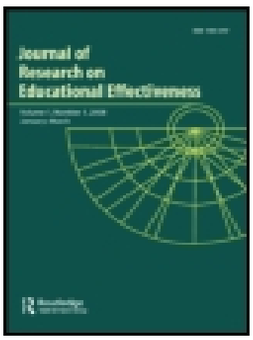

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Moderation of UBC Impact by Student Absenteeism

Experimental Impacts of a Preschool Intervention in Chile on Children's Language Outcomes: Moderation by Student Absenteeism

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Abstract

Despite consensus that school absenteeism has negative consequences for children's life outcomes, until recently, little was known about the prevalence of absenteeism or its potential to moderate the impacts of school-based interventions. This study provides evidence from a randomized experiment of a preschool intervention involving 1876 children in 64 schools in Chile that chronic absenteeism develops in preschool and is predicted by multiple risk factors for

poor academic achievement. We find moreover that individual children's likelihood of absenteeism moderated the intervention's impact on children's language and literacy outcomes such that there were positive impacts of the intervention only for children with the lowest likelihood of absenteeism. Experimental evaluations of school-based interventions that do not take absenteeism into account may thus mask heterogeneous effects. In the context of policy pushes to expand early education and preschool access in the United States and globally, these moderation analyses may prove essential for appropriately interpreting the results of experimental studies of school-based interventions.

Keywords: chronic absenteeism, attendance, preschool education, Latin America, Chile, experiment, regression-based subgroup analysis, impact moderation

Many low- and middle-income countries are investing in early childhood education (ECE) with expectations that such interventions can improve educational, socio-emotional, health and economic outcomes for children and effectively reduce basic economic inequality (Britto, Yoshikawa & Boller, 2011; Cunha & Heckman, 2008; Myers, 2006). The impacts of ECE interventions depend on their quality (Camilli, Vargas, Ryan, & Barnett, 2010; Yoshikawa, 2014), and an increasing amount of attention is being paid to quality in research and practice (Chavan, Yoshikawa & Bhadur, 2013; Sachs & Weiland, 2010). In the context of global efforts to expand ECE access, to improve quality and to assess causal impacts of such interventions on children's outcomes across diverse contexts, little attention has been paid to absenteeism among participating children. Limited evidence from the majority world suggests that school absenteeism rates globally are high (Evans, Kremer, & Ngatia, 2008). In the United States, recent studies estimate that 10 to 15 percent of students are chronically absent -- miss 10% of school days or more in one year --- and that patterns of chronic absenteeism develop as early as preschool, persist over time and negatively influence students' academic and life trajectories (Balfanz & Byrnes, 2012). Experimental evaluations of school-based interventions for at-risk populations---who tend to have high absenteeism rates---often do not consider student absenteeism in their design. Such evaluations may miss heterogeneous effects among children with varying levels of absenteeism.

Understanding whether and how student absenteeism may moderate the impact of early childhood education on children's outcomes has important implications. Conclusions drawn from experimental evaluations of school-based interventions that found null effects but did not

consider individual absenteeism may need to be reconsidered. This has significant ramifications for researchers, policymakers and funding agencies in the United States and globally.

In this study, in the context of a randomized controlled trial, we analyzed how student absenteeism may have moderated the impact on children's language and literacy skills of an intervention to improve the quality of Chilean preschool. Un Buen Comienzo (A Good Start, UBC) was a cluster-randomized trial of a two-year intensive professional development program in Santiago, Chile to improve the quality of public preschool and kindergarten education and the language and literacy outcomes of participating children. Two-year results from the experimental evaluation of UBC showed moderate to large positive impacts on preschool classroom quality, and null effects on the targeted child language and literacy skills (Yoshikawa et al, 2015). In Chile, a country of high educational inequality, absenteeism might be contributing to inequalities as it appears to do in the U.S. However, there are no studies examining the role that absenteeism may play in Chilean preschool education. The results of this study contribute to the growing discussion about the prevalence and relevance of individual-level absenteeism and its potential to moderate the impacts of school-based interventions on individual outcomes.

The Chilean Context

This article uses data from a school-based intervention evaluation in Chile to contribute to the gaps in our understanding of how absenteeism might moderate the effects of school-based interventions. Because readers may not be familiar with the Chilean context, we list here a few details that aid in understanding our study and its results and that help clarify the importance of examining the role of absenteeism in Chile. First, Chile is one of South America's most stable, prosperous and inequitable nations, with an average annual growth rate of 3.5 percent, the

highest gross domestic product per capita in the region, and the largest Gini coefficient of economic inequality among OECD nations (IMF, 2008; OECD, 2011). Second, inequality is observed in Chile beginning in very early stages of children's development. Chilean children under age 5 from low socioeconomic backgrounds present significantly higher rates of socioemotional problems and language delays than children from families at the top of the country's income distribution (Behrman, Bravo, & Urzúa, 2010; Schady et al, 2014). Third, Chile is a global leader in early childhood policy. Since 2007, the Government of Chile established early childhood development policy as a key priority to close achievement gaps and address persistent economic inequality: it created a national integrated system for early childhood protection (Chile Grows with You) and expanded free early education opportunities for the poorest 40% of the population (Peralta, 2011; Silva & Molina, 2010). Early childhood education coverage for 4-year-olds expanded from 35% in 2003 to 45% in 2009 and 80% in 2012 (Ministerio de Educación, 2012). Fourth, despite access gains, concerns remain about preschool quality in Chile. The effectiveness of early childhood education (ECE) depends on its quality (Camilli et al, 2010), and several studies suggest that the quality of Chilean preschool environments may not be sufficient to address the disadvantages of low-income Chilean schoolchildren (Eyzaguirre & Le Foulon, 2001; Manzi, Strasser, San Martin, &Contreras, 2008; Noboa-Hidalgo & Urzua, 2012).

Finally, little attention has been paid to absenteeism among Chilean preschool children. Chilean national accountability systems use these school-level daily attendance rates to determine allocation of school funds each month (MINEDUC, Law 20248, Article 15). This creates an incentive for schools to over-report the number of students matriculated and attending.

Official data from the Chilean Ministry of Education reported that average classroom-level attendance rates in public schools were lower for prekindergarten and kindergarten classrooms (79.9%, SD = 12.1) than they were for first through twelfth grade classrooms (85.3%, SD = 11.9; Ministerio de Educación, 2012). Individual-level attendance rates are not available, and the percent of children with chronic absenteeism (absent 10% of school days or more) is not known. However, U.S. studies that compare average daily classroom attendance and individual-level attendance show that schools with average daily attendance rates below 93% have high concentrations of chronic absenteeism: for example, at six New York City schools with 90% average daily classroom attendance, 20 to 26% of enrolled children experienced chronic absenteeism (Bruner, Discher & Chang, 2011).

Chronic Absenteeism: Prevalence, Patterns and Associations with Life-Course Outcomes

Decades of research across multiple disciplines describe associations between school absenteeism and poor child outcomes, including cognitive, academic, behavioral, health, judicial and economic outcomes (Levine, 1992; Monk & Ibrahim, 1984; Wang, Blomberg, & Li, 2005). Adults with a history of school absenteeism are twice as likely to be unemployed (Alexander, Entwistle, & Horsey, 1997) and to rely upon government assistance (McCray, 2006). Among adolescents, absenteeism is associated with delinquency (Garry, 1996), substance abuse, and teen pregnancy (Halfors et al, 2002). Multiple measures of academic achievement are negatively associated with absenteeism, from elementary through post-secondary school (Allensworth & Easton, 2007; Barge, 2011; Kieffer, Marinell, & Stephenson, 2011; Marburger, 2001).

Despite widespread and longstanding acceptance of the idea that school absenteeism has negative consequences for children's short- and long-term life outcomes, until recently, little was

known about the prevalence or patterns of absenteeism among students. No one knew how many children experienced problematic absenteeism, or what level of absenteeism at which phase of schooling puts children at risk for poor outcomes. This knowledge gap existed in part because national accountability systems in the United States and elsewhere monitor schools using school-level average daily attendance--that is, the average of the percent of enrolled students who were present each day (U.S. Department of Education, 2006). Although school-level attendance does correlate with average student achievement (Lamdin, 1996; Roby, 2004), aggregated school-level attendance rates can mask high absenteeism rates among some students. For example, in a school with average daily attendance of 90%, it is possible that all children attend 90% of days, but equally possible that some children attend 100% of days, while others attend 40% of days.

In 2008, a nationally-representative U.S. study examined individual, student-level absenteeism and revealed that children who were absent for 10% or more of kindergarten school days had worse reading, math and general academic skills in first grade, and lower reading and math skills in fifth grade (Chang & Romero, 2008). More than 11% of kindergarten and 9% of first grade students met or exceeded this 10% threshold, which the authors defined as *chronic absenteeism*. Since 2008, chronic absenteeism has been reported in some U.S. urban districts and is strongly associated with poorer academic outcomes (ASR, 2011; Connolly & Olson, 2012; Ehrlich, Gwynne, Pareja & Allensworth, 2013; Spradlin, Cierniak, Shi & Chen, 2012). Approximately 20% of urban children have chronic absenteeism in kindergarten, and these children tend to have chronic absenteeism in later years (Balfanz et al, 2012).

Mechanisms to Explain Associations between Chronic Absenteeism and Outcomes

Multiple mechanisms may explain the association of chronic absenteeism with problematic later outcomes. Perhaps the most straightforward is through a dosage effect: children who are absent receive less of a school-based intervention than those who attend. The implementation literature sometimes includes absenteeism in this sense: as an index of fidelity that reflects an important cause-and-effect sequence inside the experimental "black box" of intervention. Indices of fidelity may help to explain which components of a successful intervention worked, and whether unsuccessful interventions were flawed in theory or implementation (Nelson, Cordray, Hulleman, Darrow & Sommer, 2010). The mechanism of absenteeism's dosage effect beyond the duration of a specific intervention is that students who are absent frequently have fewer opportunities to develop skills that enable later success (Sheldon & Epstein, 2010).

More complicated mechanisms are also possible. Absences at particular times of year may have differential effects on outcomes, for example, if a child misses instruction on early skills in highly sequenced learning, like mathematics (Monk et al, 1984). Also, an individual's absences may influence his peers' learning. If children who are absent often are also the most disruptive children, their absence might increase the impact of improved classroom quality on children who attend frequently (more than it decreases the impact on the absent children's outcomes). Alternatively, if sporadic attendance by some children disrupts peer interactions and productive use of classroom time, the learning environment may deteriorate and outcomes among all children might suffer (Darling-Hammond, LaPointe, Meyerson, Orr & Cohen, 2007).

Child, Family and Community Characteristics Predict Absenteeism

Just as multiple mechanisms may explain the relationship between absenteeism and outcomes, multiple child, family and community characteristics may predict absenteeism (Baker, Sigmon & Nugent, 2001; Epstein & Sheldon, 2002). Child characteristics that are associated with absenteeism include poor child health, behavior problems, and, among kindergarten children, no prior experience with non-kinship care. Children with chronic health conditions regularly experience symptoms and need medical care that make attending school difficult (Allensworth et al, 2007; Fowler, Johnson, Atkinson, 1984). Specific chronic conditions that are associated with absenteeism include asthma (Diette, Markson, Skinner, Ngyuen, Algatt-Bergstrom, Wu, 2000), overweight (Geier et al, 2007) and depression (Breuner, Smith & Womack, 2004). Among kindergarten children, those who spent the prior year in the care of family members were more often absent than peers who attended a center-based program or were under the care of non-relatives (Chang et al, 2008), as were children with greater teacher-rated problem behaviors at school entry (ASR, 2011; Ready, 2010).

Family characteristics associated with higher absenteeism include poverty, single motherhood and teen motherhood, low maternal education, maternal unemployment, food insecurity, poor health and multiple siblings (BERC, 2012; Chang et al, 2008; Romero & Lee, 2007). Poverty and a lack of basic needs--such as food, clean and weather-appropriate clothing, transportation--make getting to school regularly difficult (Allensworth et al, 2007; McCray, 2006). Housing instability--homelessness, movement between foster care placements, temporary dislocation due to foreclosure or inability to pay rent --is associated with mobility (Balfanz et al, 2012; Ready, 2010), which is highly correlated with absences (General Accounting Office, 1994).

Poorer family health is associated with higher absenteeism. Children who live with one or more smoker had absence rates 32% higher for non-illnesses, 34% higher for respiratory illnesses, and 39% higher for gastrointestinal illnesses. This association was stronger for asthmatic children than non-asthmatic children (Gilliland et al, 2003). Children whose parents report depressive symptoms were 36% more likely to be absent than those whose parents did not (Guevara, Mandell, Danagoulian, Reyner, & Pati, 2013). Finally, family attitudes toward preschool education are associated with higher absenteeism (Alexander et al., 2001; Allensworth et al, 2007; Baker et al., 2001). Children whose parents said that preschool attendance is as important as later grades were absent 7.5% of days, as compared to 11% of days for children whose parents believe that preschool attendance is not as important as later (when they perceive their child is learning more and is more likely to fall behind) and 13% of days for children whose parents reported that preschool attendance matters somewhat or not at all (Ehrlich et al, 2013).

Community factors that are associated with higher absenteeism include poverty, violence, and air pollution (Allensworth et al, 2007; Chen, Jennison, Yang, Omaye, 2000; Gottfried, 2010).

Many of the characteristics associated with higher absenteeism are also risk factors for poor language and literacy outcomes, a fact that makes it difficult to tease out moderation effects of absenteeism in observational and cross-sectional studies. UBC offers a unique opportunity to explore the potential for individual-level absenteeism to moderate the intervention's impact because of its randomized design and because a wealth of cross-disciplinary data were collected prior to random assignment, including many of the factors described above.

Description of Un Buen Comienzo (A Good Start, UBC) and the Present Study

Data used in the present study come from Un Buen Comienzo (A Good Start, UBC), a cluster-randomized trial of a two-year intensive professional development program in Santiago, Chile. UBC aimed to improve the quality of public preschool and kindergarten education and the language and literacy outcomes of participating children. Preschool and kindergarten teachers and aides received 12 monthly workshops and 24 bi-weekly in-classroom coaching sessions over two years. Results from the experimental evaluation of UBC showed moderate to large positive impacts on classroom quality, and null effects on the targeted child language and literacy skills. Observed classroom practices, measured through the CLASS assessment (Pianta et al., 2008), improved as a result of the intervention, with effects sizes of 0.44 on instructional support ($p<0.10$), 0.46 on classroom organization ($p<0.01$) and 0.81 for emotional support ($p<0.001$) at the end of the first year, and 0.34 for classroom organization ($p<0.05$) and 0.27 for emotional support ($p<0.05$) at the end of the second year. UBC did not have a significant effect on children's language or literacy skills at the end of the 2-year program, as assessed by four subtests of the Woodcock-Muñoz Language Survey Revised Spanish Form: vocabulary, letter-word identification, dictation and passage comprehension (Yoshikawa et al, 2015).

The lack of impact on children's language and literacy outcomes at the end of two years is surprising given that that the classroom practices for which we find evidence of impact are features of observed classroom quality that have been linked to improvements in children's cognitive outcomes, over time (Burchinal et al., 2008; Howes et al., 2008; Mashburn et al., 2008). In the present study, we hypothesized that UBC and its positive impacts on classroom quality had heterogeneous effects on child language and literacy skills, according to their

absenteeism, and that program impacts would be greater among children with the lowest likelihood of absenteeism. We explored three research questions:

1) What are individual-level absenteeism rates among 4- and 5-year-old children attending public prekindergarten and kindergarten in poor municipalities in Santiago, Chile?
2) What child, family and community factors predict individual-level absenteeism?
3) Does preschool absenteeism moderate the impact of the UBC intervention designed to improve classroom quality and children's early academic skills?

Method

Sample

The UBC sample included 1876 children, 140 teachers and 110 aides in 64 schools in 6 low-income municipalities in Santiago, Chile. These represented 85.9% of eligible families (recruitment rate), 82.5% of whom completed assessments at the end of two years (retention rate). The analytic sample includes children followed through the end of kindergarten that had at least one absenteeism measurement (N = 1861). There were no differences in the measured characteristics of the attritors across treatment condition. Crossover was less than 2% (36/1876).

Table 1 summarizes descriptive statistics for the analytic sample and shows that there were no statistically significant differences in child, family and community characteristics between the intervention and control groups, as expected under random assignment. Students in the UBC sample were, on average, 53 months old when they entered prekindergarten; 51% of them were female and 45% lived with both parents. Fewer than half of them had attended center-based child care and education prior to prekindergarten. Among their parents, 36% of mothers had completed high school and an additional 13% also had some technical or university studies;

52% of mothers were employed. Although 90% of parents hoped their children would complete a university degree, only 60% expected that they would: 18% expected they would complete a technical degree; 21% expected them to complete high school or less.

Baseline language and literacy skills among students were, on average, lower than expected for their age. The average age of participating students was 53 months, whereas the age-equivalent for average Picture Vocabulary scores was 48 months, for Dictation scores was 51 months and for Oral Comprehension was less than 24 months. Only Letter-Word Identification was on target, with an age equivalent average score of 53 months.

Procedures

Between 2008 and 2010, UBC recruited municipalities within metropolitan Santiago with a high proportion of at-risk children. At-risk children were identified using the standards of the Chilean Ministry of Education, which included family income, parent education, and whether the family was a beneficiary of government assistance programs. Schools within municipalities were randomized to UBC treatment or control conditions at the beginning of the prekindergarten year at a public lottery to which all school staff were invited. The public lottery provided transparency to participants and made the experimental design more palatable to local authorities.

Background information on families, teachers, and children was collected once, prior to the intervention. During a parent-teacher meeting at the beginning of the prekindergarten school year, trained assessors introduced the project to parents, asked for consent, and administered parent questionnaires soliciting demographic information, child health, behavior, and home literacy practices. Teachers filled out questionnaires about their own backgrounds.

Direct assessments of children's language and literacy skills, executive function, behavior and well-being were conducted at schools prior to the intervention during one or two individual 30-to-50 minute "pull-out" sessions conducted by Chilean professionals with a college degree in psychology. Language and literacy outcomes were assessed again at the end of kindergarten. Student-level absenteeism was measured by direct observation periodically throughout the prekindergarten and kindergarten school years.

Measures

Child language and literacy skills

Children's language and literacy skills were assessed using the Woodcock-Muñoz Language Survey Revised Spanish Form (Woodcock, Muñoz-Sandoval, Ruef, & Alvarado, 2005). The Picture Vocabulary and Passage Comprehension subtests were used to examine receptive language skills, and the Letter-Word Identification and Dictation subtests were used to examine early reading and writing skills, respectively. These subtests have high levels of internal reliability and validity (Schrank, McGrew, Ruef, Alvarado & Muñoz-Sandoval, 2005) and in our sample had Cronbach's alpha estimates of 0.76 to 0.97. Raw scores were used in all analyses because of the relatively restricted age range of the sample.

Child school absenteeism

Because of suspected reporting bias in the officially-reported administrative attendance data and because individual-level absenteeism rates were not available, student-level absenteeism was measured by direct observation periodically throughout the prekindergarten and kindergarten school years. We trained evaluators at Universidad Diego Portales to take individual-level attendance. At each measurement, assessors marked "present" only children they

saw with their own eyes. They added names of newly enrolled students. Attendance was measured directly every two to three weeks throughout each school year, on the same day in every classroom in the sample, on varying days of the week and without prior notice to school staff (to ensure unpredictability). This periodicity of data collection was developed in consultation with educational and public health statisticians. We followed strict protocols that included training of data collectors twice each year, double-entry of 20% of the data, and periodic, unannounced observation of the data collection process.

Directly observed measures of absence were converted to total number of days absent, total number of days measured, and percent-days absent by child, consistent with prior studies of individual student-level absenteeism (Gottfried, 2011). The total number of measured days varied from one child to another (mean = 21.2; standard deviation = 6.4) due to different enrollment dates, dropout, and classroom functions that prohibited measurement on a particular day (e.g. field trips). We checked the reliability of the measure against other sources. We collected parent-reported absenteeism data for the whole sample, teacher-reported absenteeism data for a subset of children in the sample, and directly-observed daily measures of attendance for a subset of children in 4 classrooms for a limited period of time (10 weeks of the 2 year intervention). Children who dropped out of one school and re-enrolled in another UBC-participating school were maintained in the study. All of this lends confidence to our use of the measure (Authors, 2012).

Baseline Measures for Modeling Likelihood of Absenteeism and Covariates

We used pre-intervention child, family, teacher, and community characteristics to predict individual-level absenteeism and as covariates to increase the precision of impact estimates.

Parent questionnaires measured baseline *child characteristics* (gender, age, prior participation in center-based care, special healthcare needs, asthma, overweight, daily hours viewing television or playing outdoors) and *family characteristics* (maternal education and employment, depression, health insurance, family composition, causes of child absences, parents' experiences in their child's classroom, parents' educational beliefs, hopes and expectations).

Children's socioemotional skills were assessed using parents' and child assessors' reports of "how often does this child" demonstrate certain behaviors---for example, "play and work cooperatively with other children." We conducted confirmatory factor analysis for all items and found three distinct constructs: prosocial and positive behaviors, impulse control, and attention, whose Cronbach's alphas at pretest were 0.65, 0.83, and 0.90, respectively.

Children's executive function. Cognitive flexibility was assessed using the Dimensional Change Card Sort (Frye et al., 1995; Zelazo, 2006), a task that asked children to sort cards according to alternating criterion (shape or color) on six successive trials. The final score was the number of trials in which the child sorted the cards correctly. The six trials had internal consistency of 0.93. *Inhibitory control* was assessed using two tasks. In the Pencil Tapping task (Diamond & Taylor, 1996), the child tapped a pencil twice if the evaluator tapped once, and once if evaluator tapped twice, for 16 trials. The trials had internal consistency of 0.88. In Walk-a-Line Slowly (WLS, Kochanska, Murray, Jacques, Koenig & Vandegeest, 1996), the child was timed walking along a 2 meter long string taped to the floor three times, each time more slowly. The three WLS trials had internal consistency of 0.78.

Self-reported child well-being was assessed with the Autorreporte del Bienestar Socioemocional (Lira, Edwards, Hurtado, Seguel & CEDEP, 2005), a measure developed in

Chile in which cartoons of two characters displaying different behaviors are read to children who are asked, "Which is more like you?" For example, identifying with a character that can open his snack by himself versus another that requests help would be coded as a 1 on the measure of personal independence. Exploratory and confirmatory factor analysis of the original 22 items identified one distinct, reliable construct that included eight items: "Can tolerate frustration," "Does the duties she has to do" "Volunteers to answer questions in class," "Takes responsibility for his actions," "Content with school work," "Has expectations about achievement," "Adjusts to the average work pace of the group" and "Has a positive attitude about difficult tasks." Positive responses were summed to create a scale, whose Cronbach's alphas was 0.70 at pretest.

Teacher variables. To increase precision of the impact estimates, we controlled for demographic characteristics that are considered important in the literature on teacher-child interactions (Bierman, Nix, Greenberg, Blair & Domitrovich, 2008), and also of relevance in the Chilean context: teacher age (in years), private school teaching experience (a binary indicator), teaching experience (in years), and teacher postgraduate education (in years). All teacher variables were obtained from teacher surveys.

Community-level variables were gathered from publicly-available national databases (CASEN, 2011), including measures of socioeconomic vulnerability (percent of students who qualified as "priority students" from low-income households) and measures of weather and air pollution on days of attendance measurement. Dummy variables for each municipality were included because schools were randomized within municipality.

Data Analysis Strategy

We calculated individual absenteeism rates for each child (percent days absent) and categorized each child as chronically absent if he missed 10% or more of school days in a year (twenty school days in the 200-day academic year in Chile). We calculated the prevalence of chronic absenteeism. We conducted univariate regressions to examine what child, family and community factors predict individual-level absenteeism in Chile.

To estimate whether and how individual-level absenteeism moderated the impact of the UBC program, we rely on a regression-based subgroup approach described by Kemple, Snipes & Bloom (2001) and Peck (2003, 2013). While it is reasonable to expect that the effects of a school-based intervention evaluated using experimental methods might vary with varying levels of absenteeism, this is methodologically difficult to assess. Absenteeism is a post-random assignment behavior and might be influenced by the intervention itself. Therefore, examining the role absenteeism might play moderating intervention impact cannot be estimated by a simple interaction term approach (Justice, Mashburn, Pence & Wiggins, 2008), and an instrument cannot always be found to apply instrumental variables approach (Gottfried, 2011). The regression-based subgroup approach identifies subgroups of children with varying likelihoods of being absent. It creates a *likelihood of absenteeism* index from pre-random assignment baseline characteristics that can then be used within the randomized design to provide unbiased estimates of program-control group differences in outcomes for children at differing levels of the absenteeism index.

There are several advantages to the regression-based subgroup analysis. First, this approach preserves the integrity of the random assignment and experimental design by using only baseline characteristics and the control group to derive parameters that predict each child's

likelihood of absenteeism (Berg, Morris & Aber, 2013; Kemple, et al, 2001; Peck, 2013; Yoshikawa, Magnuson, Bos, & Hsueh, 2003). Second, it retains the continuous nature of the measured absenteeism variable and the predictor risk factors. Traditional risk accumulation strategies might define "high absenteeism" as being absent 20 or more days during the school year and classify students who are absent 40 days and those absent 20 days as equally "at risk." The distribution of absenteeism in our sample did not suggest a clear cutoff (see Figure 1). Also, risk accumulation strategies identify risk factors associated with a particular outcome and then count the number of risk factors an individual has, weighting each factor equally. The regression-based subgroup strategy uses continuous baseline characteristics and outcomes; therefore, it can weigh the relative magnitude and direction of each characteristic and incorporate the relationships between characteristics as well as the relationship between each characteristic and the outcome.

This strategy involved three steps. In the first step, we conducted multiple regression analyses predicting individual-level absenteeism rates from background characteristics using the control group only. This approach generated empirical estimates of the relationship between the background characteristics and individual-level absenteeism rates in the absence of intervention. Equation 1 is the simple regression predicting absenteeism from a set of background characteristics for students attending schools that were later randomized to control condition:

$$Y_i = \beta_0 + \beta_1 X_i + e_i \quad (1)$$

where Y_i = measured absenteeism of child; $X_i = X$ is a vector of baseline characteristics; β_0 = the intercept term, β_1 = the estimated relationship between X_i and Y_i, that is the estimated effect of X_i on absenteeism; e_i = a stochastic error term.

In a second step, we used the parameters estimated in the control group to calculate the *likelihood of absenteeism index* for the intervention group children. To ensure that the index was generating groups that were well-differentiated in terms of their measured individual-level absenteeism rates, we examined the distribution of the index by individual-level measured absenteeism in the full sample. We also examined the extent to which the intervention and control group samples were matched across background characteristics and likelihood of absenteeism, to ensure that they were similar and that the integrity of the randomized design was preserved. As we describe below, results of these checks supported the validity of our approach.

In the third and final step, we estimated the impact of UBC on children with different likelihoods of absenteeism. To estimate child-level program impacts in this cluster-randomized trial, we relied primarily on multi-level models that accounted for the nesting of students within schools in calculation of parameter estimates and standard errors (hierarchical linear models; Murnane & Willett, 2010; Raudenbush, Martinez, & Spybrook, 2007). We controlled for child age and gender (at the individual level) and teacher demographics, and included the child's pretest score on the corresponding outcome measure (language or literacy) at the school level, as recommended in the literature on cluster-randomized trials(Bloom, Richburg, Hayes & Black, 2007; Hedges & Hedberg, 2007).We tested whether the likelihood of absenteeism moderated the experimental program impact on language and literacy outcomes and whether program impacts were greater among children with the lowest likelihood of absenteeism, defined as those in the bottom quintile of the index. Equation 2 specifies the model that was used:

$$Outcome_{ijkl} = \beta_0 + \beta_1(treat)_{kl} + \beta_2(pretest)_{kl} + \beta_3(X)_{ijkl} + \beta_4(M)_{l} + \beta_5(Teacher)_{jkl} +$$

$$\beta_6(\textit{likelihood of absenteeism index})_{ijkl} + \beta_7(\textit{likelihood of absenteeism index}^{*}\textit{treat})_{ijkl} + (\mu_{ijkl}+\varepsilon_{jkl}+\gamma_{kl}) \quad (2)$$

where the subscripts *i, j, k, l* refer to students, classrooms, schools, and municipalities respectively; *Outcome* is the student-level outcome at the end of kindergarten; *treat* is a school-level, dichotomous variable set equal to 1 if the child was in an intervention school and to 0 if the child was in a control school; *pretest* is the school-level outcome score at the beginning of prekindergarten; *X* is a vector of student-level characteristics (age and gender); *M* is a vector of five dichotomous variables indicating which of six municipalities the school was located (fixed effects); *Teacher* is a vector of four classroom-level teacher covariates (teacher age, private school teaching experience, teaching experience, and postgraduate education); μ is a student-level stochastic error term; ε is a classroom-level, random effects intercept; and γ is a school-level, random effects intercept. We used fixed effects for municipalities because schools were randomized within municipality and because municipalities were not randomly selected.

In these models, the coefficient β_1 represented the estimated impact of the UBC intervention on the outcomes of children with the lowest likelihood of absenteeism (1st quintile of the index), β_6 estimated the relationship between likelihood of absenteeism and language and literacy outcomes, and β_7 represented four coefficients, each one estimated language and literacy outcomes among children in the intervention group with higher likelihood of absenteeism (2nd through 5th quintiles of the index), relative to the outcomes of children in the intervention group with the lowest likelihood of absenteeism (highest likelihood of attendance). We used the lowest quintile because it represented the group of children with the highest level of "dose" of UBC, and therefore, the group that was theoretically most likely to experience positive effects if there

was heterogeneity of UBC impact by absenteeism. We tested for differences in outcomes of children in the intervention versus control groups with higher likelihoods of absenteeism (2^{nd}-5^{th} quintiles of the index) using post-hoc general linear hypothesis tests (Singer & Willett, 2003).

We conducted robustness checks for two steps of the analysis: one for the first step creation of the absenteeism likelihood index, and two for the third step regression of that index on the outcomes (multiple imputation and cross-validation). For the first step, because individual-level absenteeism rates were not normally distributed, we compared three regression models predicting absenteeism rates from baseline characteristics: logistic regression models predicting more than 20% of days absent (roughly the median of the sample), ordinary least squares regression predicting percent of days absent and Poisson regression models predicting the number of days absent while controlling for the number of days measured. The Poisson model seemed theoretically most appropriate because absenteeism was a count variable whose variance was close to its mean and each subject had the same length of observation time (two years of intervention). The variables used to predict absenteeism were selected if they predicted absenteeism in univariate analyses in this sample or if they had been shown in prior work to predict absenteeism. The same variables were used in all three models. The robustness check for the first step consisted in comparing the fit and explanatory power of the three regression models (logistic, OLS and Poisson) in order to choose the best prediction to be used in the second and third step of analyses.

For the third step, we conducted two robustness checks. First, because missing data occurred in the sample due to attrition and failure to complete all assessments, and because there were differences between the cases with complete data and those missing one or more of the

variables used to create the likelihood of absenteeism index and in the impact models (see Appendix A), we used multiple imputation procedures to impute missing data values for student-level independent variables in order to maximize the use of available information and minimize bias (Rubin, 1987). Test statistics and regression coefficients were averaged across five imputed data sets. Second, because the literature suggests that estimates of the likelihood of absenteeism index that are derived from the entire control group may be overfit to the control group and biased, and that the traditional split-sample approach (that uses a randomly-selected subsample of the control group to derive step one estimates and excludes that subsample from subsequent impact analyses) eliminates bias but sacrifices power, we applied a cross-validation approach described by Harvill, Peck and Bell (2013). We randomly partitioned the full sample into 10 cross-validation groups. Then, we estimated the prediction model 10 times using nine of the 10 subsamples of the control group, each time leaving out one of the control cross-validation groups and all 10 of subsamples of the intervention group. Finally, we constructed the predicted likelihood of absenteeism index for children in each of the cross-validation groups (control and intervention) from the model estimation that excluded their subgroup. This process ensures that the index for every individual in the sample is constructed through out-of-sample prediction, and virtually eliminates overfitting while permitting retention of the entire sample.

We report UBC's impacts on language and literacy outcomes of children with the lowest likelihood of absenteeism as adjusted mean scores, the adjusted differences between these groups, the level of significance of the difference, and the effect sizes. Effect sizes were computed by dividing the estimated adjusted difference between children with lowest likelihood of absenteeism in the control versus intervention groups by the standard deviation of the outcome

for children with lowest likelihood of absenteeism in the control group (Gormley, Gayer, Phillips & Dawson, 2005; Wong, Cook, Barnett & Jung, 2008). The level of significance for all analyses was set at two-tailed alpha = .05. The databases were analyzed in Stata (Version 13).

Results

What are Individual-Level Absenteeism Rates among 4-and 5-year-old Children Attending Public Prekindergarten and Kindergarten in Poor Municipalities in Santiago, Chile?

Figure 1 shows histograms of individual absenteeism rates of UBC participants. In prekindergarten, children were absent for an average of 23.2% of school days (SD = 19.6), and 66% of students had chronic absenteeism (absent for more than 10% of school days in a year). In kindergarten, children were absent for an average of 21.3% of school days (SD = 17.7), and 69% of students had chronic absenteeism. Of those children who were chronically absent in prekindergarten, 76% were chronically absent again in kindergarten.

What Child, Family and Community Factors Predict Individual Absenteeism in Chile?

Univariate poisson regression analyses showed that a greater number of days absent was predicted by pre-intervention child, family, and community characteristics. At the child level, several indicators of poorer health predicted higher absenteeism, including lower scores on the Chilean Child's Self-Report of Well-being, enrollment in the national asthma program and parental reports of missing school due to respiratory illnesses. No prior participation in center-based child care and education predicted higher absenteeism, as did worse school-readiness skills at entry to prekindergarten. In particular, lower scores on Picture Vocabulary and Dictation and on the Pencil Tap assessment of cognitive inhibitory control predicted higher absenteeism.

Family characteristics that predicted higher absenteeism included lower maternal education, maternal unemployment, and the presence of a depressed adult in the home. Parents of children with high absenteeism were more likely to report that they felt unwelcome in the classroom, and that they believed their principal role in the child's life was to keep him safe and healthy, rather than teach him social or school skills. They were more likely to report that their children missed school due to inclement weather conditions (cold and rain), lack of sibling care or transportation, difficulty waking the child, and their own preference to keep the child at home.

At the community level, living in a more socioeconomically vulnerable community predicted higher absenteeism: Children who lived in the five municipalities where greater than 30% of students qualify as priority students from low-income households had higher absenteeism than students who lived in the one municipality where only 20% of the students qualified as priority students (CASEN, 2011). Living in the municipality with the coldest weather and the worst air pollution on days of attendance measurement predicted higher absenteeism.

Does preschool absenteeism moderate the impact of the UBC intervention designed to improve classroom quality and children's early academic skills?

Empirical relationship between the background traits and individual-level absenteeism

Creating the likelihood of absenteeism index

Building from the background literature describing conceptual links between child, family, and community risk and absenteeism as well as the univariate analyses above, we conducted regression analyses of background child, family and community characteristics predicting individual-level absenteeism rates among children in the control group. We opted to include all variables that significantly predicted absenteeism in univariate analyses, and several

that were not statistically significant predictors in this sample but were associated with absenteeism in past studies (e.g. child baseline executive function, overweight, special healthcare needs; family characteristics of number of siblings and living with both parents). The rationale behind this choice was that the sample size was hardly reduced due to missing data on these variables, the prediction's strength might increase, and the external validity and comparability to past studies was better if we included such salient characteristics.

Robustness check for step one

As a robustness check, we compared three regression models for the Step One prediction of individual absenteeism: logistic regression predicting absenteeism of greater than 20% of school days (the median of the sample, approximately), ordinary least squares predicting percent of days absent, and Poisson regression predicting the number of days absent. As expected, the Poisson model provided the best prediction: Using complete cases only (N = 448), the Poisson model accounted for nearly half of the variation in absenteeism with a maximum likelihood R^2 statistic of 0.478---twice as much as the logistic regression and OLS regression models (whose MLR were 0.195 and 0.190, respectively). Robustness checks that used multiply imputed data (N = 835) and cross-validation subgroups (N = 741-765) to predict individual absenteeism were consistent with the original Poisson model, with comparable pseudo-R2 values, similar parameter estimates and smaller standard errors (see Appendix B). Table 2 presents the parameter estimates from the Poisson multivariate regression predicting number of school days absent, controlling for number of days measured. We used these parameter estimates to create the likelihood of absenteeism index for all children in the intervention and control groups.

Testing the success of the likelihood of absenteeism index

Figure 2 shows that measured absenteeism increased steadily across the quintiles of the likelihood of absenteeism index, indicating that the index did a good job of distinguishing between participating children with differing levels of absenteeism. At the school mean level, there were no statistically significant differences between the intervention and control groups' baseline characteristics, likelihood of absenteeism indices or index quintiles (see Table 1). Thus, we conclude that for the purposes of the moderation analyses, the integrity of the randomized design was preserved.

Moderation of UBC impacts on children's language and literacy outcomes

Table 3 presents estimates of the moderation of UBC's impact on children's language and literacy outcomes by likelihood of absenteeism index at the end of the second year of the program using complete cases. The coefficients for the predicted likelihood of absenteeism index (β_6) estimate the relationship between likelihood of absenteeism and language and literacy outcomes. Half of these are negative, suggesting that the higher a child's likelihood of being absent, the lower his language and literacy skills. For the vocabulary outcome, for example, for every 1 unit increase in predicted likelihood of absenteeism index (where a 1 unit increase indicates one day out of ten, or a 10% increase), his end-of-intervention vocabulary score decreased by 3.3 points (12% of the mean post-intervention vocabulary score, equal to 0.35 SD). The coefficients for the interaction of UBC treatment with quintiles 2-5 ($\beta 7$) estimated the outcomes of children in the intervention group with greater likelihood of absenteeism, relative to the outcomes of children in the intervention group with the lowest likelihood of absenteeism. These are mostly negative, suggesting that UBC's impact on children in the group with higher

likelihood of absenteeism was less positive than UBC's impact on children in groups with lowest likelihood of absenteeism.

The coefficient for UBC treatment (β_1) in these models represented the estimated impact of the UBC intervention on the language and literacy outcomes of children with the lowest likelihood of absenteeism (1st quintile): this was positive for three of four outcomes and statistically significant for two outcomes. UBC treatment had a positive and significant impact on Letter-Word Identification and Dictation with effect sizes of 0.18 and 0.21, respectively, indicating small, significant positive effects (see Table 3).

Post-hoc general linear hypothesis tests

As expected, the coefficients for the interaction between the UBC intervention and the quintiles 2-5 of likelihood of absenteeism were negative. It is important to remember that these coefficients do not reflect differences between language and literacy outcomes of children in the control and intervention group. Post-hoc general linear hypothesis tests found no differences between the outcomes of children in the intervention and control groups with likelihood of absenteeism indices in the 2nd through 5th quintiles (i.e., no impacts). We conclude that UBC had a significant and positive impact only for the children with lowest likelihood of absenteeism, and no effect on language and literacy skills of children with higher likelihood of absenteeism.

Robustness Checks for Step Three

We conducted two robustness checks of step three, the regression of the absenteeism index on the outcomes (multiple imputation and cross-validation). First, we used multiple imputation procedures to impute missing data values for student-level independent variables, and we repeated the above analyses, with test statistics and regression coefficients averaged across

five imputed data sets. Second, we used Harvill, Peck and Bell's cross-validation approach (2013) that constructs each child's likelihood of absenteeism index through out-of-sample prediction. Moderation analyses that used the likelihood of absenteeism indices created by the multiply imputed and cross-validation approaches showed similar results. The coefficients for the predicted likelihood of absenteeism indices (β_6) and its interaction with UBC treatment were mostly negative, suggesting that the higher a child's likelihood of being absent, the lower his language and literacy skills and the smaller UBC's impact. The coefficient for UBC treatment (β_1) that estimated the impact of the UBC intervention on outcomes of children with the lowest predicted likelihood of absenteeism was positive for all four language and literacy outcomes, and statistically significant for Letter-Word Identification (see Appendix C). Post-hoc general linear hypothesis testing for all models found no detectable differences between language and literacy skills of children in the intervention and control groups with likelihoods of absenteeism in the 2nd through 5th quintiles (i.e., no impacts), thus confirming that UBC had a significant and positive impact only for the children with lowest likelihood of absenteeism, and no effect on language and literacy skills of children with higher likelihoods of absenteeism.

Discussion

Absenteeism is an understudied but important aspect of education globally. Recent literature from the United States suggests that children's absenteeism patterns develop early, persist over time and are predicted by multiple risk factors for poor academic achievement. Little is known about rates or predictors of absenteeism outside of the U.S., and the question of whether the child impacts of educational interventions differ for those with low versus high absenteeism has not been studied. In the context of an experimental evaluation of the UBC

preschool quality improvement program in Chile, we found that individual-level absenteeism rates were high, that multiple child, family, and community characteristics predicted absenteeism, and that, UBC had a positive and significant impact on two of four language and literacy skills among the subgroup of children with lowest likelihood of absenteeism. Given the high measured absenteeism rates among participating children and UBC's moderate to large positive impacts on preschool classroom quality, these findings suggest that the null impact of UBC on language and literacy outcomes for children in the sample as a whole result from averaging heterogeneous program impacts across children with varying absenteeism rates and therefore exposure to the program.

Individual-level absenteeism rates among children attending public preschool in Chile

Little is known about absenteeism rates outside of the United States, and the measurement of absenteeism at the individual level is one of this study's strengths. Average school-level absenteeism measured directly ranged from 12.2% to 43.8% in prekindergarten (M = 23.4%, SD = 6.3) and from 10.7% to 41.1% in kindergarten (M = 21.7%, SD = 6.2)-- rates similar to the 21.1% (SD = 12.1) reported in official administrative data (Ministerio de Educación, 2012). Importantly, administrative data on individual-level absenteeism is not available. Directly-observed measurement revealed that children attending public preschool in low-income, urban municipalities in Chile were absent for 21-23% of school days, and that 66% of children were chronically absent (missed more than 10% of school days).

The individual absenteeism rates in this sample of Chilean children enrolled in public preschool in low-income municipalities of Santiago are similar to those of children attending public preschools in low-income, urban school districts in the United States (Balfanz et al, 2012),

and well above the level associated with future academic risk (Chang et al, 2008). Of the 66% of Chilean preschoolers who had chronic absenteeism in prekindergarten, three quarters were chronically absent again in kindergarten. These findings suggest that the magnitude of chronic absenteeism and its persistence over time, discovered in the studies of individual-level absenteeism conducted in the United States in the last decade, may be similar in other parts of the world. They underscore the importance of considering individual-level absenteeism to identify children at risk for future problems and to explore its potential moderating effects in impact studies of school-based interventions.

Predictors of absenteeism among children attending public preschool in Chile

This study provides empirical evidence from a non-U.S. cultural context that child, family, and community risk factors for poor academic achievement predict individual-level absenteeism. Consistent with studies conducted in the United States, in this study, higher absenteeism was predicted by poor child health and worse school-entry academic skills, lower maternal education and employment, poor adult health, and having parents who do not believe preschool is important (ASR, 2011; Ehrlich et al, 2013; Ready, 2010). In this study as in others, living in a community with worse air pollution and more poverty predicted greater odds of chronic absenteeism (Chen et al, 2000). Living with a single parent was one of few characteristics associated with higher absenteeism in some U.S.-based studies (Romero et al, 2008) that did not predict higher absenteeism among Chilean preschool children. This may reflect cultural differences in household structure: In the United States, children who live with a single parent often live with only one adult, whereas in this Chilean sample, households in which

children were living with only one parent usually contained additional adults, such as grandparents, aunts or uncles (Authors, 2010).

These findings suggest that some risk factors associated with lower achievement and predictive of higher absenteeism may be culturally specific. For example, the relationship between household composition and absenteeism might vary based on cultural differences in the role of extended family in child rearing, as well as the availability and acceptability of high-quality early education options. In the current study, the majority of child, family and community risk factors that predict higher absenteeism and lower academic achievement are consistent with prior U.S. research. This reinforces the notion that absenteeism provides a reliable proxy for child risk, and underscores the importance of exploring both similarities and differences in future studies of absenteeism in global contexts.

The moderating effect of absenteeism on the intervention's impact on child outcomes

Ultimately, by combining individual-level absenteeism and baseline background characteristics that were predictive of absenteeism, we could successfully identify subgroups of children with varying likelihoods of absenteeism over the two years of the program, and then test whether UBC impact varied across the subgroups. As hypothesized, the UBC treatment had positive, significant impacts on some language and literacy outcomes for children with the lowest likelihood of absenteeism: UBC caused significant increases in early reading and writing skills, with effect sizes of 0.18 and 0.21, respectively. There were no impacts on language or literacy outcomes of children with higher likelihoods of absenteeism. These impacts were not evident in the original UBC study impact analyses that found null effects on children's language and literacy outcomes when student absenteeism was not considered (Yoshikawa et al, 2015).

We conclude that although the original UBC impact analyses provided unbiased estimates of average UBC impact over the entire enrolled population, they masked heterogeneous effects of UBC on language and literacy outcomes of children with varying likelihoods of absenteeism and overlooked positive impacts for children with the lowest likelihood of absenteeism.

The finding that UBC caused positive and significant gains in lowest-absentee children's early reading and early writing skills but not on their oral comprehension and vocabulary skills matches what we know about another form of dosage in the UBC intervention -- the instructional time treatment teachers devoted to promoting each of these skills. A separate fidelity of implementation study found that at the end of prekindgarten and kindergarten, UBC treatment group teachers spent more time teaching early reading skills and early writing skills than they did teaching oral comprehension and vocabulary (Mendive, Weiland, Yoshikawa & Snow, 2014). Prior to UBC, preschool classrooms in Chile were characterized by little letter-word building instruction, with an average of one minute per day spent teaching the names or sounds of letters (Strasser, Lissi & Silva, 2009). More instructional time spent on UBC-targeted language and literacy skills was positively and modestly associated with gains in children's early reading and writing skills at the end of kindergarten but not on their oral comprehension and vocabulary skills, likely because teachers spent comparatively less time on the latter. Instructional-time dosage thus may effectively have interacted with student-attendance-induced dosage to produce learning gains for the lowest-absentee student subgroup on these skills. The comparatively lower level of vocabulary and oral comprehension instructional dosage appears not to have been high enough to produce gains for any of the children, including the lowest absenteeism subgroup.

Several strengths of this study lend confidence to these conclusions. First, it was conducted in the context of a randomized controlled trial, using a methodology that preserves the integrity of the random assignment (regression-based subgroup design; Berg, Morris & Aber, 2013; Kemple, et al, 2001; Peck, 2013; Yoshikawa, Magnuson, Bos, & Hsueh, 2003). Second, the regression that predicted likelihood of absenteeism from the empirical estimations of relationships between pre-intervention covariates and measured absenteeism was strong: It accounted for 48 percent of the variation in measured individual-level absenteeism---more than four times the variation in outcome accounted for in Kemple, Snipes and Bloom's description of the methodology (2001). Third, the language and literacy skills among children in the 2nd-5th quintiles of the likelihood of absenteeism index were similar, whether they experienced UBC treatment or control conditions. This is as expected, given the overall null findings of the original UBC impact analyses for the full sample (Yoshikawa et al, 2015). Fourth, we performed multiple state-of-the-art robustness checks: comparisons of logistic, OLS and Poisson regressions for the first-step prediction, impact models using complete cases and multiply imputed data, and Havrill, Peck & Bell's cross-validation approach (2013). Positive and significant impacts of UBC on early reading skills of children were robust. Impacts of UBC on children's early writing skills were not consistent across approaches. We conclude that UBC had a positive and significant impact on some language and literacy skills among the subgroup of children with lowest likelihood of absenteeism, and that the original UBC impact analysis that found the null impact of UBC on language and literacy outcomes for the whole sample result from averaging heterogeneous program impacts across children with varying absenteeism rates.

Two limitations to the present study merit comment. First, the regression-based subgroup approach does not explain how or why heterogeneous effects of UBC occurred. We can be confident that the subgroup of children with lowest likelihood of absenteeism experienced greater impacts on some language and literacy outcomes than other participating children, and that the impacts were a result of their experience in the UBC intervention. Corroboration with the fidelity of implementation study provides hints that our findings represent a dosage effect. However, the above analyses cannot ascertain what mechanisms might explain the differential impact, be it a direct dosage effect, timing of absences, peer effects that affect productive use of classroom time, or another explanation. Finally, these results reflect UBC impacts after two years of participation; it is not clear whether these effects may be sustained into the longer term.

In summary, this study provides evidence from a new context that chronic absenteeism develops as early as preschool and is predicted by multiple child, family, and community risk factors for poor academic achievement. Moreover, it demonstrates that individual absenteeism may moderate the impacts of educational interventions on individual outcomes. These findings have important implications. For Chilean stakeholders that are eager to improve ECE quality, they suggest 1) that the UBC intervention can work to improve some language and literacy outcomes among children who attend regularly, and 2) that for any intervention to fulfill the expectations of those who are investing heavily in ECE in Chile, it should include explicit strategies to promote regular attendance among participants. The predictors of absenteeism identified in this study may provide some insight into how attendance among Chilean children enrolled in public preschool might be improved, by addressing transportation or sibling care needs, providing protection from cold and rain, facilitating treatment for adult depression and

child asthma, welcoming parents into the classroom and ensuring that parents experience their child's daily classroom endeavors and understand the value of early childhood education for their child's short- and longer-term development.

For the community of global ECE researchers, policymakers and funding agencies, emerging evidence that as many as one or two in three preschool-aged children may experience chronic absenteeism should alert us to examine individual-level absenteeism in every ECE intervention, to explore whether and how predictors of absenteeism vary across contexts, and to address absenteeism directly as part of ECE interventions when necessary. Demonstrating that student absenteeism can moderate the impact of ECE on children's outcomes suggests that experimental evaluations of school-based interventions that do not consider absenteeism may mask heterogeneous effects on outcomes of children with varying absenteeism rates and overlook actual differences they make for students who attend frequently--that is, they may be biased toward the null. We would expect the bias toward the null to be greatest in settings where absenteeism tends to be high, particularly among poor populations and in the developing world. Thus, conclusions drawn from the results of experimental evaluations of school-based interventions that showed null effects but did not consider individuals' absenteeism may need to be reconsidered. Future school-based interventions and studies could assess individual-level absenteeism among the target population during a pilot phase, in order to determine 1) if the intervention should include strategies to promote regular attendance among participants and 2) if the evaluation should measure or collect individual-level absenteeism data, in order to explore moderating effects of absenteeism on the interventions themselves. In the context of policy pushes to expand early intervention and preschool access in the United States and globally,

exploration of individual absenteeism, its predictors and its potential moderating effects may prove essential for appropriately interpreting the results of experimental studies of school-based interventions and for designing more impactful interventions in the future.

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Table 1. Means/Percentages (N) of Baseline Characteristics, Predicted Likelihood of Absenteeism and Predicted Likelihood of Absenteeism Quintile of Children in UBC Intervention and Control Schools

Sociodemographic		UBC	Control	Educational Expectations, Beliefs		UBC	Control
Male (1867)		50.1%	47.3%	N books in home (1740)		11.9	11.8
Age in months (1867)		53.3	53.2	N non-children's books in home (1724)		22.8	21.6
Comuna (1867)	1	9.4%	9.4%	Parents' educational expectations (1698)	high school or less	21.6%	21.3%
	2	15.6%	18.8%		technical degree	18.9%	17.3%
	3	18.8%	15.6%		university degree	59.5%	61.4%
	4	28.1%	28.1%	Parents' educational hopes (1713)	high school or less	2.3%	2.7%
	5	15.6%	18.8%		technical degree	7.4%	7.3%
	6	12.5%	9.4%		university degree	90.3%	90.0%
Maternal Education(1757)	Incomplete primary	12.3%	13.3%	Parent Permitted in Classroom (1746)		36.9%	32.5%
	Complete primary	14.9%	15.8%	Parent Has Been in Classroom (1720)		81.0%	76.8%
	Incomplete secondary	22.5%	22.5%	In classroom, parent feels (1746)	Welcome	79.2%	80.0%
	Complete secondary	37.0%	35.3%		Somewhat welcome	16.4%	15.3%
	Some/all technical or University	13.4%	13.0%		Not very welcome	3.3%	3.9%
Mother employed (1736)		51.4%	55.3%		Unwelcome	1.1%	0.8%
Health Insurance (1854)	Public Tier 1-2[a]	65.0%	64.9%	Parent believes his/her role is (1706)	to keep child safe and healthy	54.4%	56.3%
	Public Tier 3-4[b]	23.7%	22.5%		to teach child school skills	11.9%	13.1%
	blocked	4.5	4.6%		to teach child social	31.1	27.1

		%			skills	%	%
	private	6.8 %	8.1%	Child Attended Daycare (1751)		46.3 %	48.6 %
N children <6 in home (1634)		1.5	1.5				
Lives with both parents (1866)		45.7 %	43.8 %			(continued)	
Health and Habits		UBC	Control	Causes of Absences		UBC	Control
MD said child is overweight (1741)		29.8 %	34.4 %	Respiratory Illness (1820)		32.3 %	29.8 %
Parent perceives child overweight (1699)		13.6 %	12.6 %	Other Illness (1820)		63.5 %	63.5 %
Special Healthcare Needs (1603)		25.4 %	25.6 %	Cold or rain (1820)		45.3 %	40.8 %
Chronic Asthma (1704)		22.1 %	19.5 %	Family travel (1820)		8.8%	9.8%
Depressed Adult at Home (1575)		28.8 %	29.2 %	Lack of transportation (1820)		12.0 %	12.1 %
TV minutes per day (1776)	<30	19.5 %	21.7 %	Overslept (1820)		13.5 %	14.9 %
	30-60	25.4 %	27.0 %	Lack of sibling childcare (1788)		8.0%	7.9%
	60-120	27.2 %	23.6 %	Parent prefers child at home (1788)		12.4 %	14.1 %
	>120	29.0 %	27.7 %	Family conflict (1736)		9.0%	8.4%
Child Behavior, Executive Function and Language Skills							
Self-reported well-being (1830)		5.68	5.84	Cognitive Flexibility, assessed (1829)		3.50	3.57
Attention, observed (1849)		3.28	3.32	Impulse Control, assessed (1744)		7.24	7.59
Impulse Control, observed (1822)		3.63	3.66	Vocabulary (1711)		18.20	18.13
Positive behavior, observed (1805)		3.03	2.99	Letter-word Identification (1687)		5.38	5.57
Prosocial Behavior, parent report (1634)		4.19	4.26	Emergent Writing (1747)		5.82	6.00
Gross Motor Control, assessed (1851)		0.22	0.24	Comprehension (1779)		2.95	3.02
School Mean Predicted Likelihood of Absenteeism and Quintiles							
Mean Predicted Likelihood of Absenteeism[b] (914)						8.3	7.2
Percent students in Q1						17.1 %	19.9 %

Percent students in Q2				20.5 %	19.4 %
Percent students in Q3				19.3 %	20.4 %
Percent students in Q4				19.4 %	21.1 %
Percent students in Q5				23.7 %	19.2 %

Note. Differences were tested with Chi2 tests for binary variables, Wilcoxon rank test for categorical variables, and t-tests for continuous variables with central tendencies

$^{***}p<0.001$

$^{**}p<0.01$

$^{*}p<0.05$

$^{\sim}p<0.1$.

[a]Health insurance Tier 1-2 is completely free for very low-income families; Tier 3-4 is heavily subsidized for low-income families.

[b]Mean predicted number of days absent per child, controlling for the number of days absenteeism was measured.

Table 2. Poisson Regression Model Predicting Absenteeism from Background Characteristics among Children in Control Group (N = 835), Complete Cases

SocioDemographic Characteristics		Educational Exposure, Expectations, Beliefs		Health and Habits		Causes of Absences	
Male	-0.049	Child Attended Daycare	0.179***	MD said child is overweight	0.035	Respiratory Illness	0.232***
	(-0.048)		(-0.048)		(-0.057)		(-0.052)
Age	-0.001	N books in home	0.001	Parent perception of child's weight	-0.062	Other Illness	0.046
	(-0.007)		(-0.002)		(-0.078)		(-0.055)
Comuna 2	-0.182	N non-children's books in home	-0.002*	Parent effort to control weight	-0.053	Cold or rain	0.142**
	(-0.119)		(-0.001)		(-0.048)		(-0.049)
Comuna 3	-0.215	Parent expects child will complete technical degree[b]	0.141	Special Healthcare Needs	0.053	Family travel	-0.136
	(-0.118)		(-0.079)		(-0.053)		(-0.083)
Comuna 4	-0.231	Parent expects child will complete	-0.011	Chronic Asthma	0.07	Lack transport	-0.036
	(-0.118)		(-0.068)		(-0.059)		(-0.077)

		university[b]					
Comuna 5	0.111	Parent hopes child will complete technical degree[c]	-0.066	Pet at home	-0.095	Overslept	-0.166*
	(-0.116)		(-0.182)		(-0.115)		(-0.069)
Comuna 6	-0.084	Parent hopes child will complete university[c]	-0.072	Depressed Adult at Home	0.153**	Lack sibling childcare	0.182*
	(-0.143)		(-0.171)		(-0.051)		(-0.078)
Maternal education	0.029	Parent Permitted in Classroom	0.107*	N hours per day watching TV	0.038	Parent prefers child at home	0.276***
	(-0.022)		(-0.051)		(-0.02)		(-0.068)
Mother employed	-0.054	Parent Has Been in Classroom	-0.085	N hours per day on computer	0.019		
	(-0.048)		(-0.065)		(-0.023)	N Days Attendance Measured	0.031***
Health Insurance Public Tier 3-4[a]	-0.166**	Parent feels welcome in classroom	-0.134***	N hours per day playing outside	-0.014		(-0.005)
	(-0.061)		(-0.039)		(-0.016)		
						(continued)	
SocioDemographic Characteristics		Educational Exposure, Expectations, Beliefs		Baseline Child Behavior & Executive Function Skills			

Health Insurance Blocked[a]	-0.327**	Parent belief: own role is to teach child school skills[d]	-0.003	Self-reported well-being	-0.002
	(-0.123)		(-0.075)		(-0.013)
Health Insurance private[a]	0.007	Parent belief: own role is to teach social skills[d]	0.059	Impulse Control (reported)	-0.045
	(-0.095)		(-0.057)		(-0.069)
N childr en younger than 6 in home	-0.005	Parent belief: own role is other[d]	0.129	Prosocial Behavior	0.001
	(-0.029)				(-0.035)
Child Lives with Both Parents	0.02			Gross Motor Control	-0.017
	(-0.049)				(-0.066)
				Cognitive Flexibility	-0.011
					(-0.009)
				Impulse Control (assessed)	0.004
					(-0.005)

Note. Standard errors in parentheses.

[a]Reference category: Health insurance Public Tier 1-2, free of cost for low-income families.

[b]Reference category: Parent expects child will complete high school or less

[c]Reference category: Parent hopes child will complete high school or less

[d]Referece category: Parent belief: own principal role is to keep child safe and healthy

[***]p<0.001

[**]p<0.01

[*]p<0.05

Table 3 UBC Program Effects on Language and Literacy Outcomes, Moderation by Predicted Likelihood of Absenteeism and Adjusted Mean Differences for Children in the Lowest Quintile of Absenteeism Risk

	Vocabulary	Letter-Word ID	Dictation	Comprehension
UBC Treatment	0.424(0.622)	2.215*(0.869)	0.557*(0.230)	-0.542(0.291)
Predicted Likelihood of Absenteeism Index	-3.281(1.959)	-1.586(2.600)	0.194(0.610)	0.208(0.735)
Q2 Likelihood Absenteeism Index*UBC Treatment	-0.754(0.765)	-1.440(1.035)	-0.386(0.283)	-0.190(0.331)
Q3 Likelihood Absenteeism Index*UBC Treatment	-1.803*(0.781)	-1.700(1.048)	-0.506(0.289)	0.506(0.338)
Q4 Likelihood Absenteeism Index*UBC Treatment	-1.130(0.866)	-1.132(1.179)	-0.824*(0.320)	0.668(0.369)
Q5 Likelihood Absenteeism Index*UBC Treatment	-0.952(1.009)	-2.114(1.359)	-0.973**(0.370)	0.049(0.430)
Observations	653	619	601	662
Adjusted Means for Children in the Lowest Quintile of Absenteeism Risk				
Intervention	26.971	13.67	10.2	3.935
Control	26.961	12.52	9.82	4.172
Difference	0.010	1.15	0.377	-0.237
Effect size	0.002	0.181*	0.214*	-0.111

Note. Standard errors in parentheses. Reference group for Q2, Q3, Q4, and Q5 is Q1 (lowest-likelihood quintile).

***p<0.001

**p<0.01

*p<0.05.

Appendix A

Table A1. Comparison of Means/Percentages (N) of Baseline Characteristics between Complete Cases (CC) and individuals missing data who were included in later, post-multiple imputation analyses.

Sociodemographic		CC	Missing	Educational Expectations, Beliefs		CC	Missing
Male (1867)		47.5 %	48.5 %	N books in home (1740)		13.1	11.4
Age in months (1867)		53.3	53.2	N non-children's books in home (1724)		22.8	22.4
Comuna (1867)	1	15.2 %	16.0 %	Parents' educational expectations (1698)	high school or less	19.9 %	18.3 %
	2	17.2 %	13.5 %		technical degree	17.3 %	18.9 %
	3	19.9 %	19.1 %		university degree	62.8 %	62.8 %
	4	24.6 %	27.3 %	Parents' educational hopes (1713)	high school or less	2.0 %	2.5%
	5	15.7 %	15.2 %		technical degree	7.0 %	7.7%
	6	7.4 %	8.9%		university degree	91.0 %	89.7 %
Maternal Education(1757)	Incomplete primary	11.0 %	10.9 %	Parent Permitted in Classroom (1746)		34.8 %	30.0˜ %
	Complete primary	15.8 %	13.4 %	Parent Has Been in Classroom (1720)		84.6 %	72.9* %
	Incomplete secondary	21.3 %	22.3 %	In classroom, parent feels (1746)	Welcome	77.0 %	80.8 %
	Complete secondary	37.8 %	38.2 %		Somewhat welcome	17.1 %	15.2 %
	Some/all technical or University	14.1 %	15.2 %		Not very welcome	4.6 %	3.1%
Mother employed (1736)		52.3 %	55.4 %		Unwelcome	1.4 %	0.9%
Health Insuranc	Public Tier 1-2[a]	60.9 %	63.1 %	Parent believes his/her role is	to keep child safe and	55.3 %	53.6 %

e (1854)				(1706)	healthy		
	Public Tier 3-4[b]	26.2 %	25.4 %		to teach child school skills	12.1 %	15.1 %
	blocked	4.9 %	5.3%		to teach child social skills	29.2 %	28.6 %
	private	8.0 %	7.3%	Child Attended Daycare (1751)		46.8 %	51.5˜ %
N children <6 in home (1634)		1.5	1.5				
Lives with both parents (1866)		50.3 %	40.1* %			(continued)	
Health and Habits		CC	Missing	Causes of Absences		CC	Missing
MD said child is overweight (1741)		29.8 %	34.4 %	Respiratory Illness (1820)		32.8%	30.8 %
Parent perceives child overweight (1699)		13.6 %	12.6 %	Other Illness (1820)		64.7%	62.4 %
Special Healthcare Needs (1603)		27.2 %	21.0* %	Cold or rain (1820)		44.3%	39.9˜%
Chronic Asthma (1704)		20.1 %	19.3 %	Family travel (1820)		9.6%	8.9 %
Depressed Adult at Home (1575)		29.1 %	27.7 %	Lack of transportation (1820)		10.7%	12.5 %
TV minutes per day (1776)	<30	18.9 %	19.4 %	Overslept (1820)		13.8%	13.9 %
	30-60	24.8 %	26.9 %	Lack of sibling childcare (1788)		8.2%	6.4 %
	60-120	26.7 %	26.4 %	Parent prefers child at home (1788)		14.3%	12.0 %
	>120	29.6 %	24.9 %	Family conflict (1736)		8.0%	9.4 %
Self-reported well-being (1830)		5.84	5.69	Cognitive Flexibility, assessed (1829)		3.61	3.54
Attention, observed (1849)		3.41	3.24*	Impulse Control, assessed (1744)		7.71	7.45
Impulse Control, observed (1822)		3.71	3.63*	Vocabulary (1711)		18.4	18.3˜

Positive behavior, observed (1805)	3.03	3.00	Letter-word Identification (1687)	5.7	5.4*
Prosocial Behavior, parent report (1634)	4.25	4.20	Emergent Writing (1747)	6.1	5.8
Gross Motor Control, assessed (1851)	0.26	0.23~	Comprehension (1779)	3.05	3.02

Note. Differences were tested with Chi2 tests for binary variables, Wilcoxon rank test for categorical variables, and t-tests for continuous variables with central tendencies

***p<0.001

**p<0.01

*p<0.05

~p<0.1.

[a]Health insurance Tier 1-2 is completely free for very low-income families; Tier 3-4 is heavily subsidized for low-income families.

[b]Mean predicted number of days absent per child, controlling for the number of days absenteeism was measured.

Appendix B

Table B1 compares three regression models predicting likelihood of absenteeism from background characteristics that used only complete cases (N = 448): Column 2 shows logistic regression predicting greater than 20% days absent, Column 3 shows ordinary least squares regression predicting the proportion of days absent, and Column 4 shows poisson regression predicting the number of days absent, controlling for the number of days measured. Column 5 shows the Poisson model using multiply imputed data and the entire control group (N = 835), and Column 6 shows the Poisson model using multiply imputed data and cross-validation subgroups (N = 741-765). The pseudo-R2 of the models are not directly comparable due to the difference in sample sizes used to derive each model, but it is reassuring that they are fairly similar in magnitude. Many of the parameter estimates for the baseline characteristic predictors are similar in magnitude across all three models. As expected, the standard errors for the model that used multiply imputed data are smaller than those for complete cases; the standard errors for the cross-validation approach are smaller still.

Table B1. Robustness Checks for Step 1 Prediction of Absenteeism from Background Characteristics from Children in Control Group (N = 835): Logit, OLS, and Poisson Regression Models Using Complete Cases, Poisson Regression Using Multiply Imputed Data and Cross-Validation Approach.

	Absent >20% days	Proportion Days Absent	Number Days Absent	Number Days Absent	Number Days Absent
Baseline Characteristics	Logit Complete Cases	OLS Complete Cases	Poisson Complete Cases	Poisson Multiple Imputation	Poisson Cross-Validation[a]

SocioDemographic Characteristics					
Male	-0.374(-0.232)	-0.026(-0.039)	-0.049(-0.048)	-0.008(-0.035)	-0.008(0.005)
Age	-0.001(-0.034)	-0.003(-0.006)	-0.001(-0.007)	0	0.000
				(-0.005)	(0.001)
Comuna 2	0.139(-0.572)	-0.004(-0.101)	-0.182(-0.119)	-0.122	-0.120
				(-0.095)	(0.017)
Comuna 3	0.173(-0.56)	-0.044(-0.099)	-0.215(-0.118)	-0.196*	-0.194
				(-0.096)	(0.014)
Comuna 4	-0.295(-0.561)	-0.044(-0.099)	-0.231(-0.118)	-0.217*	-0.215
				(-0.098)	(0.012)
Comuna 5	0.492(-0.558)	0.137(-0.098)	0.111(-0.116)	0.031	0.033
				(-0.094)	(0.011)
Comuna 6	0.589(-0.703)	0	-0.084	-0.037	-0.037
		(-0.122)	(-0.143)	(-0.112)	(0.012)
Maternal education	0.107	0.012	0.029	-0.01	-0.010
	(-0.106)	(-0.018)	(-0.022)	(-0.017)	(0.002)
Mother employed	-0.063	-0.024	-0.054	-0.05	-0.049
	(-0.232)	(-0.039)	(-0.048)	(-0.036)	(0.004)
Type of Health Insurance--Public Tier 3 or 4	-0.487	-0.098*	-0.166**	-0.201***	-0.201
	(-0.277)	(-0.048)	(-0.061)	(-0.046)	(0.003)
Type of Health Insurance--Blocked	-0.919	-0.143	-0.327**	-0.129	-0.128
	(-0.559)	(-0.09)	(-0.123)	(-0.087)	(0.005)
Type of Health Insurance--private	0.157	0.013	0.007	0.004	0.005
	(-0.441)	(-0.076)	(-0.095)	(-0.069)	(0.013)
N children younger than 6 in home	-0.061	-0.008	-0.005	-0.001	-0.001
	(-0.136)	(-0.023)	(-0.029)	(-0.021)	(0.002)
Child Lives with Both Parents	0.065	0.007	0.02	-0.029	-0.029
	(-0.237)	(-0.04)	(-0.049)	(-0.036)	(0.006)
	Absent >20% days	Proportion Days Absent	Number Days Absent	Number Days Absent	Number Days Absent
Baseline Characteristics	Logit Complete Cases	OLS Complete Cases	Poisson Complete Cases	Poisson Multiple Imputation	Poisson Cross-Validation[a]
Educational Exposure, Expectations and Beliefs					
Child Attended Daycare	0.651**	0.096*	0.179***	-0.175***	-0.175
	(-0.232)	(-0.039)	(-0.048)	(-0.037)	(0.004)
N books in home	0.006	0	0.001	0	0.000
	(-0.007)	(-0.001)	(-0.002)	(-0.001)	(0.000)
N non-children's	-0.010*	-0.001	-0.002*	0	0.000

books in home	(-0.005)	(-0.001)	(-0.001)	(-0.001)	(0.000)
Parent expects child will complete technical degree[b]	0.066	0.094	0.141	0.021	0.021
	(-0.383)	(-0.065)	(-0.079)	(-0.058)	(0.011)
Parent expects child will complete university degree[b]	-0.075	0.006	-0.011	-0.05	-0.049
	(-0.326)	(-0.056)	(-0.068)	(-0.05)	(0.009)
Parent hopes child will complete technical degree[c]	-0.733	-0.067	-0.066	0.005	0.008
	(-1.023)	(-0.165)	(-0.182)	(-0.157)	(0.019)
Parent hopes child will complete university degree[c]	-0.626	-0.051	-0.072	0.131	0.133
	(-0.954)	(-0.154)	(-0.171)	(-0.151)	(0.024)
Parent Permitted in Classroom	0.276	0.058	0.107*	0.062	0.062
	(-0.244)	(-0.042)	(-0.051)	(-0.05)	(0.005)
Parent Has Been in Classroom	-0.418	-0.045	-0.085	-0.014	-0.013
	(-0.316)	(-0.054)	(-0.065)	(-0.045)	(0.007)
Parent feels welcome in classroom	-0.567**	-0.096**	-0.134***	0.100**	0.100
	(-0.202)	(-0.033)	(-0.039)	(0.034)	(0.003)
Parent belief: own role is to teach child school skills[d]	0.199	-0.016	-0.003	-0.034	-0.035
	(-0.377)	(-0.063)	(-0.075)	(-0.056)	(0.009)
Parent belief: own role is to teach social skills[d]	0.42	0.062	0.059	-0.071	-0.071
	(-0.263)	(-0.046)	(-0.057)	(-0.046)	(0.005)
Parent belief: own role is other[d]	-0.459	-0.007	0.129	0.061	0.061
	(-0.661)	(-0.102)	(-0.125)	(-0.092)	(0.015)
Health and Habits					
MD said child is overweight	0.301	0.033	0.035	-0.024	-0.024
	(-0.271)	(-0.046)	(-0.057)	(-0.042)	(0.005)
Parent's perception of child's weight	-0.132	-0.011	-0.062	-0.056	-0.056
	(-0.37)	(-0.064)	(-0.078)	(-0.065)	(0.009)
	Absent >20% days	Proportion Days Absent	Number Days Absent	Number Days Absent	Number Days Absent
Baseline Characteristics	Logit Complete Cases	OLS Complete Cases	Poisson Complete Cases	Poisson Multiple Imputation	Poisson Cross-Validation[a]
Parent effort to control weight	-0.417	-0.035	-0.053	-0.074	-0.075
	(-0.232)	(-0.04)	(-0.048)	(-0.038)	(0.006)
Special Healthcare Needs	-0.023	0.023	0.053	0.046	0.046
	(-0.265)	(-0.045)	(-0.053)	(-0.042)	(0.003)

Chronic Asthma	0.035	0.045	0.07	0.03	0.032
	(-0.296)	(-0.05)	(-0.059)	(-0.045)	(0.003)
Pet at home	0.248	-0.019	-0.095	0.006	0.008
	(-0.534)	(-0.096)	(-0.115)	(-0.093)	(0.009)
Depressed Adult at Home	0.676**	0.103*	0.153**	0.061	0.061
	(-0.254)	(-0.043)	(-0.051)	(-0.043)	(0.005)
N hours per day watching TV	0.158	0.019	0.038	0.012	0.012
	(-0.097)	(-0.017)	(-0.02)	(-0.015)	(0.003)
N hours per day on computer	0.147	0.008	0.019	0.004	0.004
	(-0.11)	(-0.019)	(-0.023)	(-0.018)	(0.003)
N hours per day playing outside	-0.041	-0.016	-0.014	-0.025*	-0.025
	(-0.077)	(-0.013)	(-0.016)	(-0.012)	(0.002)
Causes of Absences					
Respiratory Illness	0.632*	0.120**	0.232***	0.174***	0.174
	(-0.255)	(-0.044)	(-0.052)	(-0.039)	(0.004)
Other Illness	-0.12	-0.004	0.046	0.029	0.030
	(-0.256)	(-0.044)	(-0.055)	(-0.039)	(0.005)
Cold or rain	0.239	0.065	0.142**	0.117**	0.116
	(-0.238)	(-0.041)	(-0.049)	(-0.036)	(0.005)
Family travel	-0.206	-0.054	-0.136	-0.012	-0.011
	(-0.385)	(-0.065)	(-0.083)	(-0.06)	(0.006)
Lack of transportation	0.092	0.016	-0.036	0.104*	0.103
	(-0.372)	(-0.063)	(-0.077)	(-0.051)	(0.008)
Overslept	-0.501	-0.071	-0.166*	0.065	0.065
	(-0.35)	(-0.059)	(-0.069)	(-0.051)	(0.007)
Lack of sibling childcare	0.789	0.123	0.182*	0.117	0.118
	(-0.426)	(-0.07)	(-0.078)	(-0.063)	(0.009)
Parent prefers child at home	1.122**	0.136*	0.276***	0.112*	0.114
	(-0.356)	(-0.06)	(-0.068)	(-0.05)	(0.006)
Family conflict	0.382	0.02	0.12	0.015	0.015
	(-0.455)	(-0.073)	(-0.09)	(-0.067)	(0.010)
	Absent >20% days	Proportion Days Absent	Number Days Absent	Number Days Absent	Number Days Absent
Baseline Characteristics	Logit Complete Cases	OLS Complete Cases	Poisson Complete Cases	Poisson Multiple Imputation	Poisson Cross-Validation[a]
Baseline Child Behavior and Executive Function Skills					
Attention (observed)	-0.462	-0.057	-0.122*	-0.047	-0.047
	(-0.267)	(-0.045)	(-0.054)	(-0.043)	(0.008)
Self-reported well-	-0.043	-0.002	-0.002	-0.019*	-0.019

being	(-0.061)	(-0.011)	(-0.013)	(-0.009)	(0.001)
Impulse Control (parent report)	-0.145	-0.035	-0.045	-0.035	-0.034
	(-0.338)	(-0.058)	(-0.069)	(-0.047)	(0.007)
Positive behavior (observed)	0.219	0.03	0.046	0.037	0.038
	(-0.237)	(-0.04)	(-0.049)	(-0.037)	(0.005)
Prosocial Behavior (parent report)	-0.128	0.005	0.001	0.009	0.009
	(-0.169)	(-0.028)	(-0.035)	(-0.027)	(0.006)
Gross Motor Control (assessed)	0.289	0.027	-0.017	-0.011	-0.012
	(-0.307)	(-0.052)	(-0.066)	(-0.051)	(0.009)
Cognitive Flexibility (assessed)	-0.05	-0.004	-0.011	-0.006	-0.006
	(-0.045)	(-0.008)	(-0.009)	(-0.007)	(0.001)
Impulse Control (assessed)	0.009	0.002	0.004	-0.001	-0.001
	(-0.025)	(-0.004)	(-0.005)	(-0.004)	(0.000)
N Days Attendance Measured			0.031***	0.032***	0.032
			(-0.005)	(-0.003)	(0.000)
Constant	-0.572	-0.876*	0.52	1.013**	0.998
	(-2.582)	(-0.432)	(-0.52)	(-0.364)	(0.066)
Observations	447	446	448	835	741-765
Prob>chi2 or >F	0.0003	0.0027	0.000	0.000	0.000
R^2 [e]	0.157	0.19	0.12	0.088-0.092	0.88-0.95
Maximum Likelihood R^2	0.195	0.19	0.478	NA[f]	NA[f]

Note. Standard errors in parentheses.

[a]The parameters estimated with the Cross-Validation approach represent averages from ten predictions; therefore, tests of significance are not reported.

[b]Reference category: Parent expects child will complete high school or less

[c]Reference category: Parent hopes child will complete high school or less

[d]Referece category: Parent belief: own principal role is to keep child safe and healthy

[e]Pseudo-R^2 provided for logit and poisson models.

[f]NA = not available for models using imputed data.

***p<0.001

** $p<0.01$

* $p<0.05$.

Appendix C

Similar to the complete case impact model in Table 3, the coefficients for the predicted likelihood of absenteeism index (β_6) are mostly negative, suggesting that the higher a child's likelihood of being absent, the lower his language skills. Almost all of the coefficients for the interaction of UBC treatment with quintiles 2-5 of the predicted likelihood of absenteeism index ($\beta 7$) are negative, suggesting again that UBC's impact on children in the group with higher likelihood of absenteeism was less positive than UBC's impact on children in the groups with lower likelihood of absenteeism.

The coefficient for UBC treatment (β_1) that estimated the impact of the UBC intervention on outcomes of children with the lowest predicted likelihood of absenteeism (1st quintile of the index) was positive for all four language and literacy outcomes, and statistically significant for Letter-Word Identification. Post-hoc general linear hypothesis testing for all models found no detectable differences between language skills of children in the intervention and control groups with likelihoods of absenteeism in the 2nd through 5th quintiles (i.e., no impacts), thus confirming that UBC had a significant and positive impact only for the children with lowest likelihood of absenteeism, and no effect on language skills of children with higher likelihoods of absenteeism.

Table C1. Robustness Checks for Moderation of UBC Program Effects on Language and Literacy Outcomes by Predicted Likelihood of Absenteeism Indices Derived from Multiply Imputed Data (Columns 2-5) and Cross-Validation Approach (Columns 6-9).

	Multiple Imputation				Cross-Validation Approach			
	Vocabulary	Letter-Word	Writing	Comprehension	Vocabulary	Letter-	Writing	Comprehension

		ID				Word ID		
UBC Treatment	0.627(-0.444)	1.701*(-0.675)	0.242(-0.184)	0.067(-0.207)	0.553(-0.439)	1.834**(-0.67)	0.223(-0.183)	0.028(-0.205)
Predicted Absenteeism Risk Index	-6.09(-4.41)	8.013(-5.934)	-0.671(-1.787)	0.362(-1.817)	-5.394(-4.598)	5.477(-6.16)	-0.604(-1.802)	-0.046(-1.869)
Predicted Absenteeism Risk Q2*UBC Treatment	-1.082*(-0.522)	-1.520*(-0.738)	-0.360(-0.201)	-0.069(-0.227)	-1.035*(-0.515)	-1.673*(-0.726)	-0.297(-0.198)	0.056(-0.224)
Predicted Absenteeism Risk Q3*UBC Treatment	-1.009(-0.555)	-1.280(-0.778)	-0.221(-0.211)	-0.382(-0.244)	-1.162*(-0.555)	-1.663*(-0.772)	-0.221(-0.209)	-0.334(-0.241)
Predicted Absenteeism Risk Q4*UBC Treatment	-1.831**(-0.594)	-1.554(-0.829)	-0.661**(-0.229)	-0.155(-0.257)	-1.213*(-0.586)	-2.030*(-0.817)	-0.640**(-0.224)	-0.29(-0.254)
Predicted Absenteeism Risk Q5*UBC Treatment	-1.387*(-0.703)	-1.53(-0.959)	-0.446(-0.267)	-0.455(-0.305)	-1.618*(-0.719)	-1.007(-0.967)	-0.455(-0.27)	-0.293(-0.307)
Observations	1398	1334	1300	1421	1398	1334	1300	1421

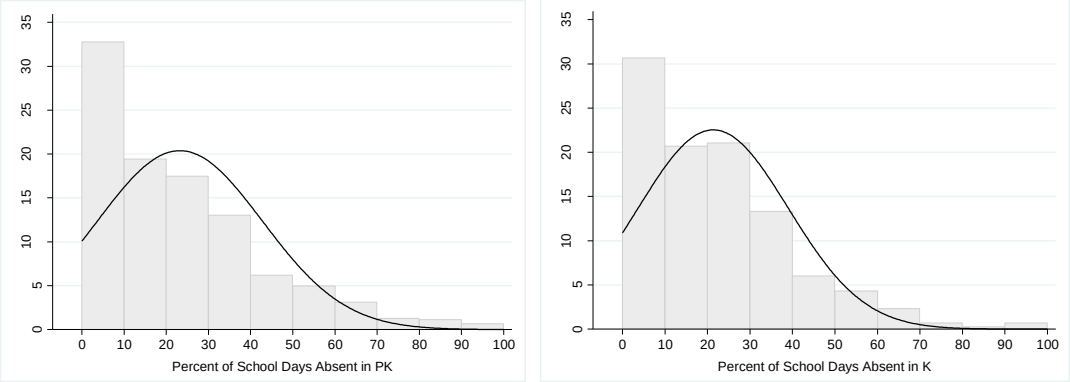

Figure 1. Histograms of individual-level absenteeism (percent of school-days absent per child) measured during the prekindergarten and kindergarten year among UBC participants.

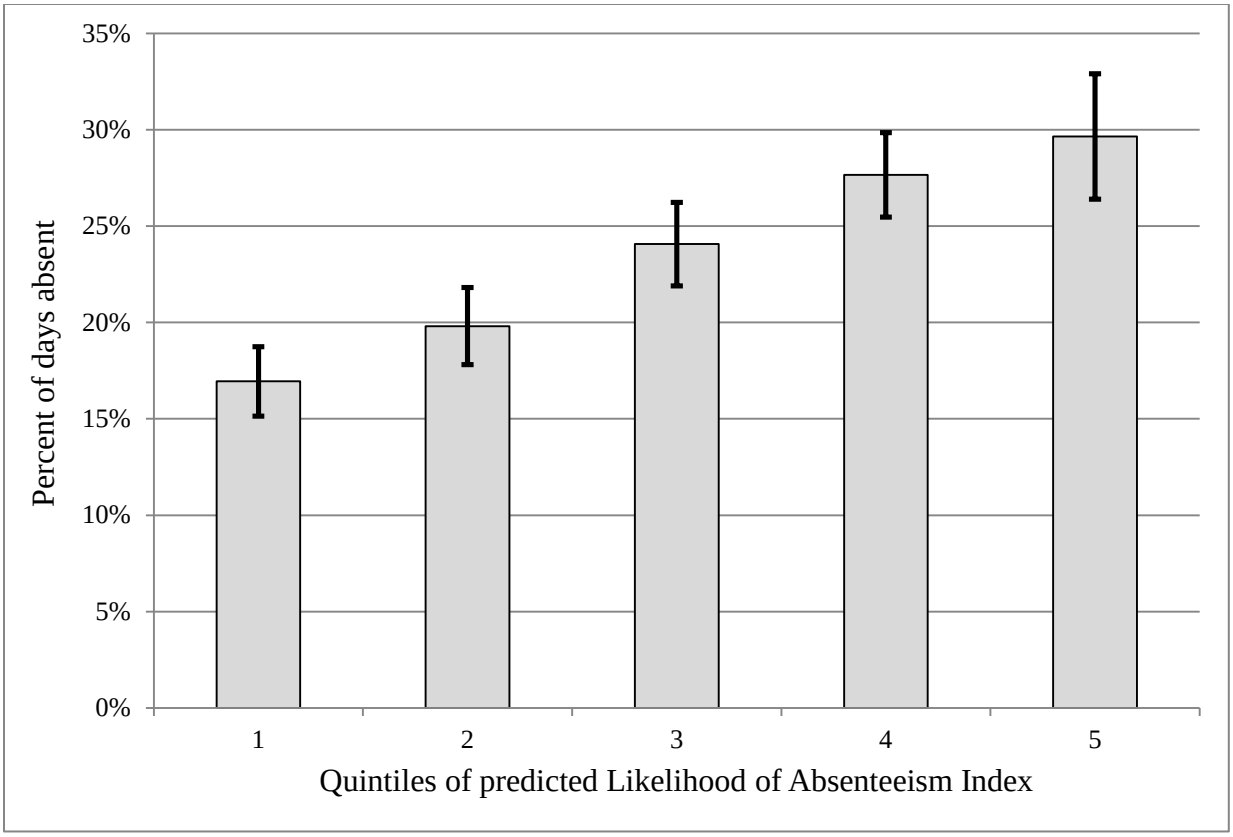

Figure 2. Mean measured percent of school days absent among children in each quintile of predicted Likelihood of Absenteeism Index. Children in the first quintile have the lowest predicted Likelihood of Absenteeism. The bars above each column represent the 95% confidence limits for each mean.

