

Research Brief

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Use of Medication to Treat Attention Deficit Disorders in Kentucky Preschoolers

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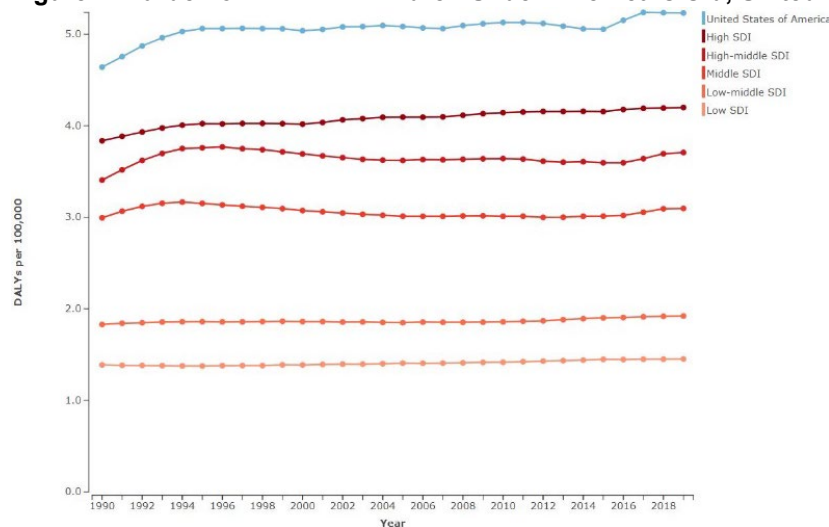
BACKGROUND

Attention deficit hyperactivity disorder (ADHD)—characterized by symptoms of hyperactivity, inattentiveness, and impulsivity—is one of the most frequently diagnosed neurodevelopmental disorders among children in the United States.¹ The Centers for Disease Control and Prevention (CDC) estimates that approximately 6 million children between the ages of 3-17 have been diagnosed with ADHD, including 265,000 children between the ages of three and five years old.²

The Impact of ADHD in Children Under Five

Children with ADHD are more likely to struggle academically, have difficult social relationships, engage in risky behaviors, and have an overall lower health-related quality of life compared to their peers.³ While it is typically diagnosed in childhood, nearly one-third of children diagnosed with ADHD continue to experience challenges into adulthood, including higher rates of substance use disorder, unemployment, increased involvement in criminal activity, and increased risk of suicide.^{4,5,6} In 2019, in the United States, the overall burden of ADHD for children under the age of five was 5.23 disability-life adjusted years (DALYs)¹, with boys experiencing a more significant burden than girls at 8.09 DALYs compared to 2.24 DALYs, respectively.⁷ Compared to other countries, the United States experiences one of the highest burdens of ADHD in terms of DALYs, even among the high SDI² countries (Figure 1).

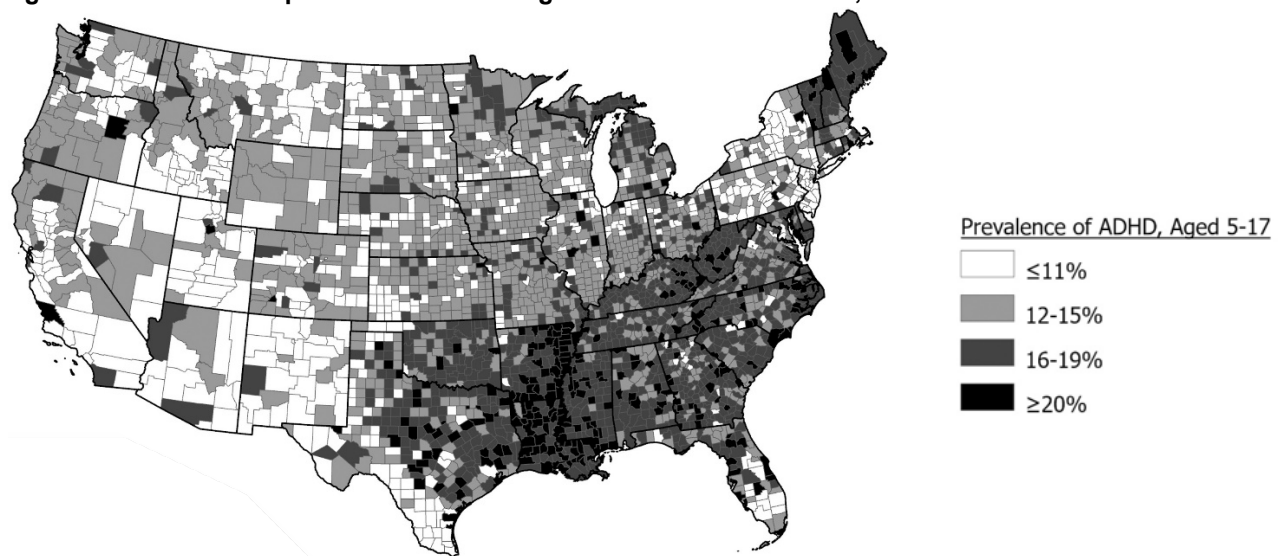
Figure 1. Burden of ADHD in Children Under Five Years Old, United States vs. Other Countries³, 1990-2018⁸



Based on parental self-report, Kentucky ranks second highest in the country for prevalence of ADHD among children ages 3-17 years old (13.2%).⁹ A recent county-level study of ADHD among children ages 5-17 years found that some counties in Eastern Kentucky had a prevalence greater than 20% (Figure 2).

¹ DALY: Disability-adjusted life years. One DALY is equal to one year of healthy life lost.

² SDI: Sociodemographic Index, a composite indicator of development that combines education, economy, and the fertility rate of a country as a representation of social and economic development.

Figure 2. Estimated Proportion of Children Aged 5-17 Years with ADHD, 2016-2018

Source: Zgodic, A., et al..¹⁰

The Challenges of Diagnosing and Treating ADHD in Preschool-Aged Children

Clinically diagnosing ADHD in preschool-aged children can be challenging since the hallmark symptoms of inattention, hyperactivity, and impulsivity are typical and often developmentally normal behaviors in children of this age. While some children may clearly meet the diagnostic criteria for ADHD, others may display behaviors that vary from the norm but are not necessarily indicative of ADHD. Research has shown that, even among children whose symptoms are significant enough to warrant an ADHD diagnosis in preschool, only 48% will have an ADHD diagnosis in late childhood or adolescence, suggesting that these symptoms alone are not sufficient for early diagnosis or are perhaps explained by unequal developmental trajectories..¹¹

Individual temperament is a factor that can complicate an ADHD diagnosis in preschool-aged children. Individual behavioral differences are influenced by interactions between genes and the environment and factors like stress and lack of sleep can interfere with the development of the brain's prefrontal cortex..¹² This area of the brain is responsible for the development of self-regulation, including attention regulation and other factors that contribute to school readiness, such as attention shifting, emotional regulation, and inhibitory control..¹³ These factors may contribute to differences in temperament among individuals that are not necessarily pathologic or indicative of ADHD.

The challenges of diagnosing ADHD in preschool-aged children, and the potential long-term consequences of a misdiagnosis, point to the need for more attention to treatment options in young children. Options for treating ADHD include medication and behavioral therapy or a combination of both. Guidelines from the American Academy of Pediatrics (AAP) recommend parent training in behavioral management (PTBM) and/or behavioral classroom interventions as a first line of treatment to address ADHD in preschool-aged children. PTBM is an evidence-based approach that has been shown to be effective in managing ADHD in children ages four to six without the use of medications..¹⁴

The Use of Psychotropic Medications in Preschool-Aged Children

Medication-based treatments involve the use of psychotropic medications, which refer to drugs that affect behavior, mood, thoughts, or perceptions and include stimulants commonly used to treat

ADHD. In 2016, more than 2,500 preschool-aged children enrolled in Kentucky Medicaid had a diagnosis of ADHD, and 38.2% of them had received a prescription for stimulant medication.¹⁵ That same year, Kentucky Medicaid spent \$215 million on stimulant medications for children younger than 18 years old.¹⁶ Despite AAP recommendations for behavioral therapy as a first-line treatment, evidence suggests that many Kentucky preschoolers are not receiving this treatment prior to receiving medication-based treatment.¹⁷

There are reasons to be concerned about the treatment of ADHD in preschoolers, including a lack of evidence regarding the long-term effects of psychotropic medication use on the brain in the early stages of development.^{18,19} Many medications used for preschoolers are used “off-label,” which means they are not approved by the United States Food and Drug Administration (FDA) for preschool-age children or specific diagnoses like ADHD. Researchers have shown that a class of non-stimulant medications called alpha-2 agonists has been used “off label” to successfully treat ADHD symptoms and other psychiatric disorders in children.^{20,21,22} Studies have shown that alpha-2 agonists are being used more frequently in younger (2-3 years) preschoolers compared to older (4-5 years) preschoolers.²³ The long-term effects of these practices on the health of individuals are currently unknown.

For the same reason that there is a concern related to the long-term effects of giving psychotropic medications to young children, developing brains are positively susceptible to the effects of non-pharmaceutical interventions.^{24,25,26} Attention training has shown promise for some individuals. In the preschool period, the effects of attention training may be more effective due to the positive susceptibility of the young brain during early developmental periods. Overall, studies suggest that behavioral therapies are effective in young children and may moderate the need for medication.²⁷

Policy and Practice Considerations

Given the extent of ADHD in Kentucky preschool-aged children, and the potential long-term consequences of misdiagnoses and the use of psychotropic medication, increased focus on policy and practice solutions should be considered. Some potential considerations are described below.

Invest in expanding the pediatric mental health workforce in Kentucky.

In Kentucky, 82% of counties do not have a child and adolescent psychiatrist, and the remaining 18% are considered shortage areas.^{28,29} The pediatric mental health workforce is essential to both ensuring accurate diagnoses of ADHD in young children and in meeting the AAP’s recommendation for providing behavioral health treatment prior to a medication-based treatment in children four to five years old. One option for addressing this workforce shortage is to provide comprehensive pediatric mental health training to a broad range of pediatric providers, including nurse practitioners, family medicine physicians, clinical psychologists, and pediatricians. Training could boost the capacity of existing providers to more effectively diagnose and treat ADHD in preschool-aged children.

Additionally, increasing access to programs designed to improve the mental health capacity of primary care providers may be a practical pathway to expand the mental health workforce. For example, Kentucky’s Kids’ Interface and Network for Healthy Development (KY K.I.N.D.) is a partnership of the Health Resources and Services Administration, the Kentucky Department of Health’s Maternal and Child Health Division, and the Kentucky chapter of the American Academy of Pediatrics. The goals of KY K.I.N.D. are to educate and train pediatric primary care providers on children’s mental health care, diagnosis, and treatment, to support their ability to conduct

telepsychology and telepsychiatry visits, and to facilitate their access to consults with regional child psychiatrists and psychologists to support appropriate treatment pathways.³⁰ Additional funding to support the expansion and reach of these types of programs could benefit the behavioral healthcare system across the Commonwealth. Research to assess these programs' effectiveness and impact is also needed.

Expand access to parenting programs for parents of children with concerning behaviors.

AAP clinical practice guidelines suggest that a diagnosis of ADHD is not necessary to initiate parent training in behavior management (PTBM) as it is effective for all types of challenging behaviors. Behavioral health interventions prior to medication may support the identification of modifiable environmental risk factors that may be contributing to differences in behavior.³¹ According to the CDC, therapy that focuses on training parents is recommended for young children with ADHD because young children are not mature enough to change their own behavior without their parents' help.³²

Developed by Dr. Sheila Eyberg, Parent-Child Interaction Therapy (PCIT) is one evidence-based parent training program for children.³³ Traditionally, PCIT is delivered in a clinic setting, with the therapist behind a one-way mirror providing live instruction and coaching during family interactions using a parent-worn earpiece though delivery has now been expanded to additional formats.^{34, 35} These behavioral strategies improve family functioning and, therefore, may moderate the need for medication in young children.³⁶ More research is needed to inform the development of family-centered interventions and strategies to engage families in behavioral parent training as much remains unknown about the timing, dose, duration, and delivery method (face-to-face, virtual, or combination).^{37, 38, 39}

Support research to explore the effectiveness of implementing a prior authorization process to require behavioral health intervention before prescribing a medication-based treatment for young children diagnosed with ADHD.

There is currently no data available to assess whether prior authorization for psychotropic medications can reduce overall use in children with ADHD and/or increase the use of behavioral health interventions. Funding to support research regarding the effectiveness of a prior authorization process in reducing the use of psychotropic medications in preschool-aged children would benefit children across the Commonwealth.

Expand telehealth for pediatric mental health visits.

The expansion of telehealth for pediatric mental health visits has the potential to increase access to mental health care for preschool-aged children and, in turn, improve outcomes related to a potential ADHD diagnosis. Telehealth is especially important for those living in rural and low-resourced communities, where there is often no or very limited access to mental health care.^{40, 41}

CONCLUSION

Changes in policy and practice are needed to ensure that adequate and appropriate options for the safe and effective treatment of ADHD in developing young children are available. Kentucky providers should be cautious when recommending medication-based treatment for young children who have been diagnosed with ADHD, given the lack of evidence about long-term consequences on the

developing brain. More research is needed to determine the safest and most effective treatments that minimize adverse effects and maximize long-term outcomes.

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REFERENCES

- ¹ Centers for Disease Control and Prevention. Research on ADHD. Centers for Disease Control and Prevention. Updated September 3, 2020. Accessed January 14, 2023 at <https://www.cdc.gov/ncbddd/adhd/research.html>
- ² Centers for Disease Control and Prevention. Data and Statistics about ADHD. Accessed January 23, 2023 at <https://www.cdc.gov/ncbddd/adhd/data.html>.
- ³ Danielson, M. L., Holbrook, J. R., Bitsko, R. H., Newsome, K., Charania, S. N., McCord, R. F., Kogan, M. D., & Blumberg, S. J. (2022). State-Level Estimates of the Prevalence of Parent-Reported ADHD Diagnosis and Treatment Among U.S. Children and Adolescents, 2016 to 2019. *Journal of attention disorders*, 26(13), 1685–1697. <https://doi.org/10.1177/10870547221099961>
- ⁴ Groenman, A. P., Janssen, T. W. P., & Oosterlaan, J. (2017). Childhood Psychiatric Disorders as Risk Factor for Subsequent Substance Abuse: A Meta-Analysis. *Journal of the American Academy of Child and Adolescent Psychiatry*, 56(7), 556–569. <https://doi.org/10.1016/j.jaac.2017.05.004>
- ⁵ Fletcher J. M. (2014). The effects of childhood ADHD on adult labor market outcomes. *Health economics*, 23(2), 159–181. <https://doi.org/10.1002/hec.2907>.
- ⁶ Barbaresi, W. J., Colligan, R. C., Weaver, A. L., Voigt, R. G., Killian, J. M., & Katusic, S. K. (2013). Mortality, ADHD, and psychosocial adversity in adults with childhood ADHD: a prospective study. *Pediatrics*, 131(4), 637–644. <https://doi.org/10.1542/peds.2012-2354>.
- ⁷ Institute for Health Metrics and Evaluation. Global Burden of Disease, 2019. Accessed January 31, 2023 at <https://vizhub.healthdata.org/gbd-compare/>.
- ⁸ Institute for Health Metrics and Evaluation. GBD Compare. Accessed January 31, 2023 at <https://vizhub.healthdata.org/gbd-compare/>.
- ⁹ Centers for Disease Control and Prevention. State-Based Prevalence of ADHD Diagnosis and Treatment, 2016–2019. Accessed online January 17, 2023 at <https://www.cdc.gov/ncbddd/adhd/data/diagnosis-treatment-data.html>.
- ¹⁰ Zgodic, A., McLain, A. C., Eberth, J. M., Federico, A., Bradshaw, J., & Flory, K. (2023). County-Level Prevalence Estimates of ADHD in Children in the United States. *Annals of epidemiology*, S1047-2797(23)00006-6. Advance online publication. <https://doi.org/10.1016/j.annepidem.2023.01.006>.
- ¹¹ Connor D. F. (2002). Preschool attention deficit hyperactivity disorder: a review of prevalence, diagnosis, neurobiology, and stimulant treatment. *Journal of developmental and behavioral pediatrics : JDBP*, 23(1 Suppl), S1–S9. <https://doi.org/10.1097/00004703-200202001-00002>.
- ¹² Hodel A. S. (2018). Rapid Infant Prefrontal Cortex Development and Sensitivity to Early Environmental Experience. *Developmental review : DR*, 48, 113–144. <https://doi.org/10.1016/j.dr.2018.02.003>.
- ¹³ Brandes-Aitken, A., Braren, S., Swingler, M., Voegtline, K., & Blair, C. (2019). Sustained attention in infancy: A foundation for the development of multiple aspects of self-regulation for children in poverty. *Journal of experimental child psychology*, 184, 192–209. <https://doi.org/10.1016/j.jecp.2019.04.006>.
- ¹⁴ Wolraich, M. L., Hagan, J. F., Jr, Allan, C., Chan, E., Davison, D., Earls, M., Evans, S. W., Flinn, S. K., Froehlich, T., Frost, J., Holbrook, J. R., Lehmann, C. U., Lessin, H. R., Okechukwu, K., Pierce, K. L., Winner, J.

- D., Zurhellen, W., & subcommittee on children and adolescents with attention-deficit/hyperactive disorder (2019). Clinical Practice Guideline for the Diagnosis, Evaluation, and Treatment of Attention-Deficit/Hyperactivity Disorder in Children and Adolescents. *Pediatrics*, 144(4), e20192528. <https://doi.org/10.1542/peds.2019-2528>.
- ¹⁵ Davis, D. W., Feygin, Y., Creel, L., Williams, P. G., Lohr, W. D., Jones, V. F., Le, J., Pasquenza, N., Ghosal, S., Jawad, K., Yan, X., Liu, G., & McKinley, S. (2019). Longitudinal Trends in the Diagnosis of Attention-Deficit/Hyperactivity Disorder and Stimulant Use in Preschool Children on Medicaid. *The Journal of pediatrics*, 207, 185–191.e1. <https://doi.org/10.1016/j.jpeds.2018.10.062>.
- ¹⁶ Davis DW. (June 2017). *State-University Partnership Annual Report: Medication prescribing to children insured by Kentucky Medicaid final report 2016-2017*. Annual Report.
- ¹⁷ Davis DW, Jawad K, Lohr WD, Le J, Trace M. (October 23, 2021). First-line behavioral health treatment prior to stimulant or a2-agonist use for preschoolers on Kentucky Medicaid. Podium presentation presented at: Society for Developmental and Behavioral Pediatrics. Virtual (COVID-19). Accessed January 31, 2023 at <https://sdbp-video.s3.amazonaws.com/wp-content/uploads/2021/09/16160947/SDBP-Concurrents-platforms-2021-SCHED-9.16.pdf>.
- ¹⁸ Johnston M. V. (2004). Clinical disorders of brain plasticity. *Brain & development*, 26(2), 73–80. [https://doi.org/10.1016/S0387-7604\(03\)00102-5](https://doi.org/10.1016/S0387-7604(03)00102-5).
- ¹⁹ Ghuman, J. K., Arnold, L. E., & Anthony, B. J. (2008). Psychopharmacological and other treatments in preschool children with attention-deficit/hyperactivity disorder: current evidence and practice. *Journal of child and adolescent psychopharmacology*, 18(5), 413–447. <https://doi.org/10.1089/cap.2008.022>.
- ²⁰ Davis, D. W., Feygin, Y., Creel, L., Williams, P. G., Lohr, W. D., Jones, V. F., Le, J., Pasquenza, N., Ghosal, S., Jawad, K., Yan, X., Liu, G., & McKinley, S. (2019). Longitudinal Trends in the Diagnosis of Attention-Deficit/Hyperactivity Disorder and Stimulant Use in Preschool Children on Medicaid. *The Journal of Pediatrics*, 207, 185–191.e1. <https://doi.org/10.1016/j.jpeds.2018.10.062>.
- ²¹ Lohr, W. D., Creel, L., Feygin, Y., Stevenson, M., Smith, M. J., Myers, J., Woods, C., Liu, G., & Davis, D. W. (2018). Psychotropic Polypharmacy Among Children and Youth Receiving Medicaid, 2012-2015. *Journal of managed care & specialty pharmacy*, 24(8), 736–744. <https://doi.org/10.18553/jmcp.2018.24.8.736>.
- ²² Blum, N. J., Shults, J., Harstad, E., Wiley, S., Augustyn, M., Meizen-Derr, J. K., Wolraich, M. L., & Barbaresi, W. J. (2018). Common Use of Stimulants and Alpha-2 Agonists to Treat Preschool Attention-Deficit Hyperactivity Disorder: A DBPNet Study. *Journal of developmental and behavioral pediatrics : JDBP*, 39(7), 531–537. <https://doi.org/10.1097/DBP.0000000000000585>.
- ²³ Davis, D. W., Feygin, Y., Creel, L., Kong, M., Jawad, K., Sun, J., Blum, N. J., Lohr, W. D., Williams, P. G., Le, J., Jones, V. F., & Pasquenza, N. (2020). Epidemiology of Treatment for Preschoolers on Kentucky Medicaid Diagnosed with Attention-Deficit/Hyperactivity Disorder. *Journal of child and adolescent psychopharmacology*, 30(7), 448–455. <https://doi.org/10.1089/cap.2020.0015>.
- ²⁴ Belsky, J., & Pluess, M. (2009). The Nature (and Nurture?) of Plasticity in Early Human Development. *Perspectives on psychological science : a journal of the Association for Psychological Science*, 4(4), 345–351. <https://doi.org/10.1111/j.1745-6924.2009.01136.x>.
- ²⁵ Rosenzweig, M. R., & Bennett, E. L. (1996). Psychobiology of plasticity: effects of training and experience on brain and behavior. *Behavioural brain research*, 78(1), 57–65. [https://doi.org/10.1016/0166-4328\(95\)00216-2](https://doi.org/10.1016/0166-4328(95)00216-2).
- ²⁶ Mangina, C. A., & Beuzeron-Mangina, J. H. (2004). Brain plasticity following psychophysiological treatment in learning disabled/ADHD pre-adolescents. *International journal of psychophysiology : official journal of the International Organization of Psychophysiology*, 52(2), 129–146. <https://doi.org/10.1016/j.ijpsycho.2003.10.006>.
- ²⁷ Tang, Y. Y., & Posner, M. I. (2009). Attention training and attention state training. *Trends in cognitive sciences*, 13(5), 222–227. <https://doi.org/10.1016/j.tics.2009.01.009>.
- ²⁸ Davis, D. W., Feygin, Y., Creel, L., Kong, M., Jawad, K., Sun, J., Blum, N. J., Lohr, W. D., Williams, P. G., Le, J., Jones, V. F., & Pasquenza, N. (2020). Epidemiology of Treatment for Preschoolers on Kentucky Medicaid Diagnosed with Attention-Deficit/Hyperactivity Disorder. *Journal of child and adolescent psychopharmacology*, 30(7), 448–455. <https://doi.org/10.1089/cap.2020.0015>.
- ²⁹ American Academy of Child and Adolescent Psychiatry. Workforce maps by state. Accessed February 1, 2023 at https://www.aacap.org/aacap/Advocacy/Federal_and_State_Initiatives/Workforce_Maps/Home.aspx
- ³⁰ Kentucky Chapter of the American Academy of Pediatrics. Initiatives and Programs. Accessed online February 22, 2023 at <https://www.kyaap.org/chapter-focus/initiatives-programs/>.
- ³¹ Davis, D. W., Jawad, K., Lohr, W. D., Trace, M., Le, J., Feygin, Y., & Jones, V. F. (2023). First-line Behavioral Health Treatment Prior to Stimulant or Alpha-2 Agonist Use for Preschoolers on Kentucky Medicaid in 2017. *Journal of attention disorders*, 27(4), 437–446. <https://doi.org/10.1177/10870547221147543>.

- ³² Centers for Disease Control and Prevention. Parent Training in Behavioral Management of ADHD. Accessed online February 22, 2023 at <https://www.cdc.gov/ncbddd/adhd/behavior-therapy.html>.
- ³³ PCIT. What is Teacher Child Interaction Training (TCIT)? Accessed online February 22, 2023 at <https://www.parentchildinteractiontherapy.com/what-is-tcit>.
- ³⁴ Comer, J. S., Furr, J. M., Cooper-Vince, C., Madigan, R. J., Chow, C., Chan, P., Idrobo, F., Chase, R. M., McNeil, C. B., & Eyberg, S. M. (2015). Rationale and Considerations for the Internet-Based Delivery of Parent-Child Interaction Therapy. *Cognitive and behavioral practice*, 22(3), 302–316. <https://doi.org/10.1016/j.cbpra.2014.07.003>.
- ³⁵ Beveridge, R., Fowles, T., Masse, J., McGoron, L., Smith, M., Parrish, B, Circo, G, Widdoes, N. (2015). State-wide Dissemination and Implementation of a Parent-Child Interaction Therapy (PCIT): Application of Theory. *Children and Youth Services Review*, 48, 38-48. <https://doi.org/10.1016/j.chilyouth.2014.11.013>
- ³⁶ Davis, D. W., Jawad, K., Lohr, W. D., Trace, M., Le, J., Feygin, Y., & Jones, V. F. (2023). First-line Behavioral Health Treatment Prior to Stimulant or Alpha-2 Agonist Use for Preschoolers on Kentucky Medicaid in 2017. *Journal of attention disorders*, 27(4), 437–446. <https://doi.org/10.1177/10870547221147543>.
- ³⁷ DuPaul, G. J., Kern, L., Belk, G., Custer, B., Daffner, M., Hatfield, A., & Peek, D. (2018). Face-to-face versus online behavioral parent training for young children at risk for ADHD: Treatment engagement and outcomes. *Journal of Clinical Child & Adolescent Psychology*, 47, S369–S383.
- ³⁸ Spencer, A. E., Sikov, J., Loubeau, J. K., Zolli, N., Baul, T., Rabin, M., Hasan, S., Rosen, K., Buonocore, O., Lejeune, J., Dayal, R., Fortuna, L., Borba, C., & Silverstein, M. (2021). Six stages of engagement in ADHD treatment described by diverse, urban parents. *Pediatrics*, 148(4), e2021051261. <https://doi.org/10.1542/peds.2021-051261>.
- ³⁹ Tarver, J., Daley, D., & Sayal, K. (2022). A self-help version of the New Forest Parenting Programme for parents of children with attention deficit hyperactivity disorder: A qualitative study of parent views and acceptability. *Child and Adolescent Mental Health*, 27(3), 215–222.
- ⁴⁰ Pradhan, T., Six-Workman, E. A., & Law, K. B. (2019). An Innovative Approach to Care: Integrating Mental Health Services Through Telemedicine in Rural School-Based Health Centers. *Psychiatric services (Washington, D.C.)*, 70(3), 239–242. <https://doi.org/10.1176/appi.ps.201800252>.
- ⁴¹ Contreras, S., Porrás-Javier, L., Zima, B. T., Soares, N., Park, C., Patel, A., Chung, P. J., & Coker, T. R. (2018). Development of a Telehealth-Coordinated Intervention to Improve Access to Community-Based Mental Health. *Ethnicity & disease*, 28(Suppl 2), 457–466. <https://doi.org/10.18865/ed.28.S2.457>.