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Factors Associated with Self-regulation in a Nationally Representative Sample of Children Ages 3–5 Years: United States, 2016

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Abstract

Objective—The aim of the present study was to describe self-regulation (the ability to influence or control one's thoughts or behavior in response to situational demands and social norms) in children ages 3–5 years using a nationally representative sample and examine risk and protective factors to identify opportunities to support children and families.

Methods—Using a cross-sectional design, we examined data from a parent-reported pilot measure of self-regulation from the 2016 National Survey of Children's Health (NSCH). We compared U.S. children aged 3–5 years who were described by parents as "on track" with self-regulation development with children who were not. In addition, we described how health care and developmental services, community, family, and child health and development factors are associated with children's self-regulation.

Results—The majority of children (4 of 5) were described by their parents to be developmentally on track with self-regulation. Compared to children described as not on track, children described as on track more often lived in financially and socially advantaged environments and less often experienced family adversity. They also had other positive health and development indicators, whether or not they were receiving developmental services. However, only half of children not on

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track received developmental surveillance, and only 1 in 4 children described as not on track received educational, mental health, or developmental services.

Conclusion—The findings are a step towards using self-regulation as an indicator of healthy child development and as a potential strategy to identify groups of children who may need additional support.

Keywords

Self-regulation; Child health and development; National Survey of Children's Health; National and state estimates

Introduction

Self-regulation, the ability to influence or control one's thoughts or behavior in response to situational demands and social norms, is part of higher-level executive functions that develop rapidly in early childhood (McClelland et al. 2018; Murray et al. 2015). Self-regulation is influenced by genetics, relationships, and experiences (Bernier et al. 2010; Blair and Raver 2016; Eisenberg et al. 2010; Evans and Kim 2013; Murray et al. 2015). While coping with challenges can support the development of self-regulation, prolonged or pronounced stress and adversity can disrupt self-regulation and result in long-term negative effects on development (Evans and Kim 2013; Murray et al. 2015). Early exposure to certain community, family, and individual stressors such as neighborhood disadvantage, food insecurity, poverty, poor parental mental health, and maltreatment has been linked to poor self-regulation (American Academy of Pediatrics Council on Community Pediatrics 2016; Blair and Raver 2016; Hamoudi et al. 2015). Poor self-regulation can present in children with identified conditions and disorders, e.g., attention-deficit/hyperactivity disorder (ADHD) or autism spectrum disorder (Ros and Graziano 2019). However, children may also have poor self-regulation without meeting criteria for a diagnosis.

Because it represents a period of rapid brain development, early childhood is a particularly important phase for the development of self-regulation skills (Eisenberg et al. 2010; Hamoudi et al. 2015). Self-regulation is related and complementary to overall social-emotional and behavioral development (Eisenberg et al. 2010; Ghandour et al. 2019; McClelland et al. 2018). Skills related to regulating and controlling attention, behavior, and emotions start in infancy and can be described as self-regulation by age of 3 years (McClelland et al. 2018). Self-regulation in young children predicts later educational, occupational, and behavioral health outcomes e.g., socio-economic success, substance abuse, and physical health (Moffitt et al. 2011; Murray et al. 2015). Interventions focusing on social-emotional development can have a positive impact on the development of self-regulation and related outcomes (Blair and Diamond 2008; Blair and Raver 2016; Eisenberg et al. 2010; McClelland et al. 2018; Pandey et al. 2018). However, problems with self-regulation development may not be easily noticed in the general population of young children. Overall, developmental screening and developmental monitoring by pediatricians and childcare providers have increased over time (Lipkin and Macias 2020). But although screening guidelines include concerns about behavior and emotions, they do not specifically address self-regulation at this time (Lipkin and Macias 2020).

Although self-regulation has been studied for many years and has shown to predict long-term outcomes (Moffitt et al. 2011), prior research generally relied on studies that were not population-based and did not allow for a comprehensive assessment of a variety of population-based risk factors. Until recently, no nationally representative data on early self-regulation were available. The Health Resources and Services Administration's (HRSA) National Survey of Children's Health (NSCH) was redesigned in 2016 and included a pilot measure of parent-reported self-regulation for children ages 3–5 years. The resulting dataset allows the exploration of self-regulation and related factors among young children on a population level (Ghandour et al. 2019; Paschall et al. 2020). From a public health perspective, getting a national snapshot on self-regulation and understanding which children are on track with developing these essential skills and which children may be at risk can identify opportunities for providing further intervention and support for US children and families.

Methods

Sample

The present study used the 2016 NSCH, funded and directed by the HRSA's Maternal and Child Health Bureau and conducted by the U.S. Census Bureau in accordance with all applicable ethical, privacy, and confidentiality standards. The NSCH is an online and paper survey of parents (or guardians) who reported on one, randomly selected, target child aged 0–17 years per household (N = 50,212). The publicly available dataset did not contain personally identifying information. The survey is designed to be nationally representative. The survey procedures oversampled households flagged as having children under 18 years of age. Households with children with special health care needs and with children under 5 years were oversampled, allowing for robust data estimates; sample weights were developed to account for unequal probability of selection and for nonresponse (U.S. Census Bureau 2017). As described by Ghandour et al. (2018), the child-level weights allow for the calculation of estimates that can be generalized to the population of noninstitutionalized children nationally and in each state. To ensure that sociodemographic subgroups are appropriately represented in these estimates, the survey methods used post-stratification adjustment, or raking (Ghandour et al. 2018). The proportion of screened households known to contain a child that completed the child-specific questionnaire was 69.7%, and the overall weighted response rate was 40.7% (Ghandour et al. 2018). For children aged 3–5 years, parents or guardians were asked to report on early developmental skills, including self-regulation (Ghandour et al. 2019). The sample for the present study was restricted to respondents with valid data for any self-regulation items (n = 7379). The dataset was publicly available, was reviewed by the Census Disclosure Review Board before release, and did not contain personally identifiable information (U.S. Census Bureau 2018), thus, no additional institutional review was needed for the present paper. Additional information about the design and methodology for the NSCH is available elsewhere (Ghandour et al. 2018; U.S. Census Bureau 2018).

Measures

Self-regulation—Self-regulation was based on 4 indicators (task persistence, behavioral control, working memory, and attention regulation). The scale was part of a larger set of items to assess whether children are healthy and ready to learn. Item development and scoring of this pilot measure is described in detail by Ghandour et al. (2019). Preliminary information about the utility of the healthy and ready to learn measure as a population-based indicator show that it detects expected patterns of school readiness (Paschall et al. 2020). The domain of self-regulation was developed using confirmatory factor analyses. Self-regulation was originally hypothesized to be a sub-domain of social-emotional development but the results of the cluster analysis showed it to be complementary but distinct (Ghandour et al. 2019). Therefore, only the self-regulation items were included in the present study, as they were the measure of interest.

For the survey, parents used a 4-point scale to rate their child on the following questions: “How often is this child easily distracted?”, “Compared to other children his or her age, how often is this child able to sit still?” “How often does this child keep working at something until he or she is finished?” “When he or she is paying attention, how often can this child follow instructions to complete a simple task?” Response options included “all of the time, most of the time, some of the time, none of the time”. Cutoff determinations for being “on track” developed by Ghandour et al. (2019) were examined by age. Based on the data from the pilot studies, for the domain of self-regulation, the same scoring criteria were deemed appropriate for ages 3, 4, and 5. Children were assigned 2 points if parents responded with “all/most of the time” to the questions about task persistence, behavioral control, and working memory, 1 point for “some of the time”, and zero points for “none of the time”. For attention regulation (being easily distracted), the reverse was applied, with 2 points for “some/none of the time”, 1 point for “most of the time” and zero points for “all of the time”. Children were identified as on track with self-regulation if they had a sum of 7 or 8 points across the 4 scales. The original scoring used by Ghandour et al. (2019) differentiated children not on track as either “needs support” or “at-risk”. These categories were collapsed for the current report due to small cell sizes for the “at risk” category (18.7% as “needs support” compared to 3% as “at risk”, see Ghandour et al. 2019). A categorical rather than linear approach to examining self-regulation was used to allow for understanding the issues from a public health perspective; identifying a subset of children whose parents report that they, as a group, are not mastering the same skills as their peers, and may potentially have other risks that could benefit from additional support.

Contextual Factors—Parents also reported on other contextual factors for the child. See Table 1 for descriptions of the variables included. A composite for developmental services included behavioral and educational intervention and therapies. Healthcare factors included the receipt of any healthcare services in the past year, receipt of developmental surveillance from their healthcare provider (including monitoring and screening), having a medical home, and having adequate health insurance. Neighborhood characteristics included having available amenities, the neighborhood being in good condition, having a feeling of safety, and a having sense of community support. Family factors included adversity, such as poverty, food insecurity, financial difficulties with childcare, work being impacted by

childcare, parental mental and physical health, parental aggravation with the child, and the child's adverse life experiences. Positive factors included parental education, parental emotional support, parental coping, and family resilience.

Child characteristics included the child's overall health, number of emergency visits or hospitalizations, insufficient sleep, and suspension or expulsion from childcare. Parents reported whether a healthcare provider had ever told them their child had diagnosed conditions including mental, behavioral and developmental disorders such as internalizing or externalizing disorders, developmental or learning disabilities, or speech or other language disorders. Parents also reported on health conditions such as allergies, asthma, or heart conditions.

Analyses—Children on track were compared with children not on track on modifiable factors such as receiving developmental services, access to preventive health care, community characteristics, and exposure to protective and adverse family factors. Further, associations of self-regulation with child health and development factors were examined and replicated with only those children who were not receiving developmental services.

Analyses were conducted using SAS-callable SUDAAN version 11.0.1 (RTI International; Cary, NC). All analyses accounted for the 2016 NSCH complex survey design and the results reflect the application of sampling weights; weighted estimates represent noninstitutionalized children 3–5 years of age in the United States. Multiple imputation analytic procedures were incorporated for household poverty and parent's educational attainment, as directed in the 2016 NSCH methodology report (U.S. Census Bureau 2018). Wald Chi square tests were used to examine differences across sociodemographic factors. Prevalence estimates with Clopper–Pearson 95% confidence intervals (CI) and prevalence ratios (PR) with Wald 95% CI were calculated for on-track self-regulation in relation to child, family, and community factors.

Results

Nationwide, the overall proportion of children described as on track with self-regulation was 78.3% (CI 76.2–80.2). The prevalence among different states ranged from 65.6 to 89.0% (Fig. 1); however, in most states the proportion of children on track was not significantly different from the overall average for the nation.

Children described as on track with self-regulation less often received developmental services (6.2% vs 23%, PR = 0.27) and developmental surveillance (39.8% vs 50%, PR = 0.80) compared to children not on track (Table 2). Being on track with self-regulation was positively associated with having a medical home (54.5% vs 42.5%, PR = 1.28) and adequate insurance (91% vs 85.4%, PR = 1.07). Being on track had higher prevalences of living in neighborhoods with amenities (42.1% vs 33.8%, PR = 1.25), in good condition (76.7% vs 69%, PR = 1.11), and with social support systems (75.8% vs 60.9%, PR = 1.24). On-track self-regulation was associated with lower prevalences of family adversity such as poverty (36.5% vs 52%, PR = 0.70), food insecurity (26.8% vs 42.9%, PR = 0.62), financial difficulty with health care (10.5% vs 20%, PR = 0.52), and work being impacted by

childcare difficulties (4.6% vs 14.4%, PR = 0.32) or by the child's health (7.3% vs 17.3%, PR = 0.42). Parents also reported lower prevalence of fair or poor parental mental health (4.7% vs 13.9%, PR = 0.41) or physical health (7% vs 17.2%, PR = 0.41), and of adverse experiences for the child (35.4% vs 58.2%, PR = 0.61). On-track self-regulation was associated with higher prevalences of family protective factors such as parental emotional support (80.3% vs 73.5%, PR = 1.09), coping (69.3% vs 57.3%, PR = 1.21), and family resilience (88.2% vs 73.0%, PR = 1.21).

Self-regulation was significantly related to several other child development and health factors (Table 3). Compared to those children described as not on track, children on track for self-regulation had a lower prevalence of poor to good health ratings (4.7% vs 18.4% PR = 0.26), emergency room visits or hospitalizations (19.6% vs 33.8%, PR = 0.58), or insufficient sleep (33% vs 42.4%, PR = 0.78). They were less often suspended or expelled from childcare (0.6% vs 5.6%, PR = 0.10), or had parents who reported aggravation with the child (0.7% vs 8.1%, PR = 0.09). Compared to children not on track, a lower prevalence of children on track had any diagnoses or conditions (32.4% vs 59.2%, PR = 0.55). Differences were significant for mental, behavioral or developmental disorders (MBDDs, 8.8% vs 35.7%, PR = 0.25), including internalizing (0.6%, vs 5.1%, PR = 0.12), externalizing (1.6% vs 19.9%, PR = 0.08), developmental/learning disabilities (3.4% vs 22.7%, PR = 0.15), and speech/language disorders (65. % vs 23.3%, PR = 0.28). Compared to children not on track, a lower prevalence of children on track had physical health conditions such as allergies (18.1% vs 27.9%, PR = 0.65), asthma (7.6% vs 13.5%, PR = 0.56), and heart conditions (1.3% vs 5.0%, PR = 0.26).

When analyses were replicated for the subsample of children not receiving developmental services, prevalence ratios for most factors were very similar to the full sample, except for asthma, which was no longer significant (Table 4).

Discussion

The majority of U.S. children aged 3–5 years were described by their parents as developmentally on track with self-regulation. However, 1 in 5 young children (or an estimated 2.5 million young children nationwide) were described as not on track and thus at higher risk for poor outcomes, affecting individual and family health, well-being and communities (Eisenberg et al. 2010; Moffitt et al. 2011; Murray et al. 2015).

In this first nationally representative examination of self-regulation in young children, children on track more often had better health as rated by parents, and less often had emergency room visits. This finding suggests that self-regulation skills, along with other indicators of social-emotional health, may expand our understanding of young children's health to include components of children's behavioral development. Furthermore, poor self-regulation in childhood has been associated with suboptimal later educational, occupational, and social outcomes (McClelland and Cameron 2011; Moffitt et al. 2011; Murray et al. 2015).

The indicator used in this study is based on a composite of 4 parent-reported items. From a public health perspective, these pilot data may have utility for identifying groups of children who are on track versus children not on track who may be at risk for additional developmental challenges (Paschall et al. 2020). For an individual child, self-regulation represents a continuum of developmental skills (McClelland et al. 2018). The available data do not provide information about the clinical utility of this composite. A more in-depth assessment of self-regulation may be needed to examine the development of individual children (Paschall et al. 2020). However, the findings from this analysis are a step towards using self-regulation as a population-based indicator of groups of children who may need additional support.

Several healthcare, community, and family factors, including social determinants of health (SDOH; e.g., family income, food sufficiency, neighborhood condition) were significantly associated with self-regulation. Economic supports for parents and high-quality early childhood education and care have shown predictive associations with children's self-regulation and long-term health and academic and economic success (American Academy of Pediatrics Council on Community Pediatrics 2016; Blair and Raver 2016; Hahn et al. 2016; Hamoudi et al. 2015; Murray et al. 2015; Pandey et al. 2018). This finding suggests that wider dissemination of these supportive approaches may warrant further investigation as potentially promoting children's self-regulation on a population level (American Academy of Pediatrics Council on Community Pediatrics 2016). For children potentially at risk due to SDOH, screening for SDOH within healthcare settings can provide opportunities for early intervention and referral for more comprehensive community services (American Academy of Pediatrics Council on Community Pediatrics 2016). On the community level, high quality center-based early childhood education programs have strong evidence for increasing positive outcomes including self-regulation (standardized mean difference 0.21; Community Preventive Services Task Force 2015). Early childhood education professionals and healthcare providers can receive training on their role in supporting self-regulation (Rosanbalm and Murray 2017). In the context of early childhood education, specific curricula can be used as selective prevention to enhance self-regulation skills in preschool age children (McClelland et al. 2018; Ursache et al. 2012). Healthcare and early childhood providers can give information to parents about the importance of self-regulation and guidance on fostering it in children through positive, supportive parenting practices (Rosanbalm and Murray 2017). At the individual level, children who are not yet on track for self-regulation might benefit from receiving the type of evidence-based parent behavior therapy recommended for young children with ADHD (Wolraich et al. 2019), given the overlap between self-regulation indicators and symptoms of ADHD (Bailey et al., 2018). This type of intervention that focuses on positive, supportive parenting has been used preventively with children at risk for behavioral problems and can help strengthen parent's skills to support the child's social and emotional development (Piquero et al. 2016; Rosanbalm and Murray 2017; Tully and Hunt 2016).

The findings show that current practices used to identify children for services may not be capturing the majority of children in need of support for self-regulation. Although the NSCH does not specifically capture receipt of supports and/or services to promote self-regulation, it includes questions about developmental surveillance including screening and monitoring,

early intervention, and other services for MBDD. Only half of children who were not on track received any developmental surveillance that could facilitate access to such supports. Furthermore, only 1 in 4 not on track had received educational, mental health, or developmental services at the time of the survey. Although a more in-depth assessment would be needed to confirm this potential concern, these results suggest gaps in identifying children who need developmental supports, in referring them to services, and in families' ability to access needed services.

The increased prevalence of physical and developmental health concerns like MBDDs, allergies, asthma, sleep problems, or heart conditions among children not on track with self-regulation may point to a possible cumulative effect of physiological and psychological stressors (Evans and Kim 2013). Healthcare providers treating children with these health conditions could consider efforts to identify whether those children are on track with self-regulation, particularly if they are not receiving developmental services, or experience additional risk from SDOH (Bailey et al. 2018; McClelland et al. 2018).

The findings in this report are subject to several limitations. First, the data are based on parent report. Parents' perception of their child's development and report of diagnoses and conditions may be affected by recall error, interpretation of survey items, or social desirability. Second, the self-regulation index represents a pilot measure and must be interpreted with caution until further validation (Ghandour et al. 2019). Further, the designation 'not on track' represents increased risk, but is not diagnostic (Ghandour et al. 2019). Third, parent-reported self-regulation may be influenced by the parent's mental health and the parent–child relationship and may not reflect the child's self-regulation skills in all contexts. Information from other observers such as early care and education providers would be helpful in discerning and confirming individual children's risk status but was not assessed in this national survey (Paschall et al. 2020). Fourth, the survey was designed to be representative of U.S. children. Although self-regulation itself is a universal aspect of child development, the specific constructs used to assess it may be affected by cultural norms and perceptions (McClelland et al. 2018), so the generalizability to other cultures and countries would need to be evaluated. Fifth, these data are cross-sectional and cannot be used to infer direction of effects or causality. Finally, the statistical weighting may not completely account for nonresponse bias; however, a U.S. Census Bureau analysis found no strong or consistent evidence of nonresponse bias in this survey, therefore, no known demographic differences emerged between the families who responded and families who did not (U.S. Census Bureau 2017).

This study adds nationally representative analyses to the emerging evidence on the importance of self-regulation in early childhood. Tracking and monitoring self-regulation, along with other measures of mental, emotional, and behavioral health, may be a step toward assessing progress on child development goals for early intervention and parenting support programs (McClelland et al. 2018). Broader public health surveillance of SDOH, self-regulation, and children's mental health could provide data to support decision-making and quality metrics in health care and early childhood systems.

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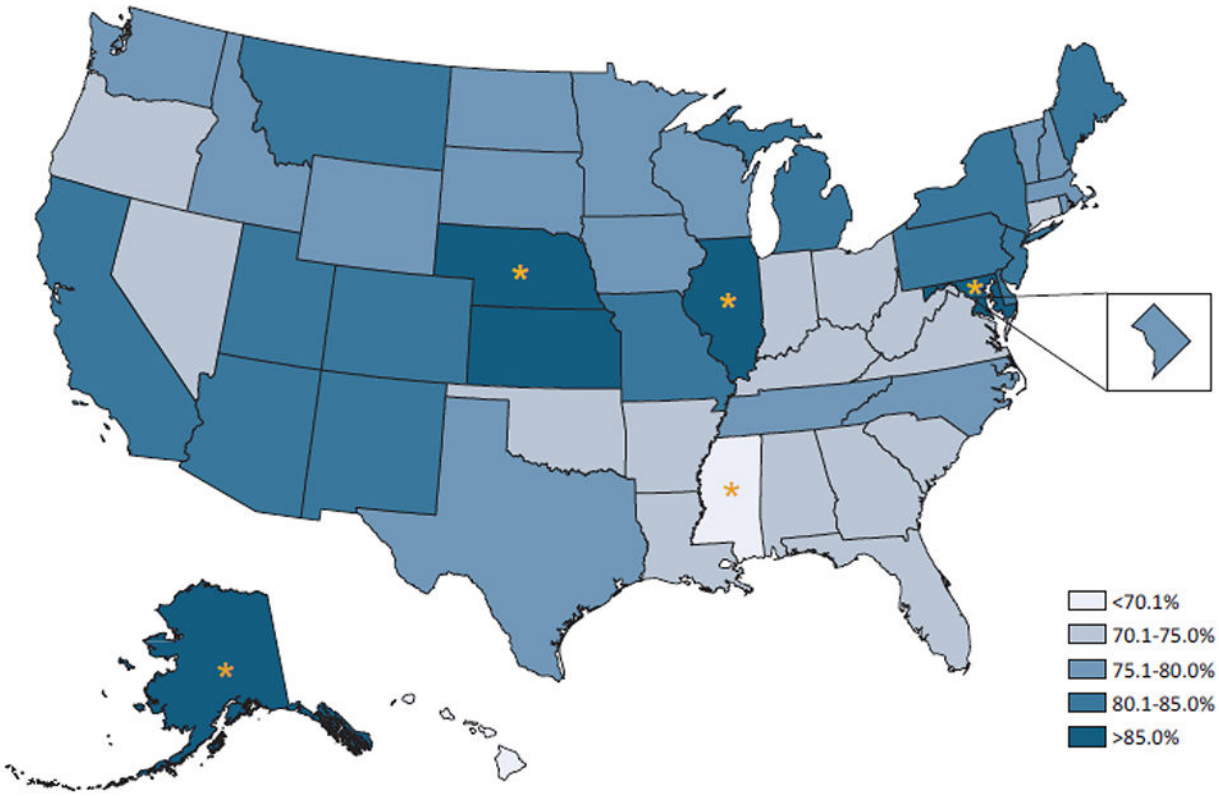
Significance Statement

What is already known on this subject? Self-regulation in childhood is an important predictor of long-term development and health. *What this study adds?* Parent-reported data from 2016 showed that children aged 3–5 years described as on track with self-regulation more often lived in financially and socially advantaged families and communities, and less often experienced family adversity. They also had other positive indicators of good health and development, whether or not they were receiving developmental services. One in five children were described as not on track with self-regulation and many of these children were not being monitored for development or receiving supports or services. Tracking self-regulation along with other measures of mental, emotional, and behavioral health may be a step toward assessing progress on child development goals for early intervention and parenting support programs.



* Prevalence estimates for the states marked with * significantly differed from the prevalence estimate for the US overall

Fig. 1.

Prevalence of children on track with self-regulation by state—National Survey of Children's Health, United States, 2016*

Table 1

Description of variables included in the analyses

Variable	Description
Self-regulation	Based on parents' responses to the questions: "How often is this child easily distracted?" "Compared to other children his or her age, how often is this child able to sit still?" "How often does this child keep working at something until he or she is finished?" "When he or she is paying attention, how often can this child follow instructions to complete a simple task?" Cutoff determinations for "on track" were developed based on developmentally appropriate and age-adjusted indices developed by Ghandour et al. (2018)
Child services	
Developmental services for child	Based on parent report of current early intervention or special education, current special services such as speech, occupational, or behavioral therapy, and mental health treatment or counseling, behavioral treatment for ADHD or autism spectrum disorder and related conditions during the past 12 months
Healthcare	
Healthcare in the past year	Based on parent report of the child seeing a doctor, nurse, or other health care professional for sick-child care, well-child check-ups, physical exams, hospitalizations or any other kind of medical care during the past 12 months
Developmental monitoring	Based on parent report that a doctor or other health care provider asked the parent about concerns about the child's learning, development, or behavior
Developmental screening	Based on parent report that a doctor or other health care provider asked the parent about concerns about the child's learning, development, or behavior
Developmental surveillance	Based on having received monitoring, screening or both
Medical home	Based on parent report that the child had a personal doctor or nurse, usual source for sick and well care, family-centered care, satisfaction with communication, and effective care coordination when needed
Adequate insurance	Based on parent report that the child was currently covered by any kind of health insurance or health coverage plan and usually/always compared to sometimes/never when asked how often the insurance offers benefits or cover services that meet this child's needs
Community factors	
Neighborhood amenities	Based on parent report that there are sidewalks or walking paths, a park or playground, a recreation center, community center, or boys' and girls' club, and a library or bookmobile in the neighborhood
Neighborhood in good condition	Based on parent response of no to litter or garbage on the street or sidewalk, poorly kept or run-down housing, or vandalism such as broken windows or graffiti in their neighborhood
Safe neighborhood	Based on parent response of somewhat agree/definitely agree compared with definitely disagree/somewhat disagree when asked whether the child is safe in their neighborhood
Neighborhood support	Based on parent response of somewhat agree/definitely agree compared with definitely disagree/somewhat disagree when asked whether people in the neighborhood help each other out, watch out for each other's children, and know where to go for help in our community when they encounter difficulties
Family—adversity	
Poverty	Federal poverty level (FPL) is based on family income and family size and composition using federal poverty thresholds that are updated annually by the U.S. Census Bureau using the change in the average annual consumer price index for all urban consumers. Imputed income was used for 9.3% of children aged 2–8 years without reported household income. The variable was dichotomized into ≥ 200% FPL compared to < 200% FPL
Food insecurity	Based on parent report that the family sometimes or often could not afford enough to eat or could not always afford the kinds of food they should eat
Financial difficulties with child health care	Based on parent report of the family having problems paying for any of this child's medical or health care bills during the past 12 months

Variable	Description
Child health impact on work	Based on parent report of having stopped working or cutting hours of work because of this child's health or health conditions or having avoided changing jobs because of concerns about maintaining health insurance for this child for themselves or family members during the past 12 months
Child care problems affecting work	Based on parent report that they or anyone in the family had to quit a job, not take a job, or greatly change their job because of problems with child care for this child during the past 12 months
Family—protective factors	
Parent education	Based on the education level of adult parents or respondents comparing parents who completed high school or more with parents who did not complete high school. If missing, education level was imputed for the first adult respondent
Parental emotional support	Based on parent report that there was someone that they could turn to for day-to-day emotional support with parenting or raising children during the past 12 months
Parental coping	Based on parent response of very well compared to somewhat well/not very well/not at all when asked about handling the day-to-day demands of raising children
Family resilience	Composite measure based on parent report of most of the time/all of the time to the following 4 items: When your family faces problems, how often are you likely to do each of the following? (a) Talk together about what to do, (b) work together to solve our problems, (c) know we have strengths to draw on, and (d) stay hopeful even in difficult times
Child health and development	
Good–poor overall child health	Based on parent report of good/fair/poor compared to excellent/very good general health for the child
Emergency room visits	Based on parent report of 1 or more visits for the child to a hospital emergency room in the past 12 months
Insufficient sleep	Based on parent response of 9 or fewer hours of sleep including naps for the child during an average day, less than the recommended minimum for preschoolers, https://www.cdc.gov/sleep/about_sleep/how_much_sleep.html
Suspended/expelled from child care	Based on parent report that they were asked to pick their child up early, keep their child home, or permanently not to return to any child care or preschool because of the child's behavior
MBDD	Mental, behavioral or developmental disorder, based on parent report of a diagnosis of anxiety, depression, ADHD, behavior or conduct problems, learning disability, intellectual disability, developmental delay, autism spectrum disorder, speech or other language disorder, Tourette syndrome
Internalizing	Based on parent report of a diagnosis of anxiety or depression
Externalizing	Based on parent report of a diagnosis of ADHD, behavior or conduct problems
Developmental or learning	Based on parent report of a diagnosis of learning disability, intellectual disability, developmental delay, autism spectrum disorder
Any physical child health condition	Based on parent report of the following specific conditions: Allergies, arthritis, asthma, blood disorders, brain injury, cerebral palsy, cystic fibrosis, diabetes, down syndrome, epilepsy, heart condition, frequent or severe headaches, deafness or problems with hearing, or blindness or problems with seeing, even when wearing glasses. Only conditions with sufficient sample size for the overall comparison are presented individually

Table 2

Prevalence of selected child services, healthcare, community, and family factors among children aged 3–5 years, by level of self-regulation—National Survey of Children's Health, United States, 2016

Variable	Self-regulation			
	On track % (95% CI)	Not on track % (95% CI)	PR (95% CI)[1]	p value[2]
Child services				
Developmental services for child	6.2 (5.0, 7.6)	23.0 (19.1, 27.2)	0.27 (0.21, 0.35)	< 0.0001
Healthcare				
Healthcare in the past year	90.8 (88.8, 92.4)	86.9 (81.8, 91.0)	1.04 (0.99, 1.10)	0.0781
Any developmental surveillance	39.8 (37.3, 42.4)	50.0 (44.4, 55.6)	0.80 (0.70, 0.90)	0.0008
Developmental monitoring	28.8 (26.5, 31.2)	37.5 (32.4, 42.9)	0.77 (0.65, 0.90)	0.0016
Developmental screening	26.9 (24.7, 29.1)	35.1 (30.0, 40.5)	0.76 (0.65, 0.90)	0.0025
Medical home	54.5 (51.8, 57.3)	42.5 (37.3, 47.9)	1.28 (1.12, 1.46)	0.0001
Adequate insurance	91.0 (88.9, 92.8)	85.4 (80.4, 89.5)	1.07 (1.01, 1.13)	0.0105
Community factors				
Neighborhood amenities	42.1 (39.5, 44.8)	33.8 (28.7, 39.3)	1.25 (1.06, 1.47)	0.0062
Neighborhood in good condition	76.7 (74.3, 79.0)	69.0 (63.0, 74.6)	1.11 (1.02, 1.21)	0.0091
Safe neighborhood	95.0 (93.3, 96.5)	92.1 (87.8, 95.2)	1.03 (0.99, 1.08)	0.0922
Neighborhood support	75.8 (73.2, 78.3)	60.9 (54.9, 66.6)	1.24 (1.13, 1.37)	< 0.0001
Family—adversity				
Poverty[3]	36.5 (33.4, 39.7)	52.0 (44.7, 59.3)	0.70 (0.58, 0.85)	0.0017
Food insecurity	26.8 (24.3, 29.5)	42.9 (37.4, 48.7)	0.62 (0.53, 0.73)	< 0.0001
Financial difficulties with child health care	10.5 (8.7, 12.6)	20.0 (15.4, 25.3)	0.52 (0.39, 0.71)	< 0.0001
Child health impact on work	7.3 (5.7, 9.1)	17.3 (13.4, 22.0)	0.42 (0.30, 0.58)	< 0.0001
Child care problems affecting work	4.6 (3.5, 6.0)	14.4 (10.4, 19.2)	0.32 (0.22, 0.48)	< 0.0001
Parent with fair/poor mental health	4.7 (3.8, 5.7)	13.9 (9.8, 18.8)	0.34 (0.23, 0.49)	< 0.0001
Parent with fair/poor physical health	7.0 (5.6, 8.6)	17.2 (12.5, 22.8)	0.41 (0.29, 0.58)	< 0.0001
Parental aggravation	0.7 (0.4, 1.2)	8.1 (5.7, 11.0)	0.09 (0.05, 0.16)	< 0.0001
Adverse life experiences	35.4 (32.6, 38.3)	58.2 (52.8, 63.4)	0.61 (0.54, 0.69)	< 0.0001
Family—protective factors				

Variable	Self-regulation			
	On track % (95% CI)	Not on track % (95% CI)	PR (95% CI)[1]	p value[2]
Parent education[4]	93.9 (91.3, 95.9)	89.5 (83.5, 93.9)	1.05 (0.99, 1.11)	0.0702
Parental emotional support	80.3 (77.6, 82.9)	73.5 (67.3, 79.0)	1.09 (1.00, 1.19)	0.0230
Parental coping	69.3 (66.8, 71.8)	57.3 (52.0, 62.4)	1.21 (1.10, 1.33)	< 0.0001
Family resilience	88.2 (86.6, 89.7)	73.0 (68.0, 77.7)	1.21 (1.13, 1.29)	< 0.0001

[1] Children 'Not on Track' is the referent group

[2] A value of $p \leq 0.05$ indicates statistical significance

[3] If missing, family income was imputed using sequential regression as an input to the family poverty ratio based on the federal poverty level (FPL). FPL was multiply imputed and contains six implicates

[4] If missing, education for the primary respondent was imputed using sequential regression imputation methods

Table 3

Prevalence of selected child health and development factors among children aged 3–5 years by level of self-regulation—National Survey of Children's Health, United States, 2016

Child health and developments	Self-regulation overall			
	On track % (95% CI)	Not on track % (95% CI)	PR (95% CI)*	p value[1]
Good–poor overall child health	4.7 (3.6, 6.1)	18.4 (13.7, 23.8)	0.26 (0.18, 0.37)	< 0.0001
Emergency room visits	19.6 (17.5, 21.7)	33.8 (28.1, 39.9)	0.58 (0.47, 0.71)	< 0.0001
Insufficient sleep	33.0 (30.2, 35.9)	42.4 (36.9, 48.1)	0.78 (0.67, 0.91)	0.0021
Suspended/expelled from child care	0.6 (0.4, 0.8)	5.6 (3.5, 8.5)	0.10 (0.06, 0.17)	< 0.0001
Any diagnoses or conditions	32.4 (30.0, 34.8)	59.2 (53.7, 64.6)	0.55 (0.49, 0.61)	< 0.0001
MBDD	8.8 (7.4, 10.3)	35.7 (30.2, 41.4)	0.25 (0.20, 0.31)	< 0.0001
Internalizing	0.6 (0.4, 0.8)	5.1 (3.4, 7.3)	0.12 (0.07, 0.19)	< 0.0001
Externalizing	1.6 (1.2, 2.2)	19.9 (15.3, 25.2)	0.08 (0.06, 0.12)	< 0.0001
Developmental or learning	3.4 (2.6, 4.3)	22.7 (17.7, 28.3)	0.15 (0.11, 0.21)	< 0.0001
Speech or other language disorder	6.5 (5.3, 7.9)	23.3 (18.4, 28.9)	0.28 (0.21, 0.38)	< 0.0001
Any physical child health condition	26.3 (24.1, 28.6)	42.5 (36.8, 48.3)	0.62 (0.53, 0.72)	< 0.0001
Allergies	18.1 (16.3, 20.0)	27.9 (23.0, 33.2)	0.65 (0.53, 0.80)	0.0001
Asthma	7.6 (6.2, 9.1)	13.5 (9.3, 18.7)	0.56 (0.38, 0.82)	0.0037
Heart Condition	1.3 (0.9, 1.8)	5.0 (3.1, 7.5)	0.26 (0.15, 0.44)	< 0.0001

A value of $p \leq 0.05$ indicates statistical significance

Table 4

Prevalence of selected child health and development factors among children aged 3–5 years who are not currently receiving developmental services, by level of self-regulation—National Survey of Children's Health, United States, 2016

Child health and development	Self-regulation among children not currently receiving developmental services			
	On track % (95% CI)	Not on track % (95% CI)	PR (95% CI)	p value[1]
Good–poor overall child health	4.3 (3.1, 5.7)	13.9 (9.6, 19.2)	0.31 (0.20, 0.48)	< 0.0001
Emergency room visits	18.8 (16.7, 21.1)	28.4 (22.4, 35.0)	0.66 (0.52, 0.85)	0.0016
Insufficient sleep	33.1 (30.2, 36.1)	42.1 (35.9, 48.6)	0.79 (0.66, 0.93)	0.0079
Suspended/expelled from child care	0.5 (0.3, 0.7)	3.0 (1.3, 5.8)	0.17 (0.08, 0.37)	< 0.0001
Any diagnoses or conditions	28.3 (26.0, 30.6)	44.7 (38.4, 51.1)	0.63 (0.54, 0.74)	< 0.0001
MBDD	4.1 (3.3, 5.0)	17.7 (12.5, 23.9)	0.23 (0.16, 0.34)	< 0.0001
Internalizing	0.3 (0.1, 0.5)	1.8 (0.8, 3.6)[2]	0.14 (0.06, 0.35)	< 0.0001
Externalizing	0.9 (0.6, 1.4)	9.6 (5.9, 14.5)	0.09 (0.05, 0.17)	< 0.0001
Developmental or learning	1.1 (0.7, 1.6)	7.2 (3.4, 13.2)[3]	0.15 (0.07, 0.31)	< 0.0001
Speech or other language disorder	2.6 (2.0, 3.3)	8.5 (4.5, 14.3)	0.31 (0.17, 0.56)	0.0001
Any physical child health condition	25.2 (23.1, 27.5)	35.7 (29.7, 42.0)	0.71 (0.59, 0.86)	0.0007
Allergies	17.8 (15.9, 19.7)	25.4 (20.4, 30.9)	0.70 (0.56, 0.88)	0.0027
Asthma	7.1 (5.8, 8.5)	9.8 (6.3, 14.3)	0.73 (0.47, 1.12)	0.1414
Heart Condition	1.1 (0.8, 1.7)	3.7 (1.9, 6.4)	0.31 (0.16, 0.62)	0.0009

[1] A value of $p \leq 0.05$ indicates statistical significance

[2] The RSE is between 30 and 60% (somewhat unstable)

[3] The RSE is between 30 and 60% (somewhat unstable)