Exploring the impact of a Breakfast in the Classroom (BIC) program in an urban Middle School in Western Massachusetts

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Exploring the impact of a Breakfast in the Classroom (BIC) program in an urban Middle School in Western Massachusetts

A Thesis Presented

by

MARIA A. O’DONNELL

Submitted to the Graduate School of the University of Massachusetts Amherst in partial fulfillment of the requirements for the degree of

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NUTRITION
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I am very grateful for the opportunities that the Department of Nutrition provided to me during my master’s program. I am also grateful to all faculty who supported my success. I am exceptionally grateful to my advisor, Dr. Lindiwe Sibeko, for her expertise and experience as I conducted my studies and for her continual assistance as I wrote my manuscript. She has provided tremendous support and guidance throughout my studies and has provided me with a number of opportunities allowing me to be where I am today. I am thankful to Dr. Lorraine Cordeiro for her support, mentorship, insight and valuable advice and suggestions as a committee member. I appreciate my committee for their critique and time spent to ensure the successful completion of my projects.

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ABSTRACT

EXPLORING THE IMPACT OF A BREAKFAST IN THE CLASSROOM (BIC) PROGRAM IN AN URBAN MIDDLE SCHOOL IN WESTERN MASSACHUSETTS

MAY 2020

MARIA O’DONNELL, B.S., THE PENNSYLVANIA STATE UNIVERSITY
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Directed by: Professor Lindiwe Sibeko

Although breakfast programs in schools have been encouraged in school-aged children due to numerous benefits on physical and academic performance, participation in School Breakfast Programs (SBP) remains lower than the National School Lunch Program in the United States. Some studies have found that lower participation in the SBP are due to barriers and stigmas. Some studies have found that when breakfast programs are taken into the classroom, uptake of the program improves. However, the relationship between breakfast intake and academic outcomes among young adolescents remains inconclusive. The goal of this study was to examine the effect of a newly implemented Breakfast in the Classroom (BIC) program within a large urban school district in Western Massachusetts. A secondary comparative cross-sectional analysis was conducted to investigate the impact of the “Breakfast in the Classroom” (BIC) program on middle school students’ academic performance, absenteeism rates, and school nurse visits, factors that influence learners positive experience within the school system. Data on a total of 1,897 students from seven public schools in Western Massachusetts were included in the analysis. Linear regression models showed that breakfast in
the classroom (BIC) program did not have a significant effect on student academic performance, attendance, and school nurse visits in a cohort of middle school students. Sensitivity analysis on a subset of the sample of students receiving free lunch who are also participants of the BIC program, had significantly higher academic performance outcomes than their BIC peers who were ineligible for the free lunch program. Findings of the study provide important baseline data for both food services and the school board district and can help inform future studies on the impact of the BIC program on student outcomes.
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INTRODUCTION

Poor dietary patterns not only contribute to overweight and obesity in adolescents but can also negatively impact academic performance. Nutritious dietary intake improves cognitive and motor functions, as well as academic performance, memory, and attention in school (Boschloo et. al, 2012 and Deshmukh-Taskar et al., 2010), with growing evidence suggesting that a nutrient-dense breakfast also improves academic performance (Cordoba et al., 2013; Kim et al., 2016). Yet, approximately 20% of children and 31.5% of adolescents in the US do not eat breakfast regularly (NHANES, 1999-2006).

School breakfast programs offer an opportunity to increase the nutritional quality of student’s dietary intake and offer cost-effective solutions that may serve as a mechanism to improve academic performance. Additionally, school breakfasts and mid-morning snacks could help combat one of the major causes of poor student concentration and discipline issues: hunger. Regular intake of nutrient-dense breakfast seems to impact other aspects of student life, including a decrease in student visits to the school nurse and lower absenteeism rates (Basch C. 2011 & Anzman-Frasca et al., 2014). Consequently, there is increased interest in finding effective strategies for improving breakfast intake among children and young adolescents.

Food insecurity is predominant in households with children, who are the most impacted (USDA 2017 & US Census 2015). Over 15 million people, or 12.3%
of households, within the US suffered from food insecurity at some point in 2016 (USDA, 2017). Studies have shown that food insecurity has adverse effects on child psychosocial development, growth, academic performance, and behavior (Chilton et al., 2007). Federal assistance programs, such as the Supplemental Nutrition Assistance Program (SNAP), the National School Breakfast Program (NSBP), and the National School Lunch Program (NSLP), contribute to alleviating food insecurity in participating children (Mabli et al., 2013 & Potamites et al., 2013).

**Breakfast in the Classroom (BIC) vs NON-BIC**

Massachusetts enacted a landmark legislation “The Childhood Hunger Relief Act” in order to address critical problems of childhood hunger in the Commonwealth. This legislation was implemented in response to the 1992 Project Bread and Department of Public Health study; “Children are Hungry in Massachusetts.” This first statewide study of hungry children in the nation documented that one in four, or nearly 200,000, Massachusetts children under the age of 12 suffer from hunger or are at risk of being hungry. These children are apt to have or develop serious health problems as well as learning and other behavioral issues which can affect their growth, development, and health (Kirby et al., 1997).

Breakfast programs have emerged as an important school initiative. These programs aim to provide nutritious meals that contribute to students’ overall diets. In order to impact student’s wellbeing and influence academic performance, stakeholders must ensure that nutritional needs are being met along with academic
needs. Student’s growth and academic performance may be affected when they miss breakfast on a regular basis (Adolphus et al., 2013). Controversial findings on breakfast intake, school breakfast participation rates, and school attendance have led to initiatives that advocate for moving breakfast from the cafeteria to classrooms and to offer free breakfast to each student (FRAC, 2010). The purpose of this project was to examine the impact of a school breakfast program on academic performance, absenteeism, and school nurse visits among middle school aged youth in an urban setting in Massachusetts.
CHAPTER 2

LITERATURE REVIEW

The impact of breakfast programs on student’s academic performance and related outcomes are of great interest to educators. School breakfast programs have the potential to improve student learning outcomes that may be associated with hunger as a result of student’s lack of breakfast consumption. School meal programs nourish students and help contribute to 50% of their daily caloric intake (Gleason & Suitor, 2001). On a typical school day in the U.S., more than one-fifth of school age children (5-17 years) receive free breakfast, and greater than 30% receive free lunches (USDA, 2018). The following literature reviews the impact of school breakfast programs on academic performance, absenteeism, and school nurse visits by adolescents.

The Importance of Breakfast

The Food and Nutrition Services, an agency within the United States Department of Agriculture (USDA), oversees multiple meal programs including those aimed at improving access to nutritious meals for youth. The School Breakfast Program (SBP) is one such initiative which provides federally assisted meal programs that operate in public and private schools, as well as residential childcare institutions. This program awards cash assistance to states so they can operate not-for-profit breakfast programs. Subsidies are given to participating schools who are mandated to follow federal requirements and offer free or reduced-price meals to income eligible students (FNS, 2018).
Traditional breakfast service, Breakfast in the Classroom, Grab ‘N’ Go Breakfast, Mobile Carts for Grab ‘N’ Go Breakfast, Breakfast After First Period, and Breakfast on the Bus are different types of breakfast programs that currently exist and deliver breakfast to the schools participating in assisted meal programs. The SBP operates similarly to the National School Lunch Program (NSLP) but has lower participation rates. Schools that provide breakfast to students must meet federal requirements, which follow the Dietary Guidelines for Americans (DGA, 2015). The DGAs are a tool to help Americans make healthy food decisions and to learn about food and nutrition for the prevention of chronic diseases and health promotion. Intentions to increase breakfast participation in the SBP includes increasing the accessibility of meal delivery to students by offering breakfast in the classroom or increasing the amount of time given to students for the consumption of breakfast in schools (Bartfeld et al., 2009).

Breakfast is considered the most important meal of the day, particularly for students (Spence, 2017). As the first meal of the day after a prolonged fast (during sleep), this meal provides a “break of the fast” and gives the body a source of energy. Whether participating in learning activities in class or playing sports, all students need energy to succeed. By eating breakfast, students get important energy and nutrients for their bodies including, vitamins and minerals, dietary fiber, and protein. Furthermore, studies have shown that students can increase test scores when they eat breakfast in the morning. Adolphus et al., (2013), found that children were more alert and readier to learn every day after consuming breakfast. In addition, children who eat breakfast improve their performance on cognitive
functions such as short-term memory, arithmetic, and logical reasoning (Adolphus et al., 2013). Studies have also demonstrated that making school breakfast convenient and accessible can be an incentive for getting students to class. Children who eat breakfast demonstrate improved behavior and concentration. Improved student behavior can often mean class time is more productive (Adolphus et al., 2013).

Students from low-income families are the most vulnerable to not eating breakfast. In 2017, one in six children experienced hunger in the US, with an estimated 6.5 million children who lived in “food insecure” homes, which means that those families didn’t have enough food to eat in their households, on a regular basis (USDA). By offering breakfast, schools ensure that students have access to a morning meal which may help feed lower income students who experience food insecurity (Bartfield et al., 2009). According to the Food Research Action Center (FRAC), in 2015-2016, 12.1 million low-income children participated in the School Breakfast Program on a typical day. Almost all (92.2%) of the schools serving lunch also served breakfast. For every 100 children in the SNLP, 56 low-income children participated in the SBP (FRAC, 2017).

**Overview of the Breakfast in the (BIC) Program**

BIC is an initiative showing great promise in providing universal breakfast to pre-kindergarten to high school students. The program has been in place for over 10 years, and operates within an integrated structure, where breakfast is served conveniently in a classroom setting, typically in the ‘homeroom’ class.
Breakfasts are packed and delivered in insulated carriers to the classroom once the bell rings (Figure 2.1). Students are encouraged to consume breakfast within the first 10-20 minutes after the first bell. Teachers often encourage students to complete educational activities, while breakfast is being consumed.

Figure 2.1 Insulated Breakfast Carriers

Although the literature is suggestive of positive outcomes associated with school breakfast programs, critics, including stakeholders like teachers and parents, have expressed concerns about the BIC program (Folta et al., 2016). The two most important concerns reported relate to time commitment to serve breakfast and the amount of food waste from students participating in BIC (Krueger et al., 2018). There is also a concern that low-income students (since they may participate at higher levels) will suffer the most by falling behind academically as a result of participating in breakfast programs that take time away from academic work. However, these concerns come from stakeholders (teachers and parents)
who also advocate for the consumption of a healthy breakfast as an important contributor to improve attention span and academic performance (Krueger et al., 2018 and Adolphus et al., 2013).

Adolescents with a tendency to skip breakfast are often racial/ethnic minorities, many of whom come from lower-income households (Bruening et al., 2009, Price et al., 2013 & Hearst et al., 2016). Students in rural settings are also vulnerable to breakfast skipping. Hearst and colleagues (2016) found that in their study of rural 9th and 10th grade adolescents, students experienced numerous barriers to accessing breakfast despite their school’s aim to increase school breakfast participation rates. The barriers identified by students included experiences of the breakfast taking too long to consume, the expense of the breakfast, the undesirable taste of food items offered, transportation to school resulting in a late arrival, and eating in the classroom being uncomfortable.

Olsta (2013) found that school breakfast program participation rates increased when cafeteria hours were extended and when mobile carts with breakfast items were placed in the school halls for student’s use, so they could access the food right before class (Olsta, 2013). In a study of high school students, Sweeney and colleagues (2006), discovered that students did not have school breakfast because of a dislike of breakfast foods offered. Once menus reflected items that were more appealing to students, breakfast participation rates increased.

Adolphus et al. (2013) found that some studies in the US, South Africa, Norway and other European countries suggested that students from lower SES
performed better when having school breakfast. Doku et al. (2013) found that 12 to 18-year-old students from affluent backgrounds were more likely to have breakfast regularly (Doku et al., 2013). There is consistent evidence that free school breakfasts have a positive effect on students’ health status, short-term cognitive performance, academic success, and greater school attendance especially for children from a lower SES (Adolphus et al., 2013). Additionally, school meals might be a significant supplement to the total food intake of students of lower SES.

Global evidence confirms that low socioeconomic status (SES) is a consistent determinant of lack of breakfast intake in youth. Garg et al. (2014) studied 10 to 16-year-old children from different socio-economic groups in India. Analyzing the prevalence of breakfast skipping, lower socio-economic class students had a higher prevalence of skipping breakfast. The study stated that higher socioeconomic class students “can afford to skip meals and then later compensate by eating elsewhere” whereas students from a lower socioeconomic class may not be able to afford to skip school meals.

There is increased effort to improve breakfast participation among children and young adolescents in school systems. The USDA reimburses every school that serves breakfast to its students. When the participation rate is low in breakfast programs, there is a potential loss in revenue for the schools.

The integration of BIC into the classroom allows universal access to breakfast, therefore reducing the stigma associated with meals designated for low-income students. Additionally, breakfast served in the classroom does not require
students to come to school earlier in order to benefit from a breakfast program. However, the program also gives students the opportunity to eat breakfast twice, increasing the student’s total caloric consumption.

Current literature shows an association between breakfast consumption and academic performance. Some studies reveal positive results in undernourished children or with those with low SES (Chau et al., 2016). Even when accounting for confounding factors, study outcomes suggest that habitual breakfast consumption improves academic performance.

**Academic Performance**

Literature indicates that consumption of breakfast on a regular basis by children and adolescents is associated with academic and health benefits. Students who reported skipping breakfast regularly were less likely to perform better academically than their peers who consumed breakfast (Hearst, 2016). Although evidence indicates the importance of breakfast for adolescents (Nanney et al., 2011), students may not view breakfast as a meal of great importance. Consequently, some skip breakfast either because of time, lack of hunger, or thinking it may assist with weight loss (Garg et al., 2014).

In a fed state following a meal, insulin levels rise, resulting in glucose absorption either in the muscle or brain tissues, to be used for energy. Organs, especially the brain, need a constant supply of glucose in order to operate properly. Thus, after a prolonged fast, which happens while sleeping, glucose and insulin levels drop, and metabolism slows down resulting in fatigue and hunger.
Therefore, children and adolescents that skip breakfast have difficulty concentrating and staying focused in school due primarily to lower glucose intake (Ptomey et al., 2016). Difficulty focusing plus hunger could lead to poor attention to lessons and contribute to low academic performance. Poor academic performance is an important contributor to adolescents’ decisions to drop out of school (Cueto & Chine M., 2008).

The purpose of the BIC program is to feed healthy food to students for nourishment and to positively impact academic performance and school behavior. A cross-sectional survey found that elementary school students using the BIC program were more likely to consume breakfast in the morning than children at non-BIC schools (Van Wye et al., 2013). There is a growing interest in evaluating the impact of a school-based breakfast program on academic outcomes. Many studies suggest that children and adolescents who consume breakfast regularly display high levels of academic performance. A Canadian study of 7 to 12-year-olds, found that students who consumed breakfast regularly had stronger school connections and higher academic performance, than their counterparts with irregular breakfast intake (Sampasa-Kanyinga H. & Hamilton H., 2017 and Ptomey L., et al., 2016).

Conversely, Bartfeld et al. (2018) found no significant relationship in academic performance when breakfast was served in the classroom compared to in the cafeteria for students eligible for free and reduced-price meals and/or whose families participated in the “Supplemental Nutrition Assistance Program (SNAP)” benefits. Students in the BIC program also had lower scores in math among low-
income students (Bartfeld et al., 2018). This finding corroborates concerns raised in studies conducted by Krueger et al. (2018) and Adolphus et al. (2013), that having BIC may take time away from schoolwork resulting in students falling behind in their class work.

The ability to differentiate between healthy and unhealthy foods may also be correlated with academic performance and healthy breakfast consumption among students. In a study conducted in Spain, researchers found that children who did not consume breakfast had deficiencies in processing information. This study found that students that took the time (between 10 to 20 minutes) to eat breakfast and responded that fruit intake should be higher on a daily basis, “had a greater knowledge” of healthy foods and better grades than their peers who could not distinguish healthy versus unhealthy foods, and had lower academic performance (Cordoba et al., 2013). Within the culture in Spain, “proper breakfast” is served at home and “second breakfast” is served at the school, and it is meant to compliment the morning intake. Eating breakfast regularly and distinguishing healthy versus unhealthy foods could help children and adolescents to make better choices in their diet as well as contribute to healthy nutritional status.

In a study from Kansas, Ptomey and colleagues (2016) examined the effects of breakfast consumption and composition of the meal on academic performance, using standardized tests scores of elementary school children. Participants completed a breakfast recall of all foods and beverages consumed in the morning. Ptomey et al. (2016) found that those who consumed whole grain
foods over fruit juice had significantly higher scores in mathematics and comprehensive reading (Ptomey et al., 2016).

In contrast, a UK study found no relationship between habitual breakfast consumption and academic performance in adolescents aged 11 to 13 years (Adolphus et al., 2015). Free school breakfast was used as a proxy for socio-economic status (SES), therefore, students who received free school breakfast were considered to live in a low SES household. Their academic performance was measured through reasoning testing. This study hypothesized that the frequency of habitual breakfast consumption on young adolescents would positively influence performance on the “Cognitive Abilities Test (CAT)”, a routine reasoning test in UK schools. CAT has been a strong predictor of academic achievement, previously tested by Lohman et al. (2001) and Strand (2006). Findings from Adolphus et al. (2015) differed from other studies and suggested that future research should focus on achievement tests assessing outcomes of the curriculum that is being taught rather than using reasoning tests.

Burrows et al. (2017) reviewed several studies to determine the relationship between dietary behaviors and academic performance in Australian twin children aged 8 to 15 years. In both observational and experimental design studies, there was a positive correlation between school breakfast programs, habitual breakfast intake, quality of breakfast, and academic performance using the standardized academic achievement test called “NAPLAN” (reading, writing, grammar/punctuation, spelling and numeracy). Consumption of fruit with breakfast resulted in higher test scores in writing (Burrows et al., 2017).
A Korean cross-sectional study found that habitual breakfast consumption that included fruits and milk resulted in increased academic achievement among 7th to 12th grade adolescents. Furthermore, in a comparison of nutrient dense foods versus nutrient poor ‘fast foods’, fast foods were negatively correlated to poor school performance (Kim et al. 2016). Littlecott et al. (2015) examined the relationship between participation in a free school breakfast program and educational outcomes of 9 to 11-year-old children in Wales, UK. When assessing academic performance through the “Statutory Assessment Tests (SATs),” students that consumed nutrient-dense meals reported higher scores than those with poor diet quality intakes (Littlecott et al., 2015).

In New Zealand, Ni Mhurchu et al. (2012) found the standard progress in children’s academic performance to be in accordance to the expected outcomes for that grade level and not associated with breakfast consumption. Furthermore, during the trial, there was no significant difference in the proportion of children eating breakfast at home. But, when schools participating in the study implemented a free school breakfast program, there were more students eating breakfast at school than at home (Ni Mhurchu et al., 2012). This example illustrates that school breakfast participation rates may increase significantly when breakfast is offered to every student is free.

**Absenteeism**

School attendance is a crucial element in determining academic achievement. Engaging with peers, teachers, and the school allows students to
develop positive behavioral and social skills. One critical objective of offering breakfast in schools is to reduce absenteeism rates among students (McDonnell et al., 2004). A portion of children and adolescents go to school hungry and without fueling their bodies with energy (food). Thus, they may experience low energy levels and fatigue, resulting in difficulty in the classroom, and a greater likelihood of getting into trouble in school (Øverby & Høigaard R., 2012 and Ptomey et al., 2016). Teaching social skills that improve student and school engagement may benefit middle school students and could serve as a preventative intervention to decrease absenteeism rates. Evidence also suggests that a universal free breakfast increases the likelihood of higher school attendance rates in elementary-school students, but not necessarily in schools with BIC programs (Bartfeld et al., 2018).

Smerillo et al. (2018) examined factors associated with chronic absenteeism, defined as students missing 14 days of school or more within a school year. Low-income and minority groups were the most at risk of school underachievement and dropping out of school. Participating students were more likely to be eligible for subsidized meals. The study found that males who were chronically absent more often, were from lower SES, qualified for subsidized meals, and their mothers were more likely to be unemployed and to have not completed high school. Vermeiren et al. (2018) found that students with higher SES were absent from school less often. Further, Smerillo et. al (2018) found that chronic absenteeism was negatively associated with academic performance. Students who frequently missed school were significantly behind in academic
performance compared to their peers that did not skip school as often (Smerillo et al., 2018).

An interesting observation was reported by Chau et al. (2016), where investigators found absenteeism recurred in 13-year-olds from the north-eastern part of France. The authors suggested the absenteeism was due to multiple factors including poor physical and psychological health, fractured social relationships, or difficult living environment (Chau et al., 2016). Furthermore, they confirmed that skipping school impacted academic achievement negatively and was associated with school dropout ideation among middle school students. The authors illustrated a relationship between socioeconomic factors and low academic performance, absenteeism, and dropout ideation (Chau et al., 2016). Similar outcomes were found associated with absenteeism, academic performance and school dropout, where poor health and family environment were major contributors.

Evidence does indicate that students are more likely to succeed academically by attending school regularly (Basch C., 2011 & Anzman-Frasca et al., 2014). These two studies have differing designs. Basch et al. (2011), examined the impact of a universal breakfast program structured as BIC and compared outcomes to those with breakfast in the cafeteria; whereas Anzman-Frasca et al. (2014) analyzed data associated with a BIC program without a comparison. There is some indication that there is a higher attendance rate in the schools that offer BIC (Anzman-Frasca et al., 2014). Basch (2011), suggests that when a nourishing breakfast is offered in school at no cost, it incentivizes parents and their children to attend school (Basch C., 2011). Whereas Mhurchu and colleagues (2012) did
not find a significant relationship between free school breakfast and school attendance. However, it is not clear if a significant proportion of student participants were from households were free breakfast was a need/incentive. Although a sensitivity analysis on a subset of students who attended the free breakfast program demonstrated a significantly positive association with school attendance (Mhurchu et al., 2012).

Previous studies have shown that obesity could also influence academic performance, due to its association with increased absenteeism. Mental and physiological health problems associated with obesity could be contributing factors in the observed correlation between obesity and student absenteeism (Datar et al., 2004 & Taras et al., 2005). In a cross-sectional study, Kang and Park (2016) studied Korean high school seniors to learn whether skipping breakfast and being overweight were related to academic performance. Increased time on screens and staying in bed longer resulted in students skipping school more often and a significantly lower probability of performing well at school (Kang & Park, 2016). Similarly, Daniels (2008) found that students who skipped breakfast had a greater tendency to be obese. Furthermore, obese students suffered from low self-esteem, social anxiety, discipline problems, and skipped school more frequently than non-obese students (Daniels 2008).

Although evidence on the association between school breakfast and attendance is limited, the available data suggest breakfast programs might have an impact on school attendance. Also, lower absenteeism rates and consumption
of breakfast most days of the week is associated with positive school performance outcomes.

**School Nurse Visits**

Skipped meals are associated with gastrointestinal discomfort and/or hunger, especially following a prolonged fast (i.e. sleep). Hunger may lead to feelings of anxiety, stress, boredom, irritability, lack of concentration, stomachaches, headaches, dizziness, and nauseas (Ke & Ford-Jones, 2015). These experiences can be related to lack of breakfast and result in students visiting the school nurse. BIC in schools may result in fewer nurse visits due to fewer symptoms related to lack of intake of a morning meal.

According to Borup et al. (2010), study participants, aged 11 to 15-years, tended to visit the school nurse for numerous reasons including headaches, stomachaches, difficulty getting to sleep, and nervousness. Additionally, these students reported medication use for their presenting complaints with girls more likely to use medication for headaches and stomachaches. There were more boys than girls who re-visited the school nurse for the same complaints (Borup et al., 2010). School nurse visits can be used to monitor some of the impact of a BIC program, as well as for reinforcing some of the benefits of breakfast consumption directly to students. Sweeney et al., (2006) showed that the frequency of reported stomach aches, headaches, tiredness, inability to pay attention, and hunger diminished with decreased visits to the school nurse observed.
There are a limited number of studies examining the impact of breakfast in schools and nurse visits. However, the implications of current evidence indicate that breakfast intake and nurse visits are emerging issues of public concern in the U.S. and several other countries. Numerous schools currently working with breakfast programs such as the grab and go breakfast, second chance breakfast, and BIC were surveyed and found that students receiving free breakfast in school, had decreased instances of visits to the school nurse (Bernstein L. et al., 2004 & FRAC, 2015). The current evidence that briefly addresses school nurse visits and breakfast programs is also dated (older than five years). Our study seeks to address this gap in the literature by examining the implications of BIC on school nurse visits, and to identify some of the challenges that may exist in capturing such data.

**National Guidelines for School Meal Programs**

Nutritious meals and snacks consumed throughout the day contribute to optimal growth and development in adolescence. Regular meals and healthy snacks consumed throughout the day should include an adequate energy level, protein, carbohydrates, fruits and vegetables, dairy products, and/or lean meats, fish, poultry, eggs, legumes and nuts. This variety of food groups provides a wide range of nutrients and contributes to proper growth and development in a youth's life.

In the U.S., breakfast and lunch served at schools aims to meet the “Dietary Guidelines for Americans.” In 2012, new regulations were implemented, which
required school cafeterias to serve more fruits, vegetables, whole grains, and less sodium, calories and unhealthy fats in school meals. Schools receive federal reimbursements as long as they offer reimbursable meals that meet federal nutrition standards. The USDA created nutrition standards for foods and beverages to ensure healthy choices offered in schools.

Concerns about the quality of food that students get from the SBP or the SNLP have captured the attention of school authorities, parents, students and the larger community. There is great concern over the composition and quality of meals being served in the schools and the nutritional adequacy students are obtaining. The correlation of being overweight and health-related behaviors to academic performance has also drawn much attention globally. Poor dietary behaviors due to a lack of infrequent meals, may impact academic performance since it has been associated with increased absenteeism and likelihood of being held back in school. Due to some of these reasons, students may experience increased sick days, leading to missed classes or tardiness, and subsequently affect school performance (Taras H. et al., 2005). Interestingly enough, some studies have found that children and adolescents who skip breakfast have a higher body mass index (BMI) and lower academic performance than those who do not skip breakfast (Keski-Rahkonen A. et al., 2003).

**Western Massachusetts’ Public Schools**

Data for this study is from a Western Massachusetts regional public school district, which is also the second-largest school district in the area. The majority of
schools in this district are urban, with a significantly diverse racial/ethnic student population. District-wide, the lunch average daily participation rate has increased to 81% and it has achieved a rapid increase in the breakfast average daily participation rate up from 47% in 2014 to 69% in 2016. These rates are above the national average daily participation rates of 59% for lunch and 30% for breakfast.

In some schools in the region, where BIC has been implemented, the breakfast average daily participation has grown even more rapidly. Furthermore, the school district has achieved quantifiable improvement in behavioral metrics like absence, tardiness, and behavioral problems, as well as improvements in academic performance, understanding other factors are also likely to have contributed to these improved outcomes (New England Dairy Council, 2017). Overcoming demographic challenges associated with student success is the school district’s priority. Initiatives such as the BIC program help to address some of the factors schools in the region are challenged with.
CHAPTER 3

METHODS

Study Rationale

Universal access and consumption of breakfast in the classroom achieves several goals. It provides nourishment and energy to all learners regardless of SES status. It physiologically ‘breaks the fast’ and fuels the body and brain. It minimizes the stigma that school breakfast is just for low income students. It addresses barriers of time constraints and lack of interest in eating too early. It has the potential to improve school attendance, minimizes symptoms of hunger, increase learner’s concentration and academic performance. Existing evidence suggests students who consume breakfast are likely to experience success in increased cognitive performance and higher academic achievement.

Study Objective

The overall objective of this study was to examine associations between breakfast in the classroom participation and middle school students’ academic performance, absenteeism, and school nurse visits in an urban city in Western Massachusetts.

Hypotheses

This study tests the following hypotheses:

- Hypothesis 1: Students participating in the breakfast in the classroom (BIC) program will achieve higher academic scores than their peers who are not participating in the BIC program.
• Hypothesis 2: Students participating in the breakfast in the classroom (BIC) program will have lower absenteeism rates; and fewer school nurse visits compared to their non-BIC peers.

Study findings will generate knowledge on the relationship between breakfast intake and academic performance, absenteeism, and visits to the school nurse. This study will also provide baseline data for the school district and will inform future studies.

**Data**

Data for this study was obtained from a large urban school district in Western Massachusetts. The school district is one of the largest in the state and serves students in grades Pre-kindergarten to grade 12, with a student-teacher ratio of 1:3. State test scores indicate that among all schools in the district, 25% of students are at least proficient in mathematics and 32% in reading. The percentage of 12th grade students who graduate is 77%.

Given that the BIC program implementation overlapped with academic testing in elementary students, this study focused on middle school students. Testing data comes from the state accountability exams. The school district operates under the Boundary School Assignment Plan at the elementary and middle school levels, where students are guaranteed placement according to where the student lives. Academic test scores determine whether students can advance to the next grade as well as meet standards for “Adequate Yearly Progress” under the No Child Left Behind Act of 2001.
Design and Study Population

This study is a comparative cross-sectional analysis of secondary data sourced from seven different middle school cohorts, reflective of a three-year academic period (2014-2015 to 2016-2017). Data consists of student-level information on annual attendance rates, grade point averages, standardized test scores, and school nurse visits. The data also provides student demographics that include race, gender, language proficiency, and economic status.

The overall objective of the study was to examine the association between middle school students’ breakfast intake (BIC vs non-BIC) and academic performance, absenteeism, and school nurse visits (Figures 3.1-3.3). The participants of this study were adolescents aged 12-16 years of age. Participant data represents a total of three years of middle school (6th to 8th grade), with each participating school de-identified with an assigned code. Cohort participants over the data period are presented in detail in Figure 3.4.
Figure 3.1 Study Design: Grade 6 cohort: traditional breakfast in the cafeteria program

Year 2015

1. SES was determined by lunch status (Free or Paid Lunch).

*Pseudonyms of schools participating in the study.
Figure 3.2 Grade 7 Cohort: BIC vs. NON-BIC programs

Year 2016

7th Graders 2015 - 2016

BIC
n= 506
Windy Cay
Ivy Reef
Scarlet Isle
Oasis Cay
Penguin Peninsula

NON-BIC
n= 238
Traditional Breakfast in the Cafeteria
Paccana Key
Sunny Key*

Student Demographics
Age
Gender
Race/Ethnicity
SES

Academic Performance:
GPA by quarter or semester

Total Absences

School Nurse Visits:
Nurse Visits

Student Demographics
Age
Gender
Race/Ethnicity
SES

Academic Performance:
GPA by quarter or semester

Total Absences

School Nurse Visits:
Nurse Visits

1. SES was determined by lunch status (Free or Paid Lunch).

*Pseudonyms of schools participating in the study.
Figure 3.3 Grade 8: Cohort receiving BIC

Year 2017

1. SES was determined by lunch status (Free or Paid Lunch).
2. *Pseudonyms of schools participating in the study.
Figure 3.4. Flowchart of the BIC Study cohort study subject participation from 7 middle schools from a Western Massachusetts’ school district.

MS = Middle School

Data Variables and Analysis

Data was categorized into three variables for each of the outcome measures assessed: 1) academic performance, 2) attendance, and 3) school nurse visits.

**Academic performance** was measured using the Partnership for Assessment of Readiness for College and Careers (PARCC) test, the Massachusetts Comprehensive Assessment System (MCAS), and grade point average (GPA). Grades 6, 7, and 8 were compared for GPA.

The PARCC standardized examination is a collection of exams administered to public school students on a yearly basis and measures student’s
academic progress, performance, and identifies problems in different areas of academic performance. In this study, PARCC Test scores included Math (MATH) and English (ENG) and was only considered in Grade 6th in 2015. However, BIC was not available at this time, so Grade 6 was not taken into consideration for the standardized test analysis (Table 5.1 summarizes baseline data). In 2016, when the participants were in 7th grade, the PARCC assessment test was substituted by the MCAS. The MCAS is also a standardized test aimed to measure the student’s ability to meet the state educational curriculum learning standards. Comparisons across two different standardized tests was not possible. Data on standardized test in grade 8 (2017) was not provided. In this study, test scores were based on two obligatory subjects, English and Mathematics, through the PARCC and MCAS standardized examination for when the participants were in grades 6 and 7.

**Attendance rates** were calculated by dividing the number of days of school attendance by the number of days enrolled for each student. Excused versus unexcused absences were taken into consideration. When a student was absent from school without permission or a valid reason, it was categorized as an unexcused absence, whereas an excused absence was when a student had a valid reason and/or permission. School attendance was analyzed comparing absences with BIC and without BIC. Grades 6, 7, and 8 were compared for absences. We looked at total absences as a more reliable indicator because schools were not always as accurate in distinguishing excused from unexcused
absences. There was not a strict and concise method across all schools from the district to accurately monitor absences.

**School nurse visits** data was gathered at the school-level only for incidents of visits to the school nurse with a description related to hunger. Headache, abdominal/GI concern-discomfort, abdominal/GI concern-hunger, general symptom-dizzy/lightheaded were the descriptions categorized as related to hunger and were only included in visits to the nurse. School nurse visits were only comparable from 7th grade to 8th grade students. Inconsistencies also applied with documentation of school nurse visits. This was particularly true for data collected across the school nurse visits when students were in 6th grade. For that reason, visits to the nurse could not be taken into consideration in the analysis among 6th grade students. School nurse visits data was used to compare grades 7 and 8 only. Like attendance, the visits to the school nurse recordings were not recorded 100% across the school district. There was a high turnover of school nurses during over the years, and each nurse had their own method of recording the purpose of the visit from the student.
Table 3.1 Sample size for outcome variable

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPA</td>
<td>1,845</td>
</tr>
<tr>
<td>English PARCC</td>
<td>241</td>
</tr>
<tr>
<td>Math PARCC</td>
<td>245</td>
</tr>
<tr>
<td>English MCAS</td>
<td>611</td>
</tr>
<tr>
<td>Math MCAS</td>
<td>589</td>
</tr>
<tr>
<td>Attendance</td>
<td>1,897</td>
</tr>
<tr>
<td>Nurse Visits</td>
<td>1,369</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome variables</th>
<th>Indicator used for analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic performance</td>
<td>Standardized tests “PARCC” and “MCAS” and Grade Point Average</td>
</tr>
<tr>
<td>Absenteeism</td>
<td>Excused vs Unexcused absences</td>
</tr>
<tr>
<td>Nurse visits</td>
<td>Hunger related nurse visits (headache, abdominal/GI concern-discomfort, abdominal/GI concern-hunger, general symptom - dizzy/lightheaded)</td>
</tr>
</tbody>
</table>

**Statistical Analysis**

Descriptive statistics provided means, standard deviations, and percentages for all relevant variables. All logistic regression analyses controlled for grade, gender, race, and breakfast type. Separate analyses for males and females showed similar patterns of associations and tests for interaction with sex were not significant. Linear regression analyses were performed to explore the
associations between the exposure (BIC) and the outcome variables (i.e. academic performance, absenteeism, and school nurse visits). Potential confounding factors considered were age, sex, and SES. Lunch status was used as a proxy for SES.

Adjusted regression models were performed to assess the association between BIC and GPA, ENG MCAS, MATH MCAS, and absences. All regression analyses, included BIC status, age, race/ethnicity, lunch status, sex, and school year. The association of breakfast intake with type on attendance, test scores, and nurse visits was evaluated using linear regressions with school fixed effects and demographic controls. This approach leveraged within-school type in the district. All statistical analyses were performed using STATA software (version 15.1, Stata-Corp LP) and SAS software (version 9.4). Statistical significance was considered at $P < 0.05$.

**Ethics Approval and Consent to Participate**

This research project was approved by the University of Massachusetts Institutional Review Board (IRB) for Human Participants, and approval from the School District Board through the individual nondisclosure agreements along with a Restrictive Use Data Agreement.
CHAPTER 4

RESULTS

Student Characteristics

Complete data were available for n=528 students in 6th grade, n=744 students in 7th grade, and n=625 students in the 8th grade. The analytic sample demographic characteristics are described in Table 4.1. There were no significant differences in sex and age between BIC and NON-BIC students in the final analytic sample.

Table 4.1 Characteristics of the study sample

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Grade 6 (n = 528)</th>
<th>Grade 7 (n = 744)</th>
<th>Grade 8 (n = 625)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
</tr>
<tr>
<td>Covariates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>268 (50.76)</td>
<td>372 (50.00)</td>
<td>311 (49.76)</td>
</tr>
<tr>
<td>Female</td>
<td>260 (49.24)</td>
<td>372 (50.00)</td>
<td>314 (50.24)</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>41 (7.77)</td>
<td>70 (9.41)</td>
<td>60 (9.60)</td>
</tr>
<tr>
<td>Afr. American</td>
<td>84 (15.91)</td>
<td>116 (15.59)</td>
<td>97 (15.52)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>393 (74.43)</td>
<td>545 (73.25)</td>
<td>457 (73.12)</td>
</tr>
<tr>
<td>Other</td>
<td>10 (3.1)</td>
<td>13 (1.74)</td>
<td>11 (1.76)</td>
</tr>
<tr>
<td>Eligibility for SBP¹</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free</td>
<td>406 (76.89)</td>
<td>608 (81.72)³</td>
<td>502 (80.32)³</td>
</tr>
<tr>
<td>Paid</td>
<td>122 (23.11)</td>
<td>136 (18.28)³</td>
<td>123 (19.68)³</td>
</tr>
<tr>
<td>Participate in BIC²</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>528 (100)</td>
<td>238 (31.99)</td>
<td>625 (100)</td>
</tr>
<tr>
<td>Yes</td>
<td>506 (68.01)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹Eligibility for free or reduced-price school breakfast is set at 130% and 185%, respectively, of the federal poverty line. ²BIC program was implemented school by school in school year 2015-2016. ³Different initiation dates
Complete data were available for 1,897 students with data on student cohort from 6th grade to 8th grade, spanning 3 years (2014 to 2017), from seven middle schools in Western Massachusetts. When the participants of the study were in 6th grade (2015), students who qualified had free or reduced breakfast in the cafeteria. In 2016, BIC was implemented in some of the schools in the district. Of the seven schools in the study, five offered BIC at the beginning of the school year and two offered the traditional Breakfast in the Cafeteria in the school year 2015-2016, when the student cohort were 7th graders. There were 1,131 (59.62%) students who participated in BIC and 766 (40.38%) students in the two NON-BIC schools. By far, the dominant race/ethnic group were Hispanics (73.54%) for all seven schools, with African American (15.66%) students comprising the second largest racial group.

Pearson correlation coefficient analyses of grade 6 cohort (2015) ENG PARCC Test score and GPA was 0.49 ($p < 0.0000$); that of the MATH PARCC Test score and GPA was 0.59 ($p < 0.0000$), the MATH PARCC test score and the ENG PARCC Test score was 0.67 ($p < 0.0000$).

Correlation coefficients between absences and ENG PARCC test score was -0.15 ($p < 0.0188$), and between absences and MATH PARCC Test score was -0.22 ($p < 0.0005$). The correlation between absences and GPA was the strongest -0.32, ($p < 0.00001$). There was no correlation found among the standardized tests, absences, and GPA.

The Pearson correlation coefficients analyzed for grade 7 in 2016 between the ENG MCAS Test score and GPA was 0.44 ($p < 0.0000$), between the MATH
MCAS Test score and GPA was 0.45 ($p < 0.0000$), between the MATH MCAS test score and the ENG MCAS Test score was 0.68 ($p < 0.0000$), between absences and ENG MCAS test was -0.10 ($p < 0.0122$), and between absences and MATH MCAS Test score was -0.15 ($p < 0.0001$). Among the independent variables, the correlation between absences and GPA was the strongest (-0.27, $p < 0.00001$). The fact that there were more absences in both years (2014 and 2015), could explain the low GPA. The Pearson correlation coefficient analysis is described in Table 4.2 and 4.3.

**Table 4.2** Associations of GPA, PARCC Standardized Tests, and Absences

<table>
<thead>
<tr>
<th></th>
<th>GPA</th>
<th>ENG PARCC</th>
<th>MATH PARCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENG PARCC</td>
<td>0.4993*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>241</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH PARCC</td>
<td>0.5922*</td>
<td>0.6769*</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>245</td>
<td>240</td>
<td></td>
</tr>
<tr>
<td>ABSENCES</td>
<td>-0.3233*</td>
<td>-0.0188</td>
<td>-0.2217*</td>
</tr>
<tr>
<td>n</td>
<td>525</td>
<td>241</td>
<td>245</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01, ***p<0.001

**Table 4.3** Associations of GPA, MCAS Standardized Tests, and Absences

<table>
<thead>
<tr>
<th></th>
<th>GPA</th>
<th>ENG MCAS</th>
<th>MATH MCAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENG MCAS</td>
<td>0.4498*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>611</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH MCAS</td>
<td>0.4581*</td>
<td>0.6895*</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>589</td>
<td>584</td>
<td></td>
</tr>
<tr>
<td>ABSENCES</td>
<td>-0.2759*</td>
<td>-0.1014*</td>
<td>-0.1562*</td>
</tr>
<tr>
<td>n</td>
<td>707</td>
<td>611</td>
<td>589</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01, ***p<0.001
In the grade 7 cohort (2016), ENG MCAS Test scores and GPA correlated (0.44, \( p < 0.0000 \)), as did MATH MCAS Test scores and GPA (0.45, \( p < 0.0000 \)), and MATH MCAS test scores and ENG MCAS Test scores (0.68, \( p < 0.0000 \)).

Correlates outcome measures are described in Table 4.4.

**Table 4.4** Associations of GPA, MCAS Standardized Tests, Absences and Nurse Visits

<table>
<thead>
<tr>
<th></th>
<th>GPA</th>
<th>ENG MCAS</th>
<th>MATH MCAS</th>
<th>ABSENCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENG MCAS</td>
<td>0.4498*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>611</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH MCAS</td>
<td>0.4581*</td>
<td>0.6895*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>589</td>
<td>584</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABSENCES</td>
<td>-0.2759*</td>
<td>-0.1014*</td>
<td>-0.1562*</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>707</td>
<td>611</td>
<td>589</td>
<td></td>
</tr>
<tr>
<td>NURSE VISITS</td>
<td>-0.2046*</td>
<td>-0.1330*</td>
<td>-0.1525*</td>
<td>0.0621</td>
</tr>
<tr>
<td>n</td>
<td>707</td>
<td>611</td>
<td>589</td>
<td>744</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01, ***p<0.001

The average GPA was 2.5 in 2015 when students were in 6th grade and BIC was not implemented. The ENG PARCC score test, assessed only in grade 6, had a mean of 733.97. The MATH PARCC score had a mean of 733.76 (Table 4.5).
Table 4.5 Summary of GPA, ENG PARCC Test score & MATH PARCC Test score for Grade 6 Year 2015

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>OBSERVATIONS</th>
<th>MEAN</th>
<th>STD. DEV.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast in the Cafeteria</td>
<td>GPA*</td>
<td>525</td>
<td>2.578</td>
</tr>
<tr>
<td>Breakfast in the Cafeteria</td>
<td>ENG PARCC</td>
<td>241</td>
<td>733.975</td>
</tr>
<tr>
<td>Breakfast in the Cafeteria</td>
<td>MATH PARCC</td>
<td>245</td>
<td>733.763</td>
</tr>
</tbody>
</table>

Table 4.6 Summary of GPA, ENG MCAS Test score & MATH MCAS Test score for Grade 7 Year 2016

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>OBSERVATIONS</th>
<th>MEAN</th>
<th>STD. DEV.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIC</td>
<td>GPA*</td>
<td>479</td>
<td>2.49</td>
</tr>
<tr>
<td>NON-BIC</td>
<td></td>
<td>228</td>
<td>2.326</td>
</tr>
<tr>
<td>BIC</td>
<td>ENG MCAS</td>
<td>407</td>
<td>233.007</td>
</tr>
<tr>
<td>NON-BIC</td>
<td></td>
<td>204</td>
<td>233.333</td>
</tr>
<tr>
<td>BIC</td>
<td>MATH MCAS</td>
<td>393</td>
<td>224.661</td>
</tr>
<tr>
<td>NON-BIC</td>
<td></td>
<td>196</td>
<td>226.357</td>
</tr>
</tbody>
</table>

Table 4.7 Summary of GPA for Grade 8 Year 2017

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>OBSERVATIONS</th>
<th>MEAN</th>
<th>STD. DEV.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIC</td>
<td>GPA*</td>
<td>613</td>
<td>2.525</td>
</tr>
</tbody>
</table>
Ethnicity was collapsed into four categories: White, African American, Hispanics, and Other. There was a low percentage of students that identified themselves as ‘other’ race, a category that included Asian, American Indian, Pacific Islander, and Multiracial students (Table 4.8).

**Table 4.8 NON-BIC and BIC participation by race/ethnicity**

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Total sample (n=1,897)</th>
<th>Non-BIC (n=766)</th>
<th>BIC (n=1,131)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>171 (9.1)</td>
<td>71 (9.3)</td>
<td>100 (8.8)</td>
</tr>
<tr>
<td>African American</td>
<td>297 (15.7)</td>
<td>122 (16.0)</td>
<td>175 (15.5)</td>
</tr>
<tr>
<td>Other</td>
<td>34 (1.8)</td>
<td>13 (1.7)</td>
<td>21 (1.9)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1,395 (73.5)</td>
<td>560 (73.1)</td>
<td>835 (73.8)</td>
</tr>
</tbody>
</table>

**Regression Analysis**

**Academic Performance: GPA and Standardized Testing**

Estimate of the effect of a change in school breakfast intake on the change in academic performance, absenteeism, and nurse visits between the same cohort of students before and after the BIC program implementation found no statistical significance in any of the outcomes variables when comparing students who participated in BIC and those who were non BIC. Linear regression was used for academic performance, absences, and hunger nurse visits. All models contained the focal variable, BIC.

School nurse visits could only be compared between students when they were in 7th grade and 8th grade because the nurse recordings were not 100% recorded across the school district. As previously mentioned, there was a high turnover of school nurses during those years and each nurse had their own method.
of recording the purpose of the student visit. Absences and GPA were compared throughout middle school (6, 7, and 8th grade). Students who moved schools were not followed. **Table 4.9** shows the results of the adjusted regression assessing the association of BIC and GPA, ENG MCAS, MATH MCAS, and absences for 7th grade. All regression analyses, included BIC status, age, race/ethnicity, lunch status, sex, and school year.

**Table 4.9** Lunch status variable for school year 2015-2016

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>GPA coef</th>
<th>SE</th>
<th>ENG MCA coef</th>
<th>SE</th>
<th>MATH MCA coef</th>
<th>SE</th>
<th>ABSENCES coef</th>
<th>SE</th>
<th>HUNGER NURSE VISITS coef</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIC</td>
<td>0.040</td>
<td>0.043</td>
<td>0.977</td>
<td>1.524</td>
<td>0.385</td>
<td>1.395</td>
<td>1.149+</td>
<td>0.613</td>
<td>-0.016</td>
<td>0.273</td>
</tr>
<tr>
<td>AGE</td>
<td>-0.135***</td>
<td>0.034</td>
<td>-4.053***</td>
<td>0.937</td>
<td>-5.630***</td>
<td>0.921</td>
<td>1.135**</td>
<td>0.402</td>
<td>0.232+</td>
<td>0.139</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHITE</td>
<td>0.295**</td>
<td>0.103</td>
<td>13.410***</td>
<td>2.219</td>
<td>13.109***</td>
<td>2.295</td>
<td>-0.632</td>
<td>1.089</td>
<td>-0.078</td>
<td>0.346</td>
</tr>
<tr>
<td>AFR. AMER.</td>
<td>0.060</td>
<td>0.042</td>
<td>0.936</td>
<td>0.860</td>
<td>-0.095</td>
<td>0.900</td>
<td>-0.030</td>
<td>0.431</td>
<td>-0.029</td>
<td>0.133</td>
</tr>
<tr>
<td>OTHER</td>
<td>0.677**</td>
<td>0.212</td>
<td>12.581*</td>
<td>4.887</td>
<td>21.181***</td>
<td>5.090</td>
<td>-5.312*</td>
<td>2.753</td>
<td>-1.144</td>
<td>0.722</td>
</tr>
<tr>
<td>LUNCH STATUS</td>
<td>-0.065</td>
<td>0.041</td>
<td>-1.453</td>
<td>1.615</td>
<td>-1.727</td>
<td>1.464</td>
<td>1.023+</td>
<td>0.544</td>
<td>-0.062</td>
<td>0.257</td>
</tr>
<tr>
<td>FEMALE</td>
<td>0.177**</td>
<td>0.060</td>
<td>4.797***</td>
<td>1.268</td>
<td>0.988</td>
<td>1.335</td>
<td>1.244*</td>
<td>0.617</td>
<td>0.318+</td>
<td>0.189</td>
</tr>
<tr>
<td>YEAR 2016</td>
<td>-0.195***</td>
<td>0.040</td>
<td>-501.621***</td>
<td>1.628</td>
<td>-509.376***</td>
<td>1.335</td>
<td>-0.650</td>
<td>0.564</td>
<td>0.630**</td>
<td>0.209</td>
</tr>
<tr>
<td>YEAR 2017</td>
<td>-0.109*</td>
<td>0.050</td>
<td>0.950</td>
<td>0.719</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Observations: 1,845
Number of Unique: 736
Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p>0.1

The direction of the regression coefficients indicated that being female was associated with a slightly higher GPA, higher ENG scores, and a few more absences. Females had a 0.177 unit increase in GPA compared to males. BIC participants had a 0.040 unit increase in GPA compared to NON-BIC participants. However, this association is not statistically significant (p-value > 0.05). GPA is on
a scale of 1 to 4, with 4 being the highest GPA. A GPA of 3 or 3.04 are basically identical when being compared (i.e. the magnitude is small).

The ENG MCAS test score was not statistically significant. It was slightly higher for students in the BIC program. Although, the MCAS test scores varied, we decided that it was not meaningful because this standardized test was only available for one year when the student cohort was in 7th grade (2015-2016). The school district did not provide data for grade 8. Similarly, the MCAS scale scores ranged from 200 to 280 for all tests.

**Absences and School Nurse Visits**

This study showed that there were more absences for students in the BIC program, but the difference was not statistically significant. There were slightly less visits to the school nurse among students in the BIC program. The Pearson correlation coefficient analyzed between nurse visits and students that participated in the BIC program was -.016, so a 10⁻ of a nurse visit less. A difference that was not statistically significant. The differences between students in the BIC and NON-BIC programs were small. Female students had slightly more absences when compared to boys.

**Sensitivity Analysis**

A sensitivity analysis of the association of BIC with the primary study outcomes was performed taking into consideration lunch status as a SES indicator. A subset of the population, students that receive lunch for free and those who paid,
were analyzed separately for academic performance. Results indicated that the subset of students receiving free lunch performed better academically in their standardized testing than their peers who paid for lunch, a difference that was statistically significant. These results suggest that students who receive free lunch and participated in the BIC program had positive academic performance outcomes (Table 4.10).

**Table 4.10. Subset of students with a SES indicator**

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>ENG GPA</th>
<th>ENG Standardized Test coef</th>
<th>SE</th>
<th>MATH GPA</th>
<th>MATH Standardized Test coef</th>
<th>SE</th>
<th>ABSENCES</th>
<th>coef</th>
<th>SE</th>
<th>NURSE VISITS</th>
<th>coef</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIC</td>
<td>0.010</td>
<td>(0.052)</td>
<td>1.402</td>
<td>(1.057)</td>
<td>0.077</td>
<td>(1.620)</td>
<td>1.263+</td>
<td>(0.748)</td>
<td>0.091</td>
<td>(0.325)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGE</td>
<td>-0.171***</td>
<td>(0.039)</td>
<td>-4.146***</td>
<td>(0.978)</td>
<td>-5.422***</td>
<td>(0.589)</td>
<td>1.371**</td>
<td>(0.464)</td>
<td>0.239</td>
<td>(0.161)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHITE</td>
<td>0.049</td>
<td>(0.135)</td>
<td>9.255**</td>
<td>(2.933)</td>
<td>9.690**</td>
<td>(3.039)</td>
<td>0.155</td>
<td>(1.499)</td>
<td>-0.275</td>
<td>(0.511)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFR. AMER.</td>
<td>0.063</td>
<td>(0.046)</td>
<td>0.919</td>
<td>(0.923)</td>
<td>-0.784</td>
<td>(0.948)</td>
<td>0.042</td>
<td>(0.492)</td>
<td>-0.075</td>
<td>(0.160)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER</td>
<td>0.796**</td>
<td>(0.272)</td>
<td>14.555*</td>
<td>(5.829)</td>
<td>28.028***</td>
<td>(5.992)</td>
<td>-4.363</td>
<td>(2.875)</td>
<td>-1.042</td>
<td>(0.996)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEMALE</td>
<td>0.143*</td>
<td>(0.065)</td>
<td>5.313***</td>
<td>(1.373)</td>
<td>1.185</td>
<td>(1.415)</td>
<td>1.255+</td>
<td>(0.696)</td>
<td>0.555*</td>
<td>(0.223)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YEAR 2016</td>
<td>-0.201***</td>
<td>(0.048)</td>
<td>-501.661***</td>
<td>(1.815)</td>
<td>-508.811***</td>
<td>(1.662)</td>
<td>-0.607</td>
<td>(0.701)</td>
<td>-2.511</td>
<td>(2.757)</td>
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<tr>
<td>YEAR 2017</td>
<td>-0.078</td>
<td>(0.060)</td>
<td>1.132</td>
<td>(0.884)</td>
<td>-3.222</td>
<td>(2.621)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>5.183***</td>
<td>(0.630)</td>
<td>794.644***</td>
<td>(15.929)</td>
<td>816.980***</td>
<td>(16.086)</td>
<td>-15.423*</td>
<td>(7.537)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Observations 1,475 673 655 1,516 1,110
Number of UniqueID 652 535 522 665 632

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1
CHAPTER 5
DISCUSSION

In this comparative cross-sectional analysis of secondary data, the breakfast in the classroom (BIC) program was not significantly associated with student academic performance, attendance, and school nurse visits in a cohort of middle school students (6th to 8th grade). Sensitivity analysis conducted with students who participated in the BIC program demonstrated a significant association between participating in the breakfast program and school academic performance among a subset of students who also participated in the free lunch program when compared to their BIC peers who paid for lunch.

The school district assessed in this study piloted BIC in an elementary school prior to the implementation of BIC across all the schools in the district during the school year of 2014-2015. Implementation of BIC occurred at different schools and differing time periods during the school year. By the end of three years (2014-2017), BIC was implemented in all the schools within the district. Making breakfast part of the school day has proven to be an effective way to increase breakfast participation. Increases in breakfast participation were experienced among schools in our study sample when the morning meal was moved from the cafeteria into the classroom.

The present study sought to establish whether the breakfast in the classroom program was associated with academic performance, absenteeism, and school nurse visits. To our knowledge, this is the first study to explore breakfast in the classroom and academic performance, absenteeism, and school
nurse visits in the region, using a sample of middle school children in a diverse, urban school district. BIC is a strategy that is favored for lessening the stigma associated with school breakfast programs and helps to make breakfast more accessible to every student.

Research evidence on the importance of breakfast consumption for cognitive performance and to augment nutritional needs has motivated stakeholders to look into providing free breakfast in the classroom to every K-12 student. A successful classroom breakfast program requires careful planning and introduction into the school in order to maximize success. Developing and maintaining classroom breakfast programs involves similar skills to those used in other school meal programs: planning, organization, communication and leadership.

The literature has demonstrated that students who are going to school hungry are not performing well in school (Olsta J. 2013, Ritchie et al., 2015 & Krueger et al., 2018). Students who consume breakfast on a regular basis, especially those who have a nutrient dense breakfast perform better academically. There is evidence that also suggests that school nurse visits for hunger and absenteeism rates decrease when students eat breakfast regularly.

Overall, our findings showed no clear relationship on any of the study’s primary outcomes of interest when comparing breakfast intake through the BIC program to non-BIC users. However, we did find female students had marginally higher GPA, higher English PARCC test scores, and few more absences than boys, but these findings were not statistically significant. Our results are similar to
other findings on adolescents focused on breakfast program. Studies have found no statistically significant differences in academic performance or attention in class when students had breakfast (Jafari et al., 2013 & Lee at al., 2018).

The sample population was diverse, drawn from low socioeconomic resource areas, and included substantially higher proportion of Hispanic children. The advantages of the current study were that findings were systematically controlled for age, sex, race/ethnicity, lunch status, and school year. Academic performance was measured with standardized tests and end-of-term school grades which is something that previous studies have not achieved before. Edwards et al., 2011, Hoyland et al., 2009, and Rampersaud et al. 2005, also found evidence for a negative association between breakfast skipping and school performance in both adolescents and children. These studies found that higher test scores were associated with breakfast consumption. The evidence indicated that the consumption of breakfast is more beneficial than skipping breakfast.

Finding of lower academic performance in BIC schools may be related to the fact that in some cases the BIC program was implemented in the schools that were perceived to need the program the most, where academic performance were significantly lagging and improvements as a result of BIC could not be measured with a cross sectional design within a short period represented by our study.

Our findings suggest that impact of BIC on academic performance, absenteeism, and school nurse visits could take several years to be observed and accurately measured. Findings in this study suggest that greater attention should be placed on developing robust standardized measures of outcomes of interest
such as academic performance, absenteeism, and school nurse visits. Furthermore, this study highlights the need for reliable measures of actual student consumption of breakfast, since access to breakfast does not indicate quantifiable and qualitative measures of intake behaviors and of food waste. Evidence of the benefits of breakfast consumption on student’s academic outcomes are more consistent with habitual breakfast consumption (Adolphus et al., 2013). Further, research using direct observation methods such as plate-waste data accompanied by detailed dietary recall is necessary to measure breakfast consumption and quality of the meal to better understand the consumption pattern and its associations with academic performance, absenteeism, and school nurse visits. Food Frequency Questionnaires (FFQ) that account for academic year patterns could also be useful tools to assess dietary patterns within the school pattern, especially seasonal variations (Burrows T., et al., 2017).

Inclusion of innovative and interactive methods to measure food intake can also be considered. Students now have access to laptops in their classrooms, a well designed and implemented survey can be used to obtain data related to eating behaviors. Using validated tools to measure academic performance indicators would improve evaluation studies in this area of school-based studies. Further research is needed to illustrate which type of SBP is most effective in terms of student/school breakfast participation (Krueger et al., 2018). Quality of breakfast should also be studied to increase understanding of breakfast consumption and participation rates (Lovino I., et al., 2016).
Another association of academic performance that has not yet been studied at its fullest, is the sleep patterns in children and adolescents. This could contribute to a better understanding of breakfast intake behaviors. Studies should also focus on a younger population. Younger students are more likely to adapt to a healthier dietary intake, behaviors that can be maintained into their adulthood. Our study does provide baseline data for an urban school district in Western Massachusetts, which can help inform future studies as the BIC program in the area evolves.

**Limitations**

This study has several limitations. Since data was secondary, the accuracy of data collection could not be determined. All results were based on a school district sample of adolescents aged 12-16 years. This wide age range enabled us to cover all middle schools, however, there was a lack of standardization on collected data across participating schools. It was therefore impossible to draw conclusions in the areas of absences and nurse visits, since the measures were not consistently used across schools.

The cross-sectional design of the study was also a limitation because this does not allow causality to be assessed. Cross-sectional studies are subject to all kinds of covert biases. The use of non-validated measures is another limitation as such is the case for indicators/proxy measures of SES. Another limitation of studying the relationship between academic performance and BIC is that one of the measurements for academic performance is students reasoning test scores. Some studies suggest academic achievement based on students reasoning tests
scores may not be an accurate measurement of academic performance, the tests do not assess what students are taught in their academic curriculum during the school year (Adolphus et al., 2015). Not only can reasoning tests be a limitation to the findings of academic performance and breakfast, but other studies have found that standardized tests may not be a reliable measure of student’s academic achievement (Van Wye et al., 2013, Ptomey et al., 2016 & Burrows et al., 2017). It is also possible that students at schools that participated in BIC did not possess the same unobservable test taking skills as their counterparts.

Despite these limitations, the strength of the study is its large sample size and is the first study to use cross-sectional data to examine the breakfast in the classroom program in a sample of youth in Western Massachusetts.

**Study Relevance and Conclusion**

Over the past decade, there has been a surge in research relating to the effects of eating breakfast on the three key indicators of the student’s school success: cognitive functions, attention, absenteeism. Although there are several research limitations in studies examining the impact of breakfast consumption, BIC has been associated with an increased participation rate and improved academic performance. Consumption of breakfast in the school that is accessible to all students, avoids the stigma of targeting only low-income and favoring students who are able to arrive to school early. This study examined the impact of providing students with breakfast in the classroom, on academic performance, school attendance, and school nurse visits.
Although our study did not demonstrate statistically significant in the association of the BIC program with academic performance, school absenteeism, and school nurse visits, it did provide important baseline data for the school district in Western Massachusetts public school offering breakfast in the classroom program. Furthermore, this study provides a useful example on using school-level data to examine academic performance in the context of school feeding programs.

Future studies should use a longitudinally design comparing multiple different school breakfast programs, breakfast quality, and intake behaviors including plate waste to determine the associations between breakfast intake and academic performance, absenteeism, and school nurse visits, using validated measures with trained personnel. Such studies will provide valuable evidence for food policy that support universal free breakfast and lunch programs in schools K-12.
BIBLIOGRAPHY


