Research Article

Economic Disparities: SPARK Ohio and Narrowing the Kindergarten Readiness Gap

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The present study investigated the extent to which children of various economic backgrounds were prepared for kindergarten literacy activities, as measured by the Kindergarten Readiness Assessment-Literacy (KRA-L). The study also assessed the extent to which children's *economic disadvantagement* status moderates the relationship between KRA-L scores and the level of participation in SPARK Ohio, an early education intervention focused on increasing parental engagement and advocacy. KRA-L scores for children entering kindergarten in fall 2012 were analyzed for 548 SPARK Ohio participants and 1594 comparison children. Both SPARK Ohio and comparison children identified as economically disadvantaged scored significantly lower on the KRA-L, compared to children not classified as economically disadvantaged. Economic disadvantage status may moderate the influence of participating in SPARK Ohio; children identified as economically disadvantaged scored significantly higher on the KRA-L when they participated in SPARK Ohio, compared to those that did not participate in SPARK Ohio.

1. Introduction

Early childhood learning experiences in nurturing and stimulating environments are critical for typical brain and emotional development [1, 2]. One program designed to address these needs is the SPARK Ohio program; a child-focused parent education intervention program that works with families of preschool-aged children, schools, and the community to increase children's readiness for kindergarten, enhance parents' effectiveness as the "learning advocate" for their children, and improve children's transitions into elementary school [3].

Research describes the short- and long-term impact that living in an economically disadvantaged home can have on the learning and growth of a child. For example, Hair and colleagues found poverty in childhood to be linked to brain development associated with school readiness, which was related to academic achievement [4]. The researchers concluded that poverty influenced learning and achievement and was mediated by brain development [4]. Children growing up in poverty may live in families with limited knowledge, resources, relationships, and experiences that may prevent them from providing adequate nurturing and stimulating environments. For example, by age 4, children raised in a professional family have been exposed to 45 million words, compared to children raised in a working-class family and children raised in poverty, who have been exposed to 26 and 13 million words, respectively [5]. Additionally, adolescents

adopted into high-socioeconomic-status (SES) families had a 13-point advantage on IQ assessments compared to those adopted into families having lower SES [6].

Between 2000 and 2014, the number of U.S. students living in low-income homes as defined by eligibility for free or reduced-price lunches increased from 34 percent to 51 percent [7] or almost 10 million children. Study after study shows that children living in economically disadvantaged households exhibit cognitive, emotional, and academic achievement gaps early in life and this gap progressively widens as significant differences in home environment and resources available to children across the SES spectrum continue to persist [8–10]. These gaps have been shown to lead to potential lifelong hardships, such as lowered income and productivity in adulthood [9, 11]. This produces a burden on the economy, given the continuous promotion of an underdeveloped workforce [9].

However, enriching the learning environment with high-quality early education programs has shown short- and long-term success through improved outcomes for at-risk children [11]. For example, follow-up studies conducted among early education programs, including the Perry Preschool Project, the Carolina Abecedarian Project, Chicago Longitudinal Program/Child Parent Centers, and Parents as Teachers reveal academic benefits for program participants, including increased achievement test scores [12–14], parents reading to their children more frequently and telling stories [15, 16], reduced need for special education programs [17, 18], and higher rates of college enrollment and graduation [13, 19]. Societal benefits of such programs include, relative to non-participants, reduced rates of arrest [20], and higher median incomes [18] among participants (see Table 1).

In addition, coupling high-quality early education programs with parental involvement may further improve outcomes for at-risk children. Fantuzzo, Tighe, and Childs [21] cite family as the greatest influence on a child's development, which was observed with parental involvement's significant effect on academic skill development, social competence, and school readiness [10]. Home visitation early education programs focus on addressing the home environment by providing parent education and encouraging active engagement with their children. Parents are taught basic skills that allow them to create a positive, nurturing, and stimulating environment for their children. Two early childhood home visitation programs, the Nurse-Family Partnership and Parents as Partners (PAT), have demonstrated short- and long-term improvements in developmental [16], academic, and behavioral outcomes [22], relative to non-participants (see Table 1).

Similar to the programs listed above, SPARK Ohio has been providing services for over a decade to at-risk children and families to prevent and reduce potential academic and social gaps (While SPARK Ohio's goal is to reduce potential academic and social gaps and therefore the program recruits in locations where large numbers of children may come from economically disadvantaged home environments, no child is turned away or refused services based on income requirements.). SPARK Ohio was initially funded through a $5 million W. K. Kellogg Foundation grant awarded in 2003

to Sisters of Charity Foundation of Canton, Ohio, to address the developmental and academic needs of at-risk children in an effort to increase school readiness. SPARK Ohio is a child-focused parent education intervention program that works collaboratively with families of preschool-aged children, schools, and the community. The program's primary goals are to increase children's readiness for kindergarten, increase parents' effectiveness as the "learning advocate" for their children, and enhance children's transitions into elementary school [3]. Since its inception (2003), SPARK Ohio has reached over 2,000 children throughout several of Ohio's largest school districts.

Table 2 illustrates the similarities and differences between SPARK Ohio and other early intervention programming in terms of target populations, intervention types, age at entry, supporting agencies, recruitment methods, activities, control/comparison groups, and dosage. The HighScope/Perry Preschool, Abecedarian Project, and Chicago Child-Parent Centers provide the highest intensity of programming with daily services in school and home visits. Parents as Teachers and Nurse-Family Partnership are similar in scope to SPARK Ohio and use monthly, weekly until six weeks of age, or bi-weekly (moderate or high needs) home visits. Unlike Parents as Teachers and Nurse-Family Partnership, which begin in the prenatal period, SPARK Ohio first provides services to children at age three (The SPARK Ohio core model is designed for four-year-old children with supplementary programs available for three-year-olds.). In addition, among other skills, Parents as Teachers and Nurse-Family Partnership focus on developing parenting skills. SPARK Ohio, however, targets primarily cognitive, socio-emotional, and physical domains of school readiness using structured lessons that help parents become capable of serving as their child's first teacher. SPARK Ohio identifies parents as learning advocates and staff as Parent Partners, however, for the remainder of this paper, we will use the generic terms *parent/caregiver* and *program provider*, respectively.

Prior research (see [23]) examined differences between children who participated in the SPARK Ohio program and comparison children with similar backgrounds. That study found evidence that participation in the SPARK Ohio program was associated with significantly higher Kindergarten Readiness Assessment-Literacy (KRA-L) scores as compared to the KRA-L scores a group of comparable children who did not participate in the program. In addition, preschool attendance moderated the relationship between SPARK Ohio participation and KRA-L scores; children who demonstrated the greatest readiness for kindergarten were those who both participated in SPARK Ohio and attended preschool, followed by children who participated in SPARK Ohio but did not attend preschool.

2. Research Questions

Given that economic disadvantage has been shown to negatively impact outcomes for children [6, 24], it is important to identify and describe any relationship between early educational interventions and kindergarten readiness among

Table 1: Early childhood programs outcomes.

	SPARK Ohio	HighScope/Perry Preschool Project	Abecedarian Project	Chicago Child-Parent Centers	Parents as Teachers	Nurse-Family Partnership
Short/Intermediate Outcomes						
Developmental						
Motor development	X	X			X	
Language acquisition	X	X	X (preschool only)	X	X	X (Colorado participants)
Improved social behaviors	X	X	X	X	X	X
Academic						
Literacy	X	X		X	X	
Reduction of Special Education Needs	X	X	X	X		
Increased learning engagement	X	X (identified as "initiative")		X	X	
Long-term Outcomes						
Academic						
High school graduation	Data not yet available	X		X		
College enrollment	Data not yet available		X	X		
Bachelor's Attainment	Data not yet available		X			
Societal						
Household Financial Stability	Data not yet available	X	X	X		X
Lower arrest rates	Data not yet available	X		X		X (New York participants)

children who are economically disadvantaged and those who are not. Prior research suggests that programs such as SPARK Ohio, which couple high quality early education programs with active parental engagement in the academic process, provide improved outcomes for vulnerable children [11]. However, there is minimal literature examining the impact of programs such as SPARK Ohio among children of differing economic backgrounds. Therefore, the following research questions will be addressed through this research:

(1) To what extent are children in SPARK Ohio aided in preparation for kindergarten literacy activities, as measured by the KRA-L following each additional in-home session?

(2) Does economic disadvantage status moderate the relationship between participation in SPARK Ohio and outcomes on the KRA-L?

3. Methods

3.1. Intervention. The SPARK Ohio program works with families of preschool-aged children, schools, and the community to increase children's readiness for kindergarten, increase

parents' effectiveness as the "learning advocate" for their children, and enhance children's transitions into elementary school [3]. Operation of the SPARK Ohio program is conducted by several different type of community agencies including: school districts, libraries, location foundations, and early childhood agencies. Oversight of all individual SPARK Ohio programming is provided by the Early Childhood Resource Center (ECRC).

Using neighborhood canvassing, community social service referrals, word-of-mouth and school district referral, SPARK Ohio recruits families in locations where large numbers of children may come from economically disadvantaged home environments. Upon recruitment into the program, families begin having regular home visits and group meetings with program providers trained in early childhood development. The program is designed to be administered through eighteen sessions for three and four-year-olds. However, due to various factors (e.g., withdraw from program, illness, moving out of a SPARK school system), some children may receive fewer sessions. While there may be slight variation in the delivery of the SPARK program due to unexpected circumstances (e.g., canceled appointments, new parent partner or disruptions during a session), delivery of the SPARK curriculum (e.g., individual sessions) is largely consistent

TABLE 2: Early childhood programs overview.

	SPARK Ohio	HighScope/Perry Preschool Project	Abecedarian Project	Chicago Child-Parent Centers	Parents as Teachers	Nurse-Family Partnership
Target population	Children in low-income households	African American children in low-income households (Southeast Michigan, 1960s)	At-risk infants in low-income households (North Carolina, 1970s)	At-risk children in low-income neighborhoods (Title I funded areas)	At-risk families and children in low-income neighborhoods (specific criteria determined by program affiliates)	First-time low-income mothers and their children
Intervention type	Home visitation staff trained in early childhood development; Group meetings; Screenings and referral for developmental or mental health concerns	Home visitation and school with certified teaching staff	Child care center/preschool and primary school-based instruction	Child care center/preschool based instruction and home visitation with trained paraprofessional	Home visitation with trained paraprofessional; Group Meetings, Screening for developmental delays; Resource network	Home visitation with registered nurse
Age at Entry	3 or 4 years	3 or 4 years	Infancy	3 years	Prenatal	Prenatal (mothers 14-16 weeks gestation)
Supporting agency(ies)	Early Childhood Resource Center; Sisters of Charity Foundation, Canton Ohio	HighScope Educational Research Foundation, Ford Foundation, U.S. Administration of Children, Youth, and Families	Frank Porter Graham Child Development Institute at the University of North Carolina at Chapel Hill	Department of Early Childhood Education Chicago Public Schools	Missouri Department of Elementary and Secondary Education, Danforth Foundation, Parents as Teachers	National Institute of Mental Health, National Institute of Child Health and Human Development, U.S. Department of Justice
Recruiting method(s)	Neighborhood canvassing, community social service referrals, word-of-mouth, school district referral	Neighborhood canvassing, low IQ scores requirement (approx. 70-85pts) assessed using the Stanford-Binet Intelligence Scale	Social service referral, screening performed using High Risk Index	Neighborhood canvassing via school-community representative	Community information packets given to new parents, community social service employee and agency referral (e.g., Women, Infant, and Children [WIC] programs)	Multi-site prenatal clinic visits (Elmira, New York; Memphis, Tennessee; and Denver, Colorado)
Activity(ies)	Prescribed lesson plans, book reading with accompanying task cards to teach parents to teach and become advocates and increase parental engagement	No uniform curriculum; Plan-Do-Review sequence	Learning Games® encouraging playful exchange between adult and child	No uniform curriculum; emphasizes whole-class, small-group and individualized instruction, field trips, and play; Chicago EARLY instructional guide used as supplement	Born to Learn curriculum to provide: parent-child interaction, development-centered parenting, family well-being	Parental interviews
Control Group	No early intervention administered (peers enrolled in same kindergarten classes as participants)	No early intervention administered	No early intervention administered (utilized other community preschools/child care centers), received free diapers and formula	No early intervention administered (same-aged peers from similar socio-economic backgrounds enrolled in other school programs in area)	No early intervention administered (utilized other community preschools/child care centers)	No early intervention administered
Dosages (i.e., intensity)	Monthly	Daily (school), weekly (home)	Daily (school), bi-weekly (home)	Daily (includes 6-week summer program)	Monthly (no or minimal needs); bi-weekly (moderate or high needs)	Weekly (until 6 weeks old), bi-weekly (until 20 months old), monthly (until 2 years old)

across sites and regular fidelity checks are built into the program to increase adherence to the program. That said, SPARK Ohio and similar home-based interventions can be inherently difficult to control (see, for example, Daro et al., 2012).

The program curriculum includes the use of books, activity cards, and supporting instructional resources as prescribed through lesson plans. Lesson plans are based on Ohio's academic standards ([25]; [26] (On December 10, 2015 the No Child Left Behind Act was replaced with the Every Student Succeeds Act (ESSA; [27])).). In addition to lesson plans, using the Ages and Stages Questionnaire (ASQ), children receive regular developmental screening and referral, if necessary. Children are also screened and referred for mental health concerns. Program providers also assist parents to become more engaged in other educational activities for their children, such as enrollment in a certified preschool. While the SPARK Ohio program includes a curriculum that teaches basic literacy and math skills similar to many preschool programs, a distinction is that the SPARK Ohio program focuses on coaching parents/caregivers to increase daily interactions with children and expand a caregiver's awareness of what they can do to improve their child's readiness for kindergarten. Further, SPARK Ohio not only equips children with the skills to be adequately prepared to enter kindergarten, it also helps to establish the foundation of an engaged partnership among the home, school, and community.

3.2. Sample.

Data was collected from a total of 2,561 children. Of the 2,561 children, 578 children registered or participated in SPARK Ohio; however, twenty-eight children considered to be registered for the SPARK Ohio never received a session. Consequently, those children were reclassified as part of the comparison group for analysis leading to 550 total children in the SPARK Ohio (intervention) group. SPARK Ohio children entered kindergarten in the fall of 2012 and attended kindergarten in six Ohio counties, which included 29 schools within 12 school districts. For the comparison group, data was collected from 2,011 comparison children (1,983 original comparison children plus 28 reclassified SPARK Ohio children) who also entered into kindergarten in the fall of 2012. The comparison group is a convenience sample that is comprised of the children who are enrolled in and attend the same kindergarten classrooms as children who participate in the SPARK Ohio program. In short, these children have the opportunity to participate in the SPARK program, but their parent/caregiver chooses not to participate in the program. Variables (e.g., family income, parent/caregiver education) other than basic demographics were not available to assess group equivalence between comparison and SPARK group children were not available. This project was approved by the Kent State University's institutional review board.(Approval of Dr. DeLuca's participation of this research has been granted through an IRB Authorization Agreement between Kent State University and the University of Kansas, with Kent State University as the IRB of record.)

3.3. Data Collection.

Student-level data were obtained from the Ohio Department of Education's educational database (EMIS). Median income and urbanicity data were collected from 2013 typology data provided by the Ohio Department of Education [28]. Student-level data included the following variables: gender (1=male, 0=female), race (1=white, 2=black, 3=multi-racial, 4=Hispanic, 5=other), quarter of birth (1=January-March, 2=April-June, 3=July-September, 4=October-December), learning disability status (1=yes, 0=no), preschool attendance (1=yes, 0=unknown), economically disadvantaged status (1=eligible for financial support, 0=not eligible), SPARK Ohio Dosage (0=comparison group, 1 through 34 for SPARK Ohio participants) and KRA-L scores (0-29). Community-level variables included median income (school district-level median income) and urbanicity (1=rural, 2=suburban, 3=urban).

Economically disadvantaged status is indicated as a 1 (i.e., yes) in EMIS if any of the following conditions are met: (1) child or individual in household is eligible for free or reduced-price lunch, (2) child receives public assistance, or (3) parents of child completed a Title I application [29]. The KRA-L is a kindergarten readiness assessment focusing on literacy, with higher scores indicating greater literacy readiness (the scores range 0-29). The assessment is administered at once by kindergarten teachers during the first few weeks of the academic year. Children are assessed on the following dimensions: rhyming, alliteration, letter recognition, and oral language [30]. Reliability and validity have not been assessed, but Logan, Justice, and Pentimonti [31] assessed predictive validity of the KRA-L and found a strong positive correlation ($r = .47$, $p < .001$) between the KRA-L and the Ohio Achievement Assessment (a third grade reading assessment).

3.4. Analyses.

In addition to presenting descriptive statistics that include frequencies, means, and standard deviations, bivariate analyses examining differences between comparison and SPARK Ohio children are described (see Fischbein, et. al. [23] for further detail). The full sample was comprised of 2561 children; however, birth month was missing for 419 of these children. Multiple imputation could not be utilized to impute birth month due to variables not being significantly correlated with birth month. Therefore, children with a missing birth month were dropped from the analyses resulting in a total sample size of 2,142. A total of 110 children were missing one or more of the following variables: KRA-L score, minority status, median income for school district, or urbanicity. Multiple imputation was used to impute these missing values for these 110 children. Variables used to model the missing data included demographic variables (i.e., gender, month of birth, disability, preschool participation, economically disadvantaged), Woodcock-Johnson Scores, SPARK Ohio Dosage, and SPARK Ohio participation. Twenty datasets were imputed for this analysis. The missing values were imputed using mi impute chained (regression) using Stata 15 [32]. Following imputation, five hierarchical multiple regressions were conducted, with KRA-L scores as the dependent variable. The following models were estimated:

(i) *Model 1* predicts KRA-L scores while controlling for student-level attributes among fall 2012 kindergarten students:

$$\text{KRA-L}_i = \alpha_i + \textbf{StChar}_i\beta_1 + \mu_i \qquad (1)$$

(ii) *Model 2* estimates KRA-L scores among fall 2012 kindergarten students and includes both student- and community-level characteristics:

$$\text{KRA-L}_i = \alpha_i + \textbf{StChar}_i\beta_1 + \textbf{CommChar}_i\beta_2 + \mu_i \qquad (2)$$

(iii) *Model 3* adds SPARK Ohio Dosage number:

$$\text{KRA-L}_i = \alpha_i + \text{SparkDosage}_i\beta_1 + \textbf{StChar}_i\beta_2$$
$$+ \textbf{CommChar}_i\beta_3 + \mu_i \qquad (3)$$

(iv) *Model 4* adds Economically Disadvantaged status:

$$\text{KRA-L}_i = \alpha_i + \beta_1 \text{EconDisadvantaged status}$$
$$+ \text{SparkDosage}_i\beta_2 + \textbf{StChar}_i\beta_3 \qquad (4)$$
$$+ \textbf{CommChar}_i\beta_4 + \mu_i$$

(v) *Model 5* adds the interaction of SPARK Ohio Dosage and Economically Disadvantaged status:

$$\text{KRA-L}_i = \alpha_i$$
$$+ \beta_1 \left(\text{SparkDosage} \times \text{EconDisadvantaged} \right)$$
$$+ \beta_2 \text{EconDisadvantaged status} \qquad (5)$$
$$+ \text{SparkDosage}_i\beta_3 + \textbf{StChar}_i\beta_4$$
$$+ \textbf{CommChar}_i\beta_5 + \mu_i$$

For the five regression models, the equations' variables indicate where

KRA-L = individual scores on the KRA-L assessment

i = child (i = 1-2142)

SPARKDosage = number of completed SPARK Ohio sessions

EconDisadvantaged = economically disadvantaged status (1 = *yes*, 0 = *no*)

INTERVENTION = child participated in INTERVENTION (1 = *yes*, 0 = *no*)

StChar = a vector of student characteristics (controls)

   (a) birth month (by quarter)
   (b) gender
   (c) minority status (categorical)
   (d) disability status (1=yes, 0=no)
   (e) preschool participation *(1=yes, 0=unknown)*

CommChar = a vector of community characteristics (controls)

   (a) median school district income
   (b) urbanicity (1=rural, 2=suburban, 3=urban)

μ = unobserved error

Adjusted cell means, or predicted means, for the interaction of SPARK Ohio Dosage and economically disadvantaged status are calculated and presented to assist in interpretation of the interaction effect.

4. Results

4.1. Descriptive Statistics. Shown in Table 3, among children who participated in the SPARK Ohio program, 51.5% were males (n = 282) and 48.5% were females (n = 266). Comparison children were also slightly more likely to be male than female with 52.8% of the children being male (n = 842) and 47.2% being female (n = 752). The SPARK Ohio racial and ethnic distribution was as follows: 44.1% African American (n = 237), 40.0% Caucasian (n = 215), 10.8% multi-racial (n = 58), 3.9% Latino/Hispanic (n = 21), and 1.3% other (n = 7). The comparison group did not significantly differ on racial and ethnic distribution, $X^2(4, N = 2,128) = 8.67$, p = .07, and was 50.1% African American (n = 797), 36.7% Caucasian (n = 584), 7.7% multi-Racial (n = 123), 3.9% Latino/Hispanic (n = 62) and 1.5% other (n = 24). A significantly higher percentage of SPARK Ohio children were classified as having a learning disability (9.5%, n = 52) than comparison children (6.4%, n = 102), X^2 (1, N = 2,142) = 5.84, p = .02. Likewise, a higher percentage of SPARK Ohio children attended preschool (29.9%, n = 164) relative to comparison children (21.5%, n = 343), X^2 (1, N = 2,142) = 15.96, p = .00. The distribution of urbanicity differed significantly between the SPARK Ohio and comparison children, ($X^2(2, N = 2,134) = 36.81$, p = .00). The distribution of urbanicity among SPARK Ohio children was as follows: 21.5% rural (n = 117), 30.1% suburban (n = 164) and 48.4% urban (n = 264). The comparison group was 18.0% rural (n = 286), 44.8% suburban (n = 712) and 37.2% urban (n = 591). The median school district income was significantly lower for SPARK Ohio children (M = 24,239, SD = 4,106) relative to comparison children (M =25,946, SD = 4,763), t (2132) = 7.47, p = .00; however, Both SPARK Ohio children (44.5%, n = 244) and comparison children (45.2%, n = 720) had similar rates of economic disadvantage, 44.5% (n = 244) and 45.2% (n = 720), respectively, X^2 (1, N = 2,142) = 0.07, p = .79.

After removing the comparison group (where SPARK Ohio Dosage is 0), the average number of SPARK Ohio sessions was 12.2 sessions (SD = 6.11). Children with economically disadvantaged status had a significantly higher average number of SPARK Ohio sessions (M = 12.8, SD = 6.28) than children who did not have economically disadvantaged status (M = 11.6, SD = 5.93). For children with economically disadvantaged status, the 90th percentile is 23 sessions while for children without economic disadvantage status, the 90th percentile is only 20 sessions.

Table 3: Characteristics of SPARK Ohio and comparison group children.

	SPARK Ohio	Comparison
Sex (%)		
Male	282 (51.5)	842 (52.8)
Female	266 (48.5)	752 (47.2)
Race (%)		
African American	237 (44.1)	797 (50.1)
Caucasian	215 (40.0)	584 (36.7)
Multi-racial	58 (10.8)	123 (7.7)
Latino/Hispanic	21 (3.9)	62 (3.9)
Other	7 (1.3)	24 (1.5)
Categorical Birth Month (%)		
January-March	137 (23.8)	387 (24.7)
April-June	132 (22.9)	375 (24.0)
July-September	149 (25.9)	454 (29.0)
October-December	158 (27.4)	350 (22.3)
Disability (%)*		
Yes	52 (9.5)	102 (6.4)
No	523 (90.5)	1465 (93.6)
Preschool Participation (%)**		
Yes	164 (29.9)	343 (21.5)
No/Missing	406 (70.1)	1229 (78.5)
Urbanicity (%)**		
Rural	117 (21.5)	286 (18.0)
Suburban	164 (30.1)	712 (44.8)
Urban	264 (48.4)	591 (37.2)
Median School District Income (SD)**	24,239 (4,106)	25,946 (4,763)
Economically Disadvantaged		
Yes	244 (44.5)	720 (45.2)
No	304 (55.5)	874 (54.8)
KRAL Score (SD)*	18.6 (6.8)	17.7 (7.2)

n = 2,142; *p < .05; **p<.01.

4.2. Multivariate Statistics. Five hierarchical regression models were analyzed, predicting KRA-L scores using combinations of control variables and variables of interest (Table 4). The first model included only the following student-level control variables: birth month by quarter, gender, minority status, disability status and preschool participation. Model 2 included the community-level control variables of median school district income and urbanicity. Model 3 included the SPARK Ohio Dosage variable which indicates the number of SPARK Ohio sessions completed. For every session of SPARK Ohio completed, KRA-L scores are predicted to increase by an average of 0.12 points (SE = 0.02). Model 4 added the variable of interest of economic disadvantage status and demonstrates that students classified as economically disadvantaged are predicted to score 2.51 points lower than students without this label. Model 5 explored the interaction between the number of SPARK Ohio sessions completed and economic disadvantage status when predicting KRA-L scores. Examination of the adjusted cell means for the statistically significant interaction (Figure 1) demonstrates

that, consistent with expectations, children who were not identified as economically disadvantaged are predicted to score higher on the KRA-L (17.51 points) than children who were identified as economically disadvantaged (14.81 points) when there was no participation in SPARK Ohio. However, as the number of SPARK Ohio sessions increases, so does the predicted KRA-L score for both economically disadvantaged and non-disadvantaged. The significant interaction of dosage and economic disadvantage (p=0.02) means that those who are economically disadvantaged increase at a quicker rate than those who are not economically disadvantaged. After 18 sessions, predicted KRA-L scores for economically disadvantaged children in SPARK Ohio (17.63 points) surpass non-economically disadvantaged classmates who did not participate in SPARK Ohio (17.51 points). After 27 sessions of SPARK Ohio, the disadvantaged children (19.22 points) are predicted to surpass the scores of children without an economic disadvantage (19.20 points) who have had the same number of SPARK Ohio sessions.

TABLE 4: Summary of hierarchical regression analysis for variables predicting kindergarten readiness assessment–literacy scores.

Variable	Model 1		Model 2		Model 3		Model 4		Model 5	
	B(SE)	t	B(SE)	t	B(SE)	t	B(SE)	t	B(SE)	t
Constant	20.12(.41)	49.66**	17.60(.98)	17.89**	16.90(.98)	17.17**	17.37(.98)	17.81**	17.38(.98)	17.81**
Student Variables										
Month of Birth										
January-March	-1.13(.43)	-2.64**	-1.10(.43)	-2.56*	-1.04(.43)	-2.42*	-.96(.42)	-2.27*	-.96(.42)	-2.28*
April-June	-2.34(.43)	-5.43**	-2.40(.43)	-5.58**	-2.32(.43)	-5.41**	-2.34(.42)	-5.52**	-2.36(.42)	-5.57**
July-September	-2.47(.42)	-5.95**	-2.49(.41)	-6.02**	-2.41(.41)	-5.84**	-2.38(.41)	-5.81**	-2.40(.41)	-5.88**
October-December (referent)	-		-		-		-		-	
Male	-.88(.31)	-2.88**	-.93(.30)	-3.06**	-.90(.30)	-2.98**	-.88(.30)	-2.95**	-.86(.30)	-2.86**
Minority	-.55(.32)	-1.73	-.70(.34)	-2.07*	-.60(.34)	-1.79	-.51(.33)	-1.53	-.47(.33)	-1.42
Disability	-5.42(.62)	-8.69**	-5.02(.62)	-8.04**	-5.14(.62)	-8.29**	-4.80(.61)	-7.83**	-4.87(.61)	-7.95**
Preschool Participation	2.31(.35)	6.51**	1.20(.41)	2.91**	.92(.42)	2.20*	.99(.41)	2.39*	.93(.41)	2.24*
Community Variables										
Median Income			.00(.00)	2.35*	.00(.00)	2.60*	.00(.00)	2.15*	.00(.00)	2.25*
Urbanicity										
Urban (referent)	-		-		-		-		-	
Rural			-.10(.45)	-0.22	-.19(.44)	-0.43	1.66(.52)	3.20**	1.79(.52)	3.43**
Suburban			1.49(.41)	3.64**	1.69(.41)	4.12**	3.21(.48)	6.73**	3.33(.48)	6.95**
SPARK Ohio Dosage					.12(.02)	4.73**	.12(.02)	4.93*	.07(.04)	1.89
Economically Disadvantaged							-2.51(.37)	-6.70**	-2.92(.42)	-6.96**
SPARK Ohio Dosage x Economically Disadvantaged									.11(.05)	2.30*
R-Squared	0.08		0.10		0.11		0.13		0.13	
F for change in R-Square			11.58**		22.81**		45.20**		5.19*	

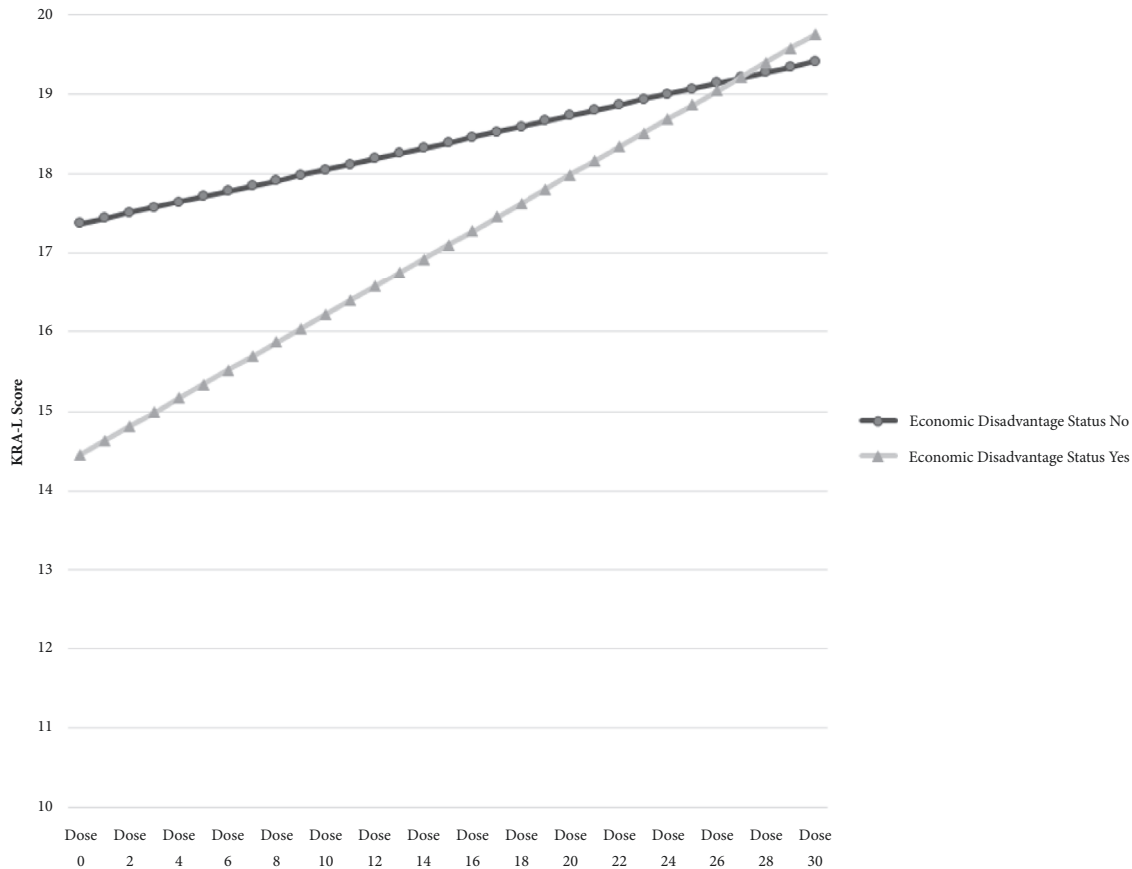n = 2,142; *p < .05; **p < .01.

Figure 1: Adjusted means for interaction of SPARK Ohio participation dosage and economic disadvantaged status.

5. Discussion

Prior research [23] found participation in SPARK Ohio, compared to non-participation, to be associated with significantly increased KRA-L scores. To further explore the impact of SPARK Ohio, this study focused on the relationship between kindergarten readiness among children classified as economically disadvantaged and SPARK Ohio participation. The first goal of this study was to assess the extent to which children of different economic backgrounds are prepared for kindergarten literacy activities, as measured by the KRA-L. Results demonstrate that children identified as economically disadvantaged are predicted to score 2.51 points lower on the KRA-L than children not classified as economically disadvantaged. These results are consistent with the work of Duyme et al. [6], who found that adolescents from low-SES backgrounds scored lower on an IQ assessment than adolescents from high-SES families.

The second purpose of the current research was to examine the impact of participation in SPARK Ohio on kindergarten literacy preparedness among children of differing economic backgrounds. Results demonstrate that economic disadvantage status may moderate the influence of SPARK Ohio participation, with children classified as economically disadvantaged who participate in SPARK Ohio significantly more prepared for kindergarten literacy tasks than children

of similar economic backgrounds who do not participate in SPARK Ohio. The impact of participation in SPARK Ohio on kindergarten literacy readiness appears to be the strongest among children classified as economically disadvantaged. This differential impact according to economic status is consistent with research on the PAT program, an early childhood home visitation intervention for children from birth through age three, which found positive effects of the program more frequently in families with very low incomes than families with moderate incomes [16].

6. Future Research

The current study suggests that children from economically disadvantaged homes were better prepared for kindergarten literacy when they participated in SPARK Ohio as compared to children who did not participate in the SPARK program. Further, SPARK children from economically disadvantaged families appear to make greater gains in terms of kindergarten readiness than SPARK children not classified as economically disadvantaged. Future research should be conducted to identify specific elements of the SPARK program that could explain this finding. Likewise, research examining the impact of similar programs (see Table 1) on academic outcomes by economic disadvantagement should be conducted. For example, do similar early childhood interventions have greater

impact for economically disadvantaged children as compared to children who are not from economically disadvantaged families?

Since SPARK Ohio focuses on parent education, parental involvement is required. However, some parents, especially parents from economically disadvantaged households, may refrain from participating in SPARK Ohio. For example, a study of parental involvement in schools with many low-income families [33] found that parents were distrusting of some elementary teachers because they felt teachers were biased against low-income families, which created a barrier to parental participation in school activities and engagement with teachers. Similarly, data from the Parent and Family Involvement in Education Survey from the National Household Education Surveys Program (2012) found that parents of students living in households with incomes below the poverty threshold were less likely to be involved in school activities (i.e., attending general meetings, attending scheduled meetings with a teacher, attending school or class events, and volunteering or serving on a committee) than parents of students living in households with incomes above the poverty threshold [34]. Future research could explore potential barriers and willingness of parents to participate in and engage with SPARK Ohio. In addition, positive experiences associated with participation in SPARK Ohio may increase parental willingness to engage with their children's future educators. Therefore, research should explore the long-term impact of SPARK Ohio on parents' levels of engagement in their children's education.

While the current study and prior research by Fischbein, et. al. [23] found a positive short-term benefit for children participating in SPARK Ohio with regard to kindergarten literacy readiness, future research is needed to examine long-term outcomes. Future studies should continue to assess the performance of SPARK Ohio participants and non-participants on standardized tests in elementary school and beyond. In addition, longitudinal studies also offer the opportunity to examine over time the impact of SPARK Ohio on children classified as economically disadvantaged.

7. Limitations

Due to limitations with data obtained through EMIS, economic disadvantage status was categorized dichotomously; children were either classified as economically disadvantaged or economically non-disadvantaged. Grouping economic disadvantage status in this manner eliminated the ability to assess for the magnitude of economic disadvantage. However, dichotomous categorization of economic disadvantage status is commonly found in research [16, 34, 35] and permits examination of the impact of SPARK Ohio program on children from economically disadvantaged homes compared to those from economically non-disadvantaged homes. In addition, multiple factors (i.e., eligibility for free or reduced-price lunch, child receiving public assistance, or completion of a Title I application) were pooled to determine economic disadvantage status; therefore, indicators are unavailable for the individual factors comprising the economic disadvantage

status variable. However, it would be beyond the scope of the current study to explore the impact of individual factors impacting economic disadvantage status, and further, the results support the expectation that children who did not participate in SPARK Ohio and are classified as economically disadvantaged would score the lowest on the KRA-L. The impact of the intervention cannot be fully explained, given various possible confounding variables. For example, because the program is voluntary, parents/caregivers who participate in the program may be more motivated to see their child succeed.

8. Conclusion

This study found evidence that children living in economically disadvantaged environments perform better on a kindergarten literacy readiness assessment when they participated in at least 18 sessions of the SPARK Ohio program compared to peers who did not participate in the program. This finding similar to previous research by Duncan and Sojourner [36] on the ability of Abecedarian curriculum to remove socioeconomic gaps in school readiness. The current expands these findings to the SPARK Ohio program and has policy, educator, and parental implications. First, Title I provides funding to local educational agencies (i.e., school districts) and schools that serve a large percentage of low-income children with the goal of ensuring these students meet state academic standards [25, 26]. Since the current research provides evidence that SPARK Ohio participation reduces economically induced disparities in KRA-L scores, Title I funding may be a source of support for SPARK Ohio and similar programs.

Second, SPARK Ohio guides and prepares parents to serve as learning advocates for their children, which the current study reveals increases children's scores on the KRA-L. Educators can work to increase levels of parental comfort and confidence in advocating for their children in an effort to increase academic performance. In addition, educators may benefit from increased engagement in the educational process among SPARK Ohio.

Lastly, evidence from the present research suggests children have better outcomes (i.e., higher KRA-L scores) when their parents are more involved with their schooling. Therefore, parents should consider increasing their involvement in their child's school by, for example, attending school meetings and events and participating on school committees. By continuing to fund programs like SPARK Ohio, and by encouraging collaboration between educators and parents to promote the academic well-being of children, the goal to reduce disparities in school performance between the economically disadvantaged and economically non-disadvantaged can be advanced.

Data Availability

Data for the current study were obtained through an agreement with the Ohio Department of Education. Data include variables from identifiable academic records from elementary

school-age children. As such data used for the current study cannot be released for public use.

Conflicts of Interest

Acknowledgments

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