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Healthy and Ready to Learn: Prevalence and Correlates of School Readiness among United States Preschoolers

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Abstract

Objective: To assess the national and state prevalence of being “Healthy and Ready to Learn” (HRL) and associated sociodemographic, health, family and neighborhood factors.

Methods: Cross-sectional analysis of the 2016 National Survey of Children’s Health, a nationally representative parent-reported survey administered by web and paper June 2016 to February 2017. Four domains were constructed from 18 items through confirmatory factor analyses: “Early

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Supplementary Data

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Learning Skills”, “Social-Emotional Development”, “Self-Regulation”, and “Physical Well-being and Motor Development.” Each item and domain were scored according to age-specific standards as “On-Track”, “Needs Support”, and “At Risk” with overall HRL defined as “On-Track” in all domains for 7565 randomly selected children ages 3 to 5 years.

Results: In 2016, 42.2% of children ages 3 to 5 years were considered HRL with the proportion considered “On-Track” ranging from 58.4% for Early Learning Skills to 85.5% for Physical Well-being and Motor Development”; approximately 80% of children were considered “On-Track” in Social-Emotional Development and Self-Regulation, respectively. Sociodemographic differences were mostly non-significant in multivariable analyses. Health, family, and neighborhood factors (ie, special health care needs status/type, parental mental health, reading, singing and storytelling, screen time, adverse childhood experiences, and neighborhood amenities) were associated with HRL. HRL prevalence ranged from 25.5% (NV) to 58.7% (NY), but only 4 states were significantly different from the U.S. overall.

Conclusions: Based on this pilot measure, only about 4 in 10 US children ages 3 to 5 years may be considered “Healthy and Ready to Learn.” Improvement opportunities exist for multiple, modifiable factors to affect young children’s readiness to start school.

Keywords

child development; National Survey of Children’s Health; school readiness

EARLY ATTAINMENT OF cognitive and social-emotional skills is strongly associated with short and long-term academic and health-related impacts, and attendant social, professional and economic consequences.¹⁻⁴ Building such skills starts before kindergarten,⁵ highlighting the need for early investments in child development, particularly for those who may be at greater risk for poor outcomes.⁶ While conceptualizations of school readiness vary,⁷ 5 overarching domains are generally agreed upon: Physical Well-Being and Motor Development; Social and Emotional Development; Approaches Toward Learning; Language Development; and Cognition and General Knowledge.⁸ However, a number of barriers to assessing school readiness exist: assessments are often completed after kindergarten initiation by teachers for instructional and reporting purposes; preschool children are cared for in various types of settings and by a range of providers; and national efforts⁹ to assess early childhood learning and experiences have not been consistently collected or included data on a broad range of health and contextual factors that can influence early learning or provided standardized estimates at the state level where key policy and programming decisions are made.

We use data from the 2016 National Survey of Children’s Health (NSCH) to address this gap.¹⁰ Starting in 2016, the NSCH contained 22 questions designed to assess young children’s readiness to start and succeed in school. These items, largely drawn from existing surveillance systems, eg, the National Household Education Survey on School Readiness and the Early Childhood Longitudinal Study, and informed by expert deliberations, were used to form pilot measures, developed in a prior study, to track young children’s attainment of key competencies and skills in 4 complementary domains: Early Learning Skills, Social-Emotional Development, Self-Regulation, and Physical Well-being and Motor Development, and an overall summary measure of “Healthy and Ready to Learn” (HRL).¹¹ The addition of

survey content and development of both summary and domain-specific HRL measures was driven by state leaders and other stakeholders who prioritized the development of a standard, comprehensive measure of young children's readiness to start and succeed in school in order to better understand the developmental needs of young children and their families and target resources accordingly.¹¹ The importance of this measure is underscored by its selection as a National Outcome Measure (NOM) by the Title V Maternal and Child Health Services Block Grant program across all 59 states and jurisdictions in the US. Title V NOMs serve as key measures of maternal and child population health status and reflect areas where there is a "recognized need to move forward".¹²

Previous research has explored, in depth, the various child, family, neighborhood and community-level characteristics and exposures that can both promote and challenge young children's development of key competencies and abilities. From parenting, to poverty (and attendant disadvantages), to adverse childhood experiences, the literature is replete with examples of how a myriad of factors can, independently and in conjunction, impact both early and later learning.^{7,11} This study extends these previous efforts by utilizing the first nationally- and state- representative, multi-dimensional measure of HRL to explore the association with multiple child, family, and neighborhood-level factors. The goals of this analysis are 2-fold: 1) describe the national prevalence and examine state-level variation in the proportion of young children who are HRL based on this previously-developed set of measures; and 2) explore the sociodemographic, health, family and neighborhood factors associated with being HRL overall and by domain.

Methods

Data Source and Study Population

Funded and directed by the Health Resources and Services Administration's Maternal and Child Health Bureau (HRSA MCHB) and conducted by the U.S. Census Bureau, the NSCH is a nationally-representative, annual, cross-sectional, address-based, self-administered survey utilizing both web and paper data collection instruments. Data are collected in 2 phases: a household screener to assess the presence, demographic characteristics, and special health care needs status of children in the home followed by a detailed, age-specific topical questionnaire for one randomly selected child. All data were voluntarily collected in English or Spanish from a parent or caregiver familiar with the child's health and health care. The 2016 NSCH was fielded June 2016-February 2017 resulting in a total of 50,212 completed questionnaires, of which 7,565 were for children ages 3-5 years. The overall weighted response rate was 40.7% and the interview completion rate, or the proportion of screened households known to include children that completed a topical questionnaire, was 69.7%. Detailed information about the design and operation of the survey is available elsewhere.^{13,14}

Outcomes

Eighteen items were used in the calculation of the pilot summary measure for HRL including 7 items used to assess "Early Learning Skills," 3 items to assess "Physical Well-being and Motor Development," and 4 items each to assess "Social-Emotional

Development” and “Self-Regulation” (Fig. 1). Complete survey content is available online (<https://mchb.hrsa.gov/data/national-surveys>). The development of the 3 separate scales for Early Learning Skills, Self-Regulation, and Social-Emotional Development and an index for Physical Well-being and Motor Development has been described in detail in previously published work.¹¹ In brief, we assessed potential HRL items in the NSCH for variability in item responses and expected differences by age. These assessments were followed by Confirmatory Factor Analyses (CFA). We first tested a model which included factors aligned with 4 of the original 5 domains of school readiness identified by the National Educational Goals Panel⁸: Social and Emotional Development; Approaches Toward Learning; Language Development; and Cognition and General Knowledge; Physical Well-Being and Motor Development was not included in the CFA as it was conceptualized as an index rather than a scale. The CFAs based on these original domains did not meet the criteria for sufficient model fit: CFI = 0.95, TFI = 0.95, and RMSEA = 0.08 and were re-specified.

Four domains emerged as a result of these subsequent analyses: Early Learning Skills ($\chi^2(14) = 228.16, P < .001$; RMSEA = 0.046 (CI: 0.04–0.05); CFI = 0.97; TLI = 0.96); Physical Well-being and Motor Development; Social-Emotional Development ($\chi^2(2) = 10.53, P < .001$; RMSEA = 0.024 (CI: 0.01–0.04); CFI = 0.99; TLI = 0.98); and Self-Regulation ($\chi^2(2) = 21.15, P < .001$; RMSEA = 0.036 (CI: 0.02–0.05); CFI = 0.99; TLI = 0.96) which differed from the 5 originally hypothesized domains in 3 ways which have been detailed previously.¹¹ Once the domains were identified, a summative score was developed for each domain. To create this score, we first recoded individual items on a 3-point scale based on age-specific expectations for a child’s ability to attain a specific skill or competency: 0 = At-Risk, 1 = Needs Support, 2 = On-Track. For example, a 3-year-old who could identify “All” or “Most” of the letters of the alphabet in response to the question: “How many letters of the alphabet can this child recognize” was considered to be “On-Track” and assigned 2 points, while a 3-year-old who could identify only “Some” was considered to be “Needing Support” and assigned 1 point; and a 3-year-old who could identify “None” was considered to be “At Risk” and assigned 0 points. This algorithm was developed by KA Moore, confirmed by HRSA MCHB and Child Trends researchers who were external to the project. We then summed the items to create an index for each domain and cut scores were created to rank children on the 3-point scale.¹¹ The summative measure for HRL was constructed for each child by summing the number of domains where the child was defined to be “On-Track” for their age (Table 1). The calculation of a summative measure is consistent with the approach to all Title V NOMs and related National Performance Measures (NPMs), several of which reflect multi-component constructs, eg, Medical Home and Systems of Care for Children with Special Health Care Needs.¹⁵ Concurrent validity of the summative measure was assessed in relation to parents’ confidence their child was ready for school and household educational attainment.

Covariates

Sociodemographic, health, family, and neighborhood characteristics were examined based on previous associations with either school readiness or child development.^{1,5,16,17} Sociodemographic characteristics included the child’s sex, age (3, 4, or 5 years), race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, non-Hispanic Asian, non-

Hispanic Other/Multiple race), primary household language (English, non-English), family structure (2 parents, married, 2 parents, unmarried, single mother, other), household income-to-poverty ratio (<100% FPL, 100%–199% FPL, 200%–399% FPL, 400% FPL), and highest education among primary caregivers in the household (high school/General Educational Development (GED), some college/Associate's degree, Bachelor's degree). Health characteristics included special health care needs (SHCN) status and type and self-rated mental health of the responding caregiver (excellent or very good, good, fair or poor). Children with Special Health Care Needs (CSHCN) are defined as those who “have or are at increased risk for chronic physical, developmental, behavioral or emotional conditions and also require health and related services of a type or amount beyond that required by children generally”¹⁸; typology was derived based on healthcare and functional impacts (no SHCN, prescription medication need/use only, elevated service need/use only, elevated service need/use and prescription medication need/use, or functional limitations, with or without other needs).¹⁹ Family and neighborhood characteristics included average weekday screen time with television, computers, and other electronic devices (1 hour, 1.1–2 hours, >2 hours), average weeknight sleep duration (7 hours, 8–9 hours, 10 hours), number of days in the past week the child was read to and sung or told stories to (either/both 0-3 days, either 4-6 days, either everyday, both everyday), number of lifetime Adverse Childhood Experiences (ACEs; 0, 1, 2), eg, parental incarceration and/or substance abuse, and presence of neighborhood amenities, such as parks or playgrounds and libraries or bookmobiles.

Statistical Analysis

Bivariate associations between the covariates and HRL outcomes were examined using χ^2 tests (Table 2). Multivariable logistic regression models were used to estimate adjusted associations with the overall HRL measure and each domain-specific measure (Table 3). To improve interpretation and translation, estimated odds were converted to marginal probabilities for presentation of adjusted rate ratios. State-level estimates were compared with national estimates using t-tests for overlapping groups (Fig. 2 and Supplementary Table 1). Because of their use in creating survey weights, the US Census Bureau multiply imputed missing data on household income-to-poverty ratio (18.6%) and respondent (Adult 1) educational attainment (3.0%) using regression imputation; missing data on child sex and race/ethnicity (<1%) were imputed using hot-deck methods. Missing data ranged from 0%-2.5% across outcomes with <5% cumulative missing data on non-imputed covariates, which were excluded from regression analysis. This level of missingness is generally considered inconsequential.²⁰ Data were weighted to account for selection probabilities and nonresponse, and to be representative of the non-institutionalized US population of children. All analyses adjusted the variance estimates for the complex sampling design and multiple imputation of poverty using SAS-callable SUDAAN, version 11.0.1 (Research Triangle Institute).

Results

In 2016, 42.2% of children ages 3-5 years were considered “Healthy and Ready to Learn” based on parent/caregiver-report for the pilot measure. The proportion of children

considered “On-Track” in each of the individual domains ranged from 58.4% for Early Learning Skills to 85.5% for Physical Well-being and Motor Development”; 81.4% and 78.3% of children were considered “On-Track” in Social-Emotional Development and Self-Regulation, respectively. For both the overall and the domain-specific measures, a minority of children were rated as “At-Risk”, ranging from 1.8% for Social-Emotional Development to 8.9% for Early Learning Skills, with just under 1 in 10 children considered “At-Risk” overall. Similarly, while the majority of children in each domain-specific measure were “On-Track”, when aggregated, nearly 50% of all young children were rated as “Needing Support.”

Unadjusted analyses revealed various sociodemographic differences in the proportion of young children rated “On-Track” across the measures (Table 2). For example, girls were more likely to be HRL and to demonstrate Self-Regulation compared to boys, and non-Hispanic White children had a higher percentage “On-Track” than most other groups for 3 of 4 domains. Household poverty, education and family structure were strongly and consistently associated with all measures. Children in wealthier, more highly educated households with 2 married parents were more likely to be rated “On-Track.”

Children with special health care needs (CSHCN) were less likely to be HRL; those who experienced functional limitations fared worst, with only 5.6% being HRL and less than 20% having attained age-expected Early Learning Skills. A consistent and significant gradient was observed between parental/caregiver mental health and each measure, with less than one fifth of children living with a parent/caregiver in fair or poor mental health being HRL. Of the family and neighborhood variables, weekday screen time, sleep, and family reading, singing and story-telling behaviors were generally associated with all HRL measures. For example, a 20-percentage point difference was observed in the proportion of young children who were HRL and who had obtained age-appropriate Early Learning Skills between those that were read to/sung or told stories to 3 days per week versus both daily. Finally, negative and positive associations with the number of ACEs and neighborhood amenities, respectively, were consistently observed across all HRL measures.

After adjustment, few of the observed differences by sociodemographic characteristics remained (Table 3). For the overall measure, children with parent(s)/caregiver(s) who had less than a bachelor’s degree were approximately 15-20% less likely to be HRL compared to those with at least one parent/caregiver having a college degree, although results for <HS/GED were marginally significant. Across all HRL domains, the association between the presence and type of SHCN remained: compared to children without SHCN, children with functional limitations were only one fifth as likely to be HRL, while those who had elevated service needs were one third as likely. Suboptimal parental/caregiver mental health also remained negatively associated with meeting all HRL measures: children with parents/caregivers reporting less than excellent or very good mental health were 20% to 40% less likely to be “On-Track” overall.

For modifiable family behaviors, several associations remained significant after adjustment. Children with >2 hours of daily screen time were 20% less likely to be HRL and 10% less likely to be “On-Track” for “Early Learning Skills”. ACE exposure was associated with a

lower likelihood of meeting 3 of 4 domains, with children exposed to 2 ACEs being one third less likely to be HRL overall compared to those without such exposures. Conversely, those with 8 or more hours of daily sleep were 25% more likely to be “On-Track” for “Social Emotional Development”; daily family reading, singing and/or story telling was associated with a 30% to 50% increase in being HRL and being “On-Track” for “Early Learning Skills.” Access to all 4 neighborhood amenities was associated with a 20% increase in being HRL and with domain-specific associations for “Early Learning Skills” and “Self-Regulation.”

Figure 2 illustrates state variation in the proportion of young children who are HRL, ranging from 25.5% in Nevada to 58.7% in New York. Despite this wide range, most states had percentages within 5% of the national estimate (Supplementary Table 1), and only 4 states were significantly different from the U.S. overall: Nevada and Idaho were lower while New York and Missouri were higher. No regional patterns or clustering were observed.

Discussion

This is the first national study to present population-level estimates of pre-school children’s readiness for kindergarten and associated sociodemographic, health, family and neighborhood factors using a multidimensional measure. About 4 in 10 US children ages 3 to 5 years may be considered “Healthy and Ready to Learn,” meaning they were on-track in all 4 domains. This is consistent with the range of 35% to 45% previously reported among kindergarteners,²¹ however, such comparisons are challenging given the variety of measures used and the focus on children at the higher end of the age spectrum. Across domains, the proportion of children considered to be “On-Track” was highest for Physical Well-being and Motor Development and lowest for Early Learning Skills.

In the bivariate analyses, we found significant sociodemographic, health, familial, and neighborhood differences regarding HRL. Sociodemographic differences were largely non-significant in multivariable analyses. However, several modifiable factors within the family context were significantly associated with age-expected skills and competencies independent of sociodemographic characteristics, pointing to potential avenues for promotion of school readiness. Findings suggest that reducing barriers for families to engage in reading, singing and storytelling and empowering families to reduce unsupervised screen time and implement healthy sleep routines could enhance children’s well-being. Our results documenting the associations between passive media exposure, sleep, and school readiness indicators support recommendations from the American Academy of Pediatrics for both media exposure²² and sleep²³ and add to the extensive body of evidence around the importance of family literacy behaviors.^{24,25} Approximately half of all children exceeded recommended media guidelines and were not read to or sung or told stories every day, indicating additional opportunities to promote school readiness. Health and social service providers, through evidence-based programs such as Reach Out and Read,²⁶ can meaningfully engage parents or caregivers in the development and implementation of simple, yet effective, behaviors to bolster young children’s development and readiness to learn.^{1,7} Additionally, preventive interventions might include 2-generation approaches, or multidimensional interventions that address the larger home environment inclusive of multiple health and development promoting behaviors,

eg, a reduction in family screen time coupled with an increase in shared literacy-building activities or reading as part of a healthy sleep routine. Of note, the NSCH does not distinguish between different types of media exposure and some forms of media use can be positive for even very young children, including the use of video chat functions to maintain important family connections and shared use with adults.²⁷ More research is needed on the interactions among these behaviors and the relative impact of improving individual versus groups of behaviors within the home, family, and community.^{5,28}

Results for CSHCN were troubling, albeit, perhaps not surprising given the wide range of conditions and impacts affecting this population.¹ The similar patterns for children with greater service utilization needs and those with functional limitations is consistent with previous research which has found these populations, despite important differences, to be qualitatively similar with respect to the presence of developmental conditions such as speech and learning disabilities which can impact the acquisition of the skills and competencies assessed here.²⁹ Although it may be expected for some CSHCN to be identified as needing support, the observed disparities across all 4 domains indicate a need to determine whether these children and their caregivers are receiving appropriate supports to promote development across a range of skills and competencies. Further work is needed across a spectrum of conditions and comorbidities to identify early interventions that may be most effective in preparing this heterogeneous population for school entry and success.

Poorer caregiver mental health, with approximately 20% of parents indicating less than excellent or very good mental health, was strikingly and consistently associated with a lower likelihood of being “On-Track” across each of the pilot measures. Research has described both direct, eg, engagement and literacy building activities like reading and talking, and indirect pathways, eg, negative affect, suboptimal bonding, and poor parenting behaviors, through which caregiver mental health can affect child development.^{30,31} The 2016 AAP policy statement³² on the role of pediatric practitioners in screening and identifying perinatal depression provides an important call to action and highlights opportunities to maximize the impact of the medical home model—including the practice of family-centered care—toward improved identification and treatment. Further, programs such as the Maternal, Infant, and Early Childhood Home Visiting Program³³ are well-poised to provide evidence-based services to at-risk pregnant women and families including screening and referral for mental health services.

The association between ACEs and a lower likelihood of school readiness observed in this study is consistent with previous work linking early adversity to a host of lifelong and multigenerational negative outcomes.³⁴⁻³⁸ An effort to translate the extensive body of research around the nature, scope and impact of multiple forms of early adversity into an agenda for action was recently undertaken.³⁹ This effort yielded recommendations for future action including the translation of this evidence into trauma-informed clinical practices⁴⁰ for implementation within appropriately equipped health care settings, such as the medical home, and the application of necessary coverage and payment approaches to support attendant practice innovations. Taken a step further, Traub and Boynton-Jarrett (2017) argue that in addition to acknowledging the role of adversity in their practice, pediatric healthcare providers are also uniquely positioned—through practices ranging from

integration of behavioral health care to parenting support groups—to foster resilience among children and families as a critical tool in mitigating the effects of past, present and future adversity.⁴¹ Finally, neighborhood supports and amenities, which we found to promote school readiness, may also help to mitigate the impact of ACEs.^{42,43}

Our study has limitations. All NSCH data are parent-reported and may be subject to both recall and/or reporting bias associated with either social desirability or a lack of familiarity with the kinds of competencies being assessed. The child’s primary language (if discordant from the primary household language) and presence of selected conditions, eg, hearing or vision difficulties, could also impact attainment of the skills and competencies assessed. The survey, while expansive in many areas, does lack data on selected exposures, eg, child abuse and neglect, that could have impacted these results. The weighted response rate for the survey was 40.7%, which may have resulted in nonresponse bias; however, nonresponse bias analyses indicated that the application of survey weights attenuated resulting bias.⁴⁴ Although there were few state-level differences, the majority of states had imprecise confidence intervals exceeding 20 percentage points, highlighting a need for future multi-year exploration of state differences. Because age-specific standards were applied to the calculation of each measure, we did not expect to see significant differences in the proportion of children “On-Track” by age. Observed differences may suggest measurement issues related to scoring and/or a lack of items that are suitably discriminant for all age groups given that it was comparatively easier for 3- and 5-year-old children to meet the threshold for “On-Track” than for 4-year-old children. Important work remains to continue to assess and validate both the individual survey items and the proposed summary measures as well as to re-estimate domain and summary measures using additional data from subsequent surveys.

The current study provides a preliminary national picture of school readiness and correlates among US children ages 3-5 years. These findings highlight multiple, modifiable factors for future investigation regarding their potential impact on young children’s holistic readiness to succeed in school, via population-level approaches and/or actions by families, providers, and communities to take small, measurable steps towards improvements overall and across individual domains. Future work to refine items used to assess “Healthy and Ready to Learn” and validate the pilot measures at the population-level and for key subgroups of children will increase the value of these data for research, policy and practice. Finally, future multiyear estimates will permit more nuanced analyses of state-level differences.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What's New

Until recently, significant barriers to assessing school readiness at a population level have existed. This study provides national and state prevalence estimates of being “Healthy and Ready to Learn” among US preschoolers and associated sociodemographic, health, family and neighborhood factors.

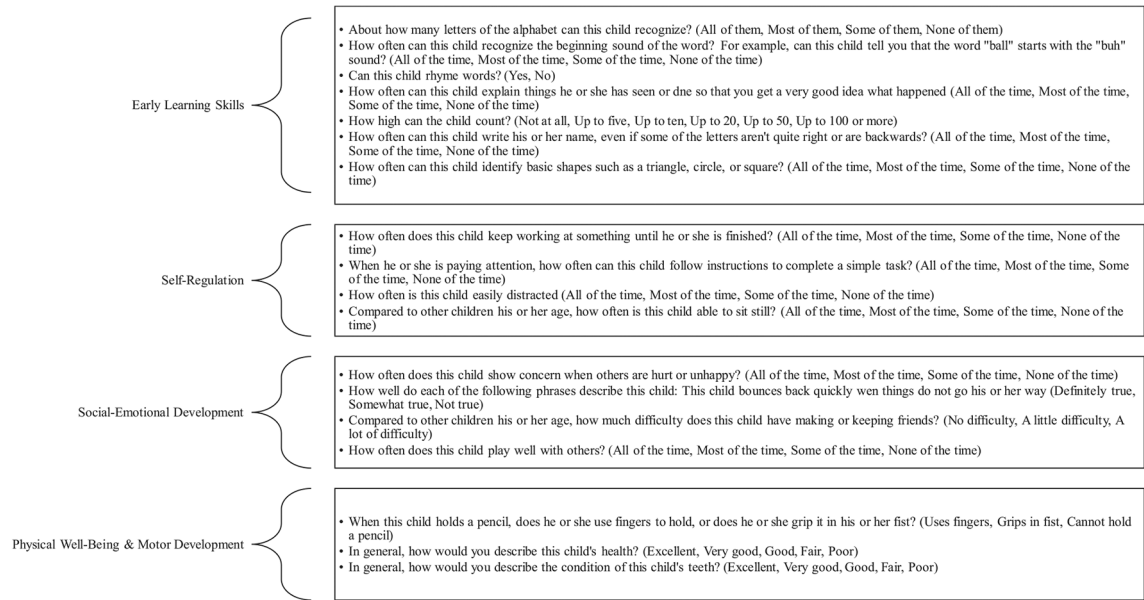


Figure 1. Survey items utilized to assess domain-specific components of “Healthy and Ready to Learn” pilot measure, National Survey of Children’s Health, 2016.

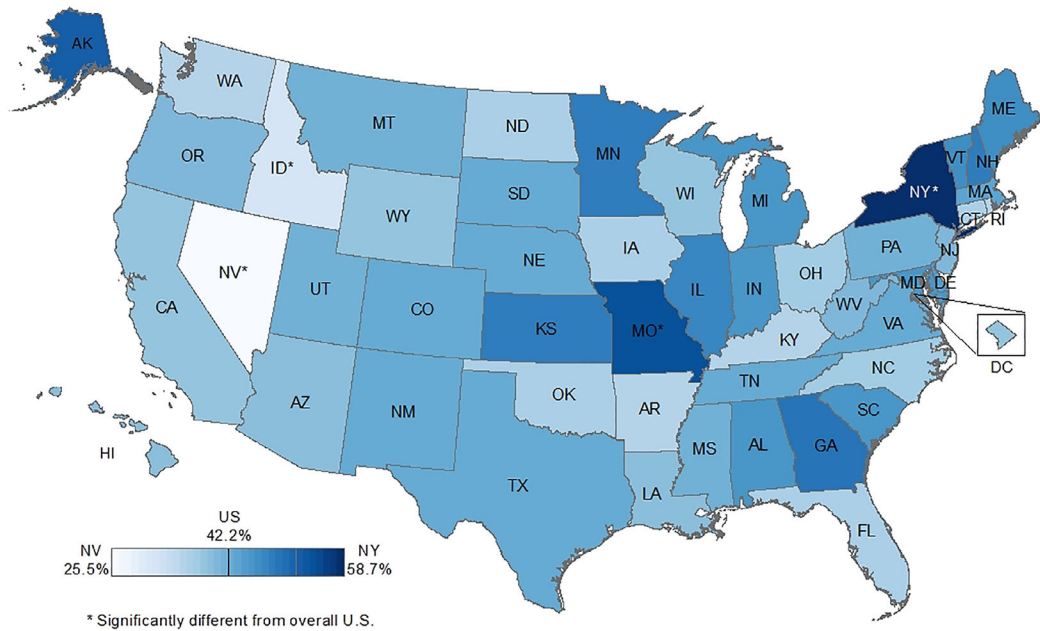


Figure 2. Prevalence of U.S. children ages 3 to 5 years rated "On-track" for "Healthy and Ready to Learn" pilot measure, National Survey of Children's Health, 2016.

Table 1. Proportion of U.S. Children Ages 3 to 5 Years Rated "On-Track," "Needs Support," and "At Risk" for "Healthy and Ready to Learn" Pilot Summary and Domain-Specific Measures, National Survey of Children's Health, 2016

	Overall School Readiness* (n = 7563)		Early Learning Skills (n = 7375)		Social Emotional Development (n = 7560)		Self-Regulation (n = 7379)		Physical Health & Motor Development (n = 7562)	
	Percent	(95% CI)	Percent	(95% CI)	Percent	(95% CI)	Percent	(95% CI)	Percent	(95% CI)
On-track	42.2	(39.9–44.6)	58.4	(56.0–60.7)	81.4	(79.4–83.3)	78.3	(76.2–80.2)	85.5	(83.5–87.3)
Needs support	48.4	(46.0–50.7)	32.7	(30.6–35.0)	16.8	(15.1–18.6)	18.7	(16.9–20.6)	12.2	(10.8–13.9)
At-risk	9.4	(8.1–10.9)	8.9	(7.5–10.4)	1.8	(1.1–2.9)	3.0	(2.1–4.3)	2.2	(1.3–3.9)

CI indicates confidence interval.

* Defined as at-risk if "on-track" in zero or one domain, needs support if "on-track" in 2 or 3 domains, and on-track if "on-track" in all 4 domains.

Table 2. Proportion of U.S. Children Ages 3 to 5 Years Rated "On-Track" for "Healthy and Ready to Learn" Pilot Summary and Domain-Specific Measures by Sociodemographic, Health, and Family Neighborhood Characteristics, National Survey of Children's Health, 2016

	Sample Distributi (n = 7565) Percent [‡]	Overall School Readiness* (n = 7563)			Early Learning Skills (n = 7375)			Social Emotional Development (n = 7560)			Self-Regulation (n = 7379)			Physical Health & Motor Development (n = 7562)		
		Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]
Total	100	42.2	(39.9– 44.6)	.03	58.4	(56.0– 60.7)	.28	81.4	(79.4– 83.3)	.08	78.3	(76.2– 80.2)	.00	85.5	(83.5– 87.3)	.10
Weighted population size	12.0 million	5.1 million			6.8 million			9.8 million			9.1 million			10.3 million		
Sociodemographic characteristics																
Sex				.03			.28			.08			.00			.10
Male	50.9	39.8	(36.4– 43.3)		57.1	(53.7– 60.5)		79.8	(76.8– 82.4)		74.0	(70.8– 77.1)		83.9	(80.8– 86.6)	
Female	49.1	44.8	(41.7– 48.0)		59.7	(56.4– 63.0)		83.2	(80.3– 85.7)		82.6	(80.0– 85.0)		87.2	(84.5– 89.4)	
Age				.00			.00			.68			.01			.04
3 Years	33.2	42.2	(38.3– 46.1)		58.5	(54.3– 62.5)		82.4	(79.0– 85.3)		74.1	(70.2– 77.7)		87.6	(84.2– 90.4)	
4 Years	34.0	36.4	(32.6– 40.4)		50.3	(46.1– 54.5)		81.5	(77.6– 84.9)		79.2	(75.4– 82.4)		87.2	(84.0– 89.8)	
5 years	32.8	48.3	(44.1– 52.5)		67.0	(63.1– 70.7)		80.4	(77.0– 83.4)		81.6	(78.1– 84.6)		81.7	(77.5– 85.2)	
Race/ethnicity				.12			.09			.01			.02			.00
White, non- Hispanic	52.6	45.4	(42.9– 47.8)		59.3	(56.8– 61.8)		84.3	(82.3– 86.1)		81.4	(79.3– 83.2)		89.2	(87.4– 90.8)	
Black, non- Hispanic	12.2	40.6	(33.4– 48.3)		59.6	(51.5– 67.3)		79.6	(71.9– 85.6)		70.8	(62.3– 78.1)		80.0	(71.8– 86.2)	
Hispanic	23.3	36.3	(29.6– 43.5)		53.8	(46.8– 60.6)		77.6	(71.5– 82.8)		76.4	(70.0– 81.7)		81.8	(75.6– 86.7)	
Asian, non- Hispanic	5.1	42.7	(34.2– 51.6)		68.7	(60.1– 76.2)		73.5	(65.6– 80.1)		75.5	(67.3– 82.2)		80.7	(71.4– 87.5)	
Other/multiple race, non-Hispanic	6.9	41.1	(34.6– 47.9)		56.6	(49.4– 63.5)		81.6	(75.3– 86.6)		75.8	(69.9– 80.8)		83.5	(77.0– 88.5)	
Primary household language				.08			.54			.02			.24			.07

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	Sample Distributi (n = 7565) Percent [‡]	Overall School Readiness* (n = 7563)			Early Learning Skills (n = 7375)			Social Emotional Development (n = 7560)			Self-Regulation (n = 7379)			Physical Health & Motor Development (n = 7562)		
		Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]
English	86.9	43.4	(41.2– 45.7)	.00	58.8	(56.4– 61.1)	.00	82.8	(80.9– 84.6)	.06	79.1	(77.0– 81.0)	.00	86.6	(84.6– 88.3)	.00
Non-English	13.1	34.3	(25.0– 45.0)	.00	55.8	(46.4– 64.8)	.00	72.9	(63.9– 80.4)	.00	73.8	(64.5– 81.3)	.00	79.1	(70.3– 85.8)	.00
Family structure																
2 parents, married	68.1	46.5	(43.9– 49.2)	.00	61.5	(58.9– 64.0)	.00	83.5	(81.4– 85.4)	.00	82.2	(80.1– 84.1)	.00	90.4	(88.7– 91.8)	.00
2 parents, unmarried	9.7	31.9	(25.6– 39.1)	.00	50.8	(42.4– 59.2)	.00	76.3	(67.1– 83.6)	.00	64.6	(55.2– 73.1)	.00	84.9	(78.9– 89.5)	.00
Single mother	12.9	37.2	(30.4– 44.5)	.00	56.3	(49.1– 63.3)	.00	80.3	(75.1– 84.7)	.00	74.6	(68.4– 79.9)	.00	76.2	(68.9– 82.2)	.00
Other	9.3	26.8	(19.9– 35.0)	.00	44.8	(35.8– 54.3)	.00	72.5	(62.0– 81.0)	.00	68.6	(58.1– 77.5)	.00	65.5	(54.0– 75.4)	.00
Household income-to-poverty ratio, % Federal Poverty Level (FPL)																
<100% FPL	19.6	32.4	(25.7– 39.9)	.00	50.7	(44.0– 57.3)	.00	70.7	(63.3– 77.1)	.01	69.3	(62.7– 75.2)	.00	75.1	(68.9– 80.5)	.00
100%–199% FPL	20.9	37.4	(31.1– 44.1)	.00	53.0	(46.5– 59.4)	.00	84.3	(79.2– 88.2)	.00	73.8	(66.8– 79.7)	.00	83.4	(76.9– 88.3)	.00
200%–399% FPL	30.0	42.4	(38.0– 46.9)	.00	56.7	(52.3– 61.0)	.00	82.4	(76.8– 86.9)	.00	81.1	(76.3– 85.1)	.00	88.3	(84.4– 91.3)	.00
400% FPL	29.5	52.1	(48.4– 55.7)	.00	68.9	(65.5– 72.0)	.00	85.7	(82.4– 88.5)	.00	84.2	(80.8– 87.2)	.00	91.1	(88.0– 93.5)	.00
Household educational attainment																
High school/General Educational Development (GED) test	24.0	32.4	(26.1– 39.5)	.00	48.9	(42.3– 55.5)	.00	75.3	(69.4– 80.3)	.00	70.1	(63.9– 75.6)	.00	76.1	(70.1– 81.3)	.00
Some college/associate's degree	22.5	33.4	(28.9– 38.1)	.00	49.8	(44.5– 55.2)	.00	82.6	(77.9– 86.5)	.00	74.4	(69.1– 79.0)	.00	83.9	(79.0– 87.8)	.00
Bachelor's degree	53.5	50.3	(47.8– 52.9)	.00	65.8	(63.3– 68.3)	.00	84.2	(82.1– 86.1)	.00	83.4	(81.5– 85.2)	.00	91.1	(89.2– 92.6)	.00

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Health Characteristics	Sample Distributi (n = 7565)	Overall School Readiness* (n = 7563)			Early Learning Skills (n = 7375)			Social Emotional Development (n = 7560)			Self-Regulation (n = 7379)			Physical Health & Motor Development (n = 7562)		
		Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]
Special health care needs status and type				.00			.00			.00			.00			.00
No special health care need (SHCN)	85.4	46.4	(43.8–48.9)		61.7	(59.2–64.1)		85.3	(83.4–87.1)		82.4	(80.4–84.2)		89.3	(87.6–90.9)	
SHCN, prescription medication need/use only	3.7	38.8	(31.4–46.7)		64.2	(56.3–71.4)		87.1	(80.9–91.4)		73.7	(66.0–80.2)		79.4	(70.8–86.0)	
SHCN, elevated service need/use only	2.9	12.9	(8.1–19.9)		37.1	(26.1–49.6)		46.8	(35.6–58.2)		50.8	(39.1–62.4)		65.2	(51.8–76.5)	
SHCN, elevated service need/use and prescription medication need/use [‡]	3.0	18.2	(11.4–27.8)		42.6	(29.2–57.2)		66.3	(50.1–79.3)		69.7	(53.5–82.1)		67.7	(51.8–80.4)	
SHCN, functional limitations	5.0	5.6	(3.1–9.8)		17.6	(10.8–27.4)		40.0	(26.1–55.7)		29.2	(20.4–39.9)		47.8	(33.9–62.1)	
Parental mental health [§]				.00			.00			.00			.00			.00
Excellent or very good	79.1	46.3	(43.7–49.0)		62.3	(59.7–64.9)		84.8	(82.7–86.6)		81.6	(79.4–83.6)		89.1	(87.3–90.8)	
Good	16.8	28.8	(23.8–34.4)		44.8	(38.9–50.9)		71.5	(64.9–77.3)		68.6	(62.2–74.4)		72.5	(65.1–78.8)	
Fair or Poor	4.1	17.0	(11.6–24.3)		33.4	(25.3–42.5)		63.5	(52.9–73.0)		52.5	(42.0–62.8)		73.0	(62.6–81.3)	
Family and neighborhood characteristics				.00			.00			.19			.00			.00
Screen time (avg. weekday)																
1 hour	22.3	51.7	(47.2–56.2)		64.1	(59.4–68.5)		83.7	(80.1–86.7)		82.6	(78.7–85.9)		89.7	(86.3–92.4)	
1.1–2 hours	28.6	48.3	(44.1–52.5)		64.2	(60.1–68.1)		83.0	(78.9–86.4)		83.6	(80.3–86.4)		90.8	(88.3–92.9)	

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	Sample Distributi (n = 7565) Percent [‡]	Overall School Readiness* (n = 7563)			Early Learning Skills (n = 7375)			Social Emotional Development (n = 7560)			Self-Regulation (n = 7379)			Physical Health & Motor Development (n = 7562)		
		Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]
>2 hours	49.2	34.2	(30.8– 37.8)	.00	52.5	(48.9– 56.1)	.06	79.9	(76.8– 82.6)	.00	73.3	(69.8– 76.4)	.00	80.5	(77.0– 83.6)	.00
Hours of sleep (avg. weeknight)																
7 hours	2.4	15.6	(7.7– 28.8)	.00	32.3	(18.3– 50.3)	.00	39.9	(24.6– 57.4)	.00	38.2	(22.6– 56.8)	.00	50.1	(31.4– 68.8)	.00
8–9 hours	32.9	41.0	(36.1– 46.0)	.00	60.3	(55.6– 64.9)	.00	80.0	(75.9– 83.5)	.00	76.4	(72.2– 80.1)	.00	82.7	(79.2– 85.8)	.00
10 hours	64.7	43.7	(41.1– 46.2)	.00	58.2	(55.5– 60.8)	.00	84.0	(81.9– 85.9)	.00	80.8	(78.5– 82.9)	.00	88.3	(85.9– 90.3)	.00
Number of days read to/sung or told stories to (past week)																
Either/both 0–3 days	28.2	30.7	(26.2– 35.6)	.00	48.4	(43.1– 53.7)	.00	78.5	(74.0– 82.4)	.00	75.0	(70.1– 79.2)	.00	82.1	(78.1– 85.5)	.00
Either 4–6 days	22.9	40.9	(36.1– 45.9)	.00	54.8	(50.1– 59.4)	.00	82.2	(78.0– 85.8)	.00	78.2	(73.9– 82.0)	.00	87.0	(82.7– 90.3)	.00
Either everyday	21.7	46.3	(41.8– 50.9)	.00	62.5	(58.2– 66.6)	.00	82.6	(79.0– 85.7)	.00	82.3	(79.0– 85.2)	.00	86.9	(83.7– 89.6)	.00
Both everyday	27.1	52.3	(48.1– 56.5)	.00	68.7	(64.4– 72.8)	.00	83.1	(79.0– 86.5)	.00	78.9	(74.7– 82.6)	.00	88.2	(84.0– 91.4)	.00
Adverse childhood experiences (ACEs) [¶]																
No ACEs	60.5	48.8	(46.1– 51.5)	.00	64.3	(61.6– 66.8)	.00	84.0	(81.6– 86.2)	.00	84.4	(82.3– 86.3)	.00	91.1	(89.3– 92.6)	.00
1 ACE	23.7	39.8	(34.1– 45.8)	.00	57.1	(51.4– 62.5)	.00	81.6	(77.6– 85.1)	.00	74.9	(69.9– 79.3)	.00	81.9	(77.5– 85.6)	.00
2 or more ACEs	15.8	20.2	(16.1– 25.1)	.00	36.8	(30.7– 43.2)	.00	71.5	(64.6– 77.5)	.00	58.7	(51.5– 65.5)	.00	69.9	(61.9– 76.9)	.00
Presence of neighborhood amenities [#]																
0–1 amenities	19.9	34.0	(29.8– 38.5)	.00	50.4	(45.3– 55.6)	.00	79.8	(75.7– 83.4)	.00	73.4	(68.4– 79.9)	.00	80.5	(75.2– 84.9)	.00

Sample Distributi (n = 7565)	Overall School Readiness* (n = 7563)			Early Learning Skills (n = 7375)			Social Emotional Development (n = 7560)			Self-Regulation (n = 7379)			Physical Health & Motor Development (n = 7562)		
	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]	Percent [‡]	(95% CI) [‡]	P Value [‡]
2-3 amenities	38.2	41.8	(38.1– 45.7)	57.6	(53.9– 61.2)		80.5	(76.7– 83.8)		76.6	(73.0– 9.8)		86.7	(83.6– 89.3)	
4 amenities	41.9	46.6	(42.8– 50.5)	62.9	(59.0– 66.7)		83.5	(80.6– 86.1)		81.8	(78.6– 84.6)		87.2	(83.9– 89.9)	

CI indicates confidence interval.

* Defined as at-risk if "on-track" in zero or one domain, needs support if "on-track" in 2 or 3 domains, and on-track if "on-track" in all 4 domains.

[‡] Percentages are weighted in the table.

[‡] Determined by the chi-square test for independence.

[§] Mental health status of survey respondent.

// Includes watching TV, videos, or playing video games, utilizing a computer, cell phone or other electronic device not for school).

[#] Includes caregiver divorce/separation, caregiver death, caregiver incarceration, witness of domestic violence, victim of violence or witnessed neighborhood violence, mentally ill household member, substance abusing household member, unfair treatment based on race/ethnicity.

[#] Includes presence of sidewalks or walking paths, park or playground, recreation/community center or boys/girls club, or library or book mobile.

Adjusted Associations With "Healthy and Ready to Learn" Pilot Summary and Domain-Specific Measures, National Survey of Children's Health, 2016

Table 3.

	Overall School Readiness* (n = 7247)		Early Learning Skills (n = 7093)		Social Emotional Development (n = 7246)		Self-Regulation (n = 7100)		Physical Health & Motor Development (n = 7247)	
	aRR	(95% CI)	aRR	(95% CI)	aRR	(95% CI)	aRR	(95% CI)	aRR	(95% CI)
Sociodemographic characteristics										
Sex										
Male	Ref		Ref		Ref		Ref		Ref	
Female	1.08	(0.98–1.19)	1.02	(0.95–1.09)	1.03	(0.99–1.07)	1.09	(1.05–1.14)	1.01	(0.97–1.05)
Age										
3 Years	Ref		Ref		Ref		Ref		Ref	
4 Years	0.84	(0.73–0.95)	0.84	(0.76–0.92)	0.99	(0.95–1.04)	1.06	(1.01–1.12)	1.00	(0.96–1.04)
5 years	1.19	(1.06–1.35)	1.15	(1.06–1.25)	0.99	(0.94–1.04)	1.11	(1.05–1.17)	0.96	(0.91–1.00)
Race/ethnicity										
White, non-Hispanic	Ref		Ref		Ref		Ref		Ref	
Black, non-Hispanic	1.05	(0.88–1.25)	1.07	(0.95–1.21)	0.97	(0.89–1.05)	0.94	(0.86–1.03)	0.97	(0.90–1.03)
Hispanic	1.02	(0.88–1.19)	1.00	(0.89–1.13)	1.00	(0.94–1.06)	1.01	(0.95–1.08)	1.01	(0.96–1.07)
Asian, non-Hispanic	1.01	(0.80–1.27)	1.11	(0.95–1.29)	0.94	(0.85–1.05)	0.91	(0.81–1.02)	0.92	(0.83–1.01)
Other/Multiple race, non-Hispanic	1.04	(0.88–1.22)	1.04	(0.92–1.18)	1.01	(0.94–1.08)	0.97	(0.90–1.04)	0.97	(0.91–1.03)
Primary household language										
English	Ref		Ref		Ref		Ref		Ref	
Non-English	0.83	(0.64–1.07)	0.98	(0.83–1.15)	0.89	(0.81–0.99)	0.91	(0.80–1.02)	0.94	(0.87–1.02)
Family structure										
2 parents, married	Ref		Ref		Ref		Ref		Ref	
2 parents, unmarried	0.93	(0.77–1.13)	1.03	(0.89–1.19)	0.99	(0.90–1.09)	0.93	(0.83–1.04)	1.01	(0.95–1.07)
Single mother	1.04	(0.87–1.25)	1.06	(0.93–1.20)	1.05	(0.99–1.12)	1.05	(0.99–1.12)	0.93	(0.87–1.00)
Other	0.90	(0.71–1.13)	0.91	(0.77–1.09)	1.00	(0.91–1.09)	1.02	(0.94–1.11)	0.91	(0.84–0.99)
Household income-to-poverty ratio, % Federal Poverty Level (FPL)										
<100% FPL	0.96	(0.78–1.18)	0.92	(0.80–1.07)	0.90	(0.81–0.99)	0.98	(0.87–1.10)	0.99	(0.93–1.07)
100%–199% FPL	1.03	(0.88–1.20)	0.96	(0.85–1.07)	1.03	(0.97–1.10)	1.01	(0.93–1.10)	1.04	(0.98–1.11)
200%–399% FPL	0.95	(0.84–1.08)	0.91	(0.83–0.99)	0.98	(0.92–1.05)	1.02	(0.95–1.09)	1.02	(0.97–1.07)

	Overall School Readiness* (n = 7247)			Early Learning Skills (n = 7093)			Social Emotional Development (n = 7246)			Self-Regulation (n = 7100)			Physical Health & Motor Development (n = 7247)		
	aRR	(95% CI)	aRR	(95% CI)	aRR	(95% CI)	aRR	(95% CI)	aRR	(95% CI)	aRR	(95% CI)	aRR	(95% CI)	
400% FPL	Ref		Ref		Ref		Ref		Ref		Ref		Ref		
Household educational attainment															
High school/General Educational Development (GED) test	0.86	(0.73–1.03)	0.89	(0.78–1.01)	1.00	(0.93–1.07)	0.96	(0.89–1.04)	0.94	(0.88–1.00)					
Some college/associate's degree	0.82	(0.72–0.95)	0.87	(0.79–0.97)	1.04	(0.99–1.09)	0.98	(0.92–1.04)	0.99	(0.94–1.03)					
Bachelor's degree	Ref		Ref		Ref		Ref		Ref						
Health characteristics															
Special health care needs status and type															
No special health care need (SHCN)	Ref		Ref		Ref		Ref		Ref		Ref		Ref		
SHCN, prescription medication need/use only	0.89	(0.74–1.07)	1.11	(0.99–1.24)	1.03	(0.97–1.09)	0.95	(0.87–1.03)	0.91	(0.84–1.00)					
SHCN, elevated service need/use only	0.33	(0.21–0.51)	0.65	(0.50–0.84)	0.60	(0.48–0.74)	0.68	(0.56–0.82)	0.77	(0.66–0.90)					
SHCN, elevated service need/use + prescription medication need/use	0.54	(0.37–0.79)	0.78	(0.60–1.00)	0.86	(0.74–1.01)	0.93	(0.79–1.09)	0.87	(0.76–1.00)					
SHCN, functional limitations	0.19	(0.11–0.32)	0.28	(0.19–0.42)	0.52	(0.40–0.67)	0.49	(0.39–0.61)	0.71	(0.59–0.86)					
Parental mental health [†]															
Excellent or very good	Ref		Ref		Ref		Ref		Ref		Ref		Ref		
Good	0.80	(0.69–0.93)	0.81	(0.73–0.91)	0.89	(0.83–0.95)	0.93	(0.87–0.99)	0.91	(0.87–0.96)					
Fair or Poor	0.61	(0.45–0.83)	0.75	(0.61–0.92)	0.88	(0.79–1.00)	0.86	(0.76–0.98)	0.94	(0.86–1.03)					
Family and neighborhood characteristics															
Screen TIME (avg. weekday) [‡]															
1 hour	Ref		Ref		Ref		Ref		Ref		Ref		Ref		
2 hours	0.98	(0.88–1.09)	1.03	(0.95–1.12)	0.98	(0.93–1.04)	1.01	(0.95–1.07)	1.02	(0.98–1.07)					
>2 hours	0.80	(0.71–0.90)	0.91	(0.83–0.99)	1.00	(0.95–1.05)	0.95	(0.90–1.01)	0.97	(0.93–1.02)					
Hours of sleep (avg. weeknight)															
7 hours	Ref		Ref		Ref		Ref		Ref		Ref		Ref		
8–9 hours	1.13	(0.78–1.63)	1.16	(0.93–1.46)	1.21	(1.02–1.43)	1.13	(0.95–1.35)	1.10	(0.97–1.24)					
10 hours	1.04	(0.73–1.49)	1.02	(0.81–1.28)	1.23	(1.03–1.46)	1.15	(0.97–1.38)	1.11	(0.98–1.25)					
Number of days read to/sung to or told stories (past week)															
Either/both 0–3 days	Ref		Ref		Ref		Ref		Ref		Ref		Ref		

	Overall School Readiness* (n = 7247)		Early Learning Skills (n = 7093)		Social Emotional Development (n = 7246)		Self-Regulation (n = 7100)		Physical Health & Motor Development (n = 7247)	
	aRR	(95% CI)	aRR	(95% CI)	aRR	(95% CI)	aRR	(95% CI)	aRR	(95% CI)
Either/both 4–6 days	1.18	(0.99–1.41)	1.14	(1.01–1.30)	1.00	(0.94–1.07)	1.00	(0.93–1.07)	0.99	(0.94–1.05)
Either but not both everyday	1.29	(1.10–1.51)	1.28	(1.14–1.43)	1.00	(0.94–1.06)	1.05	(0.99–1.11)	1.00	(0.95–1.06)
Both everyday	1.50	(1.29–1.75)	1.42	(1.28–1.59)	1.04	(0.98–1.09)	1.00	(0.94–1.07)	1.02	(0.98–1.07)
Adverse childhood experiences (ACEs)										
No ACEs	Ref		Ref		Ref		Ref		Ref	
1 ACE	0.94	(0.81–1.10)	1.00	(0.91–1.10)	1.01	(0.95–1.07)	0.94	(0.89–1.00)	0.94	(0.90–0.99)
2 or more ACEs	0.66	(0.52–0.83)	0.80	(0.68–0.95)	0.94	(0.86–1.03)	0.81	(0.73–0.91)	0.95	(0.89–1.01)
Presence of neighborhood amenities [§]										
0–1 amenities	Ref		Ref		Ref		Ref		Ref	
2–3 amenities	1.14	(1.00–1.30)	1.08	(0.98–1.19)	1.03	(0.98–1.09)	1.04	(0.98–1.10)	1.06	(1.00–1.12)
4 amenities	1.21	(1.05–1.39)	1.12	(1.01–1.24)	1.04	(0.99–1.11)	1.06	(0.99–1.13)	1.06	(1.00–1.13)

aRR indicates adjusted risk ratio; CI, confidence interval.

Statistically significant associations are **bolded**. Each model adjusted for all sociodemographic, health and family and neighborhood characteristics as determined by the chi-square test independence.

* Defined as at-risk if "on-track" in zero or one domain, needs support if "on-track" in 2 or 3 domains, and on-track if "on-track" in all 4 domains.

[†] Mental health status of survey respondent.

[‡] Includes watching TV, videos, or playing video games; utilizing a computer, cell phone or other electronic device not for school).

[§] Includes presence of sidewalks or walking paths, park or playground, recreation/community center or boys/girls club, or library or book mobile.