and the Urban Land Use Task Force and enthusiastically supported their ideas of creating a public/private effort to revitalize Boston's schoolyards. These efforts lead to the formation of the Boston Schoolyard Initiative in 1995. Currently there are 143 schools in the Boston Public School system (BPS) and by 2010 the BSI will have completed renovations on 85 of those school's yards, or outdoor spaces.

Methods

We examined grade schools only because older students have a greater probability of being influenced by other factors and the number of middle and high schools is too small to give a study the statistical power to find associations. We found the year in which the schoolyard improvements were completed, and called that "year zero."

This was an ecologic study: data were collected on a school basis, no data on any individuals were included in this analysis and thus this was not human subject research. Though the data are all public information provided by the Boston Public Schools as mandated by federal and state law, much of the data are no longer available from public datasets. Thus while some of the data were collected from the Boston Public Schools and Massachusetts Department of Education internet sites, much of the data collection necessitated visits to the archives of the Boston Public Schools. We are most grateful for the assistance we received from BPS personnel in making this data available.

Dependent variables

The primary outcome of interest was the percentage of students at a school who passed the 4th grade math MCAS test. The Massachusetts Comprehensive Assessment System (MCAS) is Massachusetts's standardized test instrument as mandated by state and federal law. The tests are administered annually to all 4th grade students at the Boston Public Schools. This was calculated using the number who received a passing grade on the test divided by the number of students taking the test at each school. We collected data at three point of time. Two years before the BSI project was completed (T-2), two years after the BSI project was completed (T+2), and 2008. For schools that did not have a schoolyard project (the control schools), we selected 2002 as Tzero year because that year represents the mean date of BSI projects. This results in the use of 2000 as the T-2 year and 2004 as the T+2 year for non-BSI schools.

Other dependent variables were the percentage of students suspended, the percent student attendance, and percent teacher attendance. School attendance rates may approximate physical health, as children miss school primarily due to illness. Suspension data rates may be a gross proxy for behavioral health, as children are generally suspended for extremely un-acceptable behavior. It is hard to measure less extreme psycho-social health effects, but perhaps academic performance reflects this.

When children are calm and well behaved, they may learn better. So perhaps the MCAS scores may be positively affected.

Independent variables

Given that student demographics have been associated with test score results, we controlled for the percentage of Asian, Black, and Hispanic students, the percentage of students receiving free or reduced lunches, and the percentage of students who were in special education programs. Again, we collected this data at three points in time, T-2, T+2, and 2008. Data on the year of BSI projects was provided to us by the Boston Schoolyard Initiative Staff.

The improvement in math MCAS scores does not appear to be the result of better school performance before the projects were initiated.

Data were analyzed using Stata v.9. Data were weighted using the number of students per school. First basic descriptive statistics were calculated, next we analyzed bivariate regressions. Then we analyzed the data in a series of multiple regression models, progressively testing to see if the previous association was also found in 2008 math data, in T+2 math data, T+2 data controlling for T-2 scores, other outcomes, then other regressions to further test if the associations we found were the result of differential participation in the BSI program.

Results

The total sample consisted of 78 schools, all the BPS schools that have a fourth grade. Unfortunately, we could not obtain T-2 data test score data for several schools which were renovated during the first several years of the BSI program, but we incorporated these schools into analyses when we could. There has been a steady improvement in math MCAS scores over time, from an approximately 12% point rate in T-2, to 20% in T+2, to 30% in 2008. Both student and teacher attendance was very high across all schools, and the percentage of students suspended low.

Student and teacher attendance is very high throughout the BPS system. However, the data still show a small, statically significant improvement in both teach and student attendance at renovated schools.

Comparing BSI versus non-BSI schools, at T-2 the BSI group had more Hispanic students, more students receiving free or reduced lunches, and higher MCAS test scores. The other variables were similar across both groups. At T+2, BSI schools had more Hispanic students and fewer special education students. In 2008, BSI schools had more Hispanic students, more special education students, and lower suspensions. Other variables were similar between the two groups.

The math T+2 bivariate regression models tended to show small, statistically insignificant associations with the exception of the percent of students receiving free and reduced lunches and the T-2 math test score results. Raw, unadjusted scores don't show any differences between BSI and non-BSI schools.

Looking at 2008 data, we found that having a BSI project was associated with a 3.82 percentage point increase in 4^{th} grade students passing the math MCAS test after controlling for school demographics. In the regression model using T+2 math scores and controlling for T-2 math scores, we found that having a BSI project was associated with a 2.84 percentage point increase in students passing the math MCAS (an approximately 12% improvement over non-BSI schools). These results were all statistically significant (meaning that it is unlikely that these results were obtained by chance).

Examining T+2 student suspension rates, we found that having a BSI project at the school was associated with 2.71 percentage points fewer students being suspended, statistically significant, and represent about a 50% improvement in the suspension rate. Because of data limitations, we could not control for T-2 suspension rates. The regression model on student attendance found that having a BSI project boosted student attendance by .025 percentage points after controlling for demographics and T-2 attendance rates. This was statistically significantly even though there was only a small variation in suspension rates among schools. Similarly, having a BSI project resulted in a .025 boost in teacher attendance rate at T+2 after controlling for demographics (we could not control for T-2 data). We examined a regression model at time T-2 to determine if having a BSI project was associated with improved math MCAS results before the projects were initiated. There was no statistically significant association with MCAS at T-2.

We looked at how school demographics changed from T-2 to T+2 in an attempt to determine if there was evidence that BSI schools improved because their student demographic profiles changed. We found that BSI schools gained Hispanic students and lost Black students at a slightly greater rate than non-BSI schools. However, these changes were modest and did not appear to explain the change in test scores at BSI schools.

Discussion

Overall, we found that having a BSI project at a school was associated with improved math MCAS performance two years after a project was completed and in 2008. BSI projects were associated with improved student and teacher attendance and decreased suspensions. These improvements persisted even in those models where we controlled for T-2 data.

Perhaps the reason why improvements in school performance persist is that the renovations themselves have proved durable.

It is important to remember that these are ecologic analyses and we do not explain the performance of any individual student. The models have high explanatory power (they predict a large percentage of the variability between schools), but there could be other, not included factors that might offer alternative explanations for the robust behavior of the BSI variables. There is no reason to expect this, however.

This study supports the idea that BSI projects are having large scale positive impacts on participating schools that range from academic improvements to better attendance and fewer discipline problems. Our analysis does not provide answers as to why the projects are improving the schools, but it could be that students are more willing to learn after using BSI improved schools, arrive at school more willing to learn, the teachers are more willing to attend these schools or that the presence of natural and learning enhancing landscapes improve school environments. These are all important potential benefits derived from BSI projects.

While the study provides important evidence that the BSI projects are resulting in measurable improvement in schools, there is still additional study that needs to be done. However, it appears that these improvements are real and that the efforts by the City of Boston, the Boston public schools, and the many people who have been involved in BSI projects, are helping young people in the city.

Descriptive statistics

	BSI schools			Non BSI Schools		
Variable	**n**	**mean**	**Std Dev**	**n**	**mean**	**Std Dev**
Black T-2	53	48.28	23.31	24	50.67	23.09
Hispanic T-2	53	29.56	21.79	24	24.11	18.63
Asian T-2	53	6.49	10.09	24	6.77	9.16
Free lunch T-2	53	82.4	8.83	24	78.94	10.18
Special Ed T-2	53	19.28	8.86	24	21.56	18.07
Suspensions T-2	0			0		
Student attendance T-2	53	94.36	1.41	24	93.98	3.17
Teacher attendance T-2	0			0		
Math MCAS T-2	37	11.95	12.41	24	12.54	10.24
Black T+2	53	45.96	24.75	25	47.3	23.43
Hispanic T+2	53	33.12	22.62	25	28.36	19.47
Asian T+2	53	6.35	10.12	25	7.18	9.66
Free lunch T+2	53	81.75	11.16	25	80.03	13.9
Special Ed T+2	53	19.53	8.95	25	24.22	17.19
Suspensions T+2	51	2.85	3.06	25	6.03	11.28
Student attendance T+2	53	94.89	1.11	25	94.51	2.42
Teacher attendance T+2	0			0		
Math MCAS T+2	53	21.24	13.43	25	19.08	18.29
Black 08	53	38.47	23.28	25	38.52	22.4
Hispanic 08	53	40.24	21.79	25	36.48	19.06
Asian 08	53	6.71	11.54	25	6	9.317
Free lunch 08	53	76.78	12.63	25	74.88	15.19
Special Ed 08	53	20.95	7.14	25	25.98	16.69
Suspensions 08	50	6.72	4.9	25	9.29	10.94
Student attendance 08	53	94.82	1.29	25	94.22	2.98
Teacher attendance 08	53	95.99	1.22	25	96.09	1.07
Math MCAS 08	53	31.13	19.97	25	28.76	16.81

Bivariate Regressions

Math T+2

Variable	Coefficient	95% Confidence Interval	R2
Black T+2	-0.123	(-.262, .016)	0.04
Hispanic T+2	-0.057	(-.215, 1.01)	0.1
Asian T+2	0.24	(-.102, .582)	0.02
Free lunch T+2	-0.472	(-.737, -.208) **	0.14
Special Ed T+2	-0.137	(-.415, .142)	0.01
BSI project	2.16	(-5.14, 9.48)	0.01
Math T-2	0.472	(.136, .809) **	0.12

Regression Models

Full Math T+2 Regression Model

Variable	Coefficient	95% Confidence Interval
Black T+2	0.586	(.512, .661) **
Hispanic T+2	0.623	(.551, .696) **
Asian T+2	0.577	(.506, .648) **
Free lunch T+2	-0.478	.(-.500, -.456) **
Special Ed T+2	-0.177	(-.184, -.157) **
BSI project	2.83	(2.45, 3.22) **
Math T-2	0.059	(.036, .082)**
Constant	-1.51	(-8.86, 5.83)
	R2 = .34	

Math MCAS2008 Regression Model (BSI variable only shown here)

BSI Project	3.82	(3.43, 4.21) **
	R2 = .41	

Math MCAS T+2 without T-2 controls (BSI variable only shown here)

BSI Project	3.08	(2.76, 3.39) **
	R2 = .38	

Suspensions T+2 (BSI variable only shown here)

BSI Project	-2.71	(-2.84, -2.59) **
	R2 = .64	

Student attendance T+2 (BSI variable only shown here)

BSI Project	0.025	(.002, .049) *
	R2 = .85	

Teacher/Staff attendance T+2

BSI Project	0.25	(.002, .491) **
	R2 = .76	

* Significant at the .05 level
** Significant at the .01 level

Acknowledgments

The authors would like to thank the staff of the Boston Schoolyard Initiative for their assistance in this project. In addition, the staff of the Boston Public Schools were most cooperative in assisting us in securing data. Finally, the authors want to recognize the work of the many people who have contributed to and worked with the Boston Schoolyard Initiative to enable it to renovate so many of the schoolyards in Boston.