Maine Rural Health Research Center

Research & Policy Brief

PB-64 April 2016

Adverse Childhood Experiences in Rural and Urban Contexts

Jean A. Talbot, PhD, MPH • Donald Szlosek, MPH • Erika C. Ziller, PhD

BACKGROUND

Adverse childhood experiences (ACEs) are disturbances in family relationships that deprive children of the security and emotional support they need for healthy development.[1-5] In their seminal work on ACEs, researchers Felitti and Anda defined these experiences as occurring before age 18 and comprising multiple forms of family dysfunction, such as childhood verbal,[1-5] physical,[1-5] and sexual[1-5] abuse; having a mentally ill,[1-5] substance-abusing,[1-5] or incarcerated[1-5] family member; witnessing family violence;[1-5] and experiencing parental separation or divorce.[2-5]

When they are numerous, ACEs can disrupt children's body chemistry and alter brain structure.[6,7] One effect of this disruption is to make people more vulnerable to serious, chronic health conditions in later life.[1,2,8] Felitti and Anda's ACE research team found that the more ACEs an individual experiences, the greater his or her risk of chronic illnesses such as ischemic heart disease,[1] chronic obstructive pulmonary disease (COPD),[2] and depression.[1]

ACEs–related disturbances in the body's responses to stress can also lead to long-term problems with emotion regulation, impulse control, and social judgment.[7] These problems, in turn, can contribute to the development of harmful health habits: the original ACE study identified linkages between high ACE levels and adulthood behaviors such as smoking,[3] alcoholism,[4] and drug abuse.[5] In addition, impairments in social and emotional functioning stemming from ACEs appear to pave the way for interpersonal difficulties across multiple domains.[7,9-14] For example, adults who witnessed domestic violence as children may be more likely to perpetrate violence on their domestic partners in adulthood,[13] and mothers who experienced childhood sexual abuse are more likely to have children who need interventions from child protective services.[14] Moreover, adults with high ACE levels and chronic health conditions often struggle to collaborate productively with health care providers attempting to assist them with disease management.[9,11,12,15]

Not only do ACEs damage the health of the individuals who lived through them: they can also have damaging consequences for the next generation. Because adults with extensive ACE histories are more likely to endure mental illness,[1,16] substance abuse,[3-5] and relationship disturbances,[10,13,14] they are at elevated risk for exposing their own children to the same types of toxic stress that they themselves lived through in their early years.[13,14]

Key Findings

Past research has shown that adverse childhood experiences (ACEs) have long-term, negative implications for health and well-being: as the number of ACEs increases, the risk for health problems in adulthood rises.

ACEs are a significant problem among rural adults. Over half of rural residents reported some ACE exposure, and over one in ten reported high levels of exposure (four or more ACEs).

After adjustment for demographics, rural and urban populations showed similar odds of experiencing high-level ACE exposure.

Rural primary care providers can play a leadership role in forging community partnerships to raise public awareness about ACEs, conduct ACE-focused community needs assessments, and launch initiatives to create new services geared toward building resilience in families.

For more information about this study, contact Jean Talbot at **jean.talbot@maine.edu**

This study was supported by the Federal Office of Rural Health Policy (FORHP), Health Resources and Services Administration (HRSA), U.S. Department of Health and Human Services (HHS) under CA#U1CRH03716. The information, conclusions and opinions expressed in this paper are those of the authors and no endorsement by FORHP, HRSA, HHS, or the University of Southern Maine is intended or should be inferred.

In light of this evidence documenting the negative implications of ACEs for population health,[1-16] clinicians[11,17,18] and health systems[19,20] are increasingly recognizing the importance of adapting health service delivery in ways that will help prevent ACEs and minimize their long-term effects. As a foundation for these efforts, departments of public health across the country are devoting more energy and resources to studying the epidemiology of ACEs.[21-23] However, basic, descriptive research on the prevalence and patterns of ACEs in rural American communities remains scarce. Although a recent report by the Health Resources and Services Administration (HRSA) indicated that rural children have higher rates of ACEs than their urban peers,[24] we know of no studies examining rural-urban differences in adults' exposure to ACEs. The present investigation was designed to address this research gap and to inform health system initiatives geared toward mitigating the impacts of ACEs on rural populations.

Some past research suggests that rural residence could be associated with elevated ACE levels in adults. Poverty and low educational attainment have long been concentrated in rural areas;[25] these types of socioeconomic disadvantage, in turn, place parents at heightened risk for experiencing behavioral health problems[26-29]and engaging in child maltreatment.[27,28] For these reasons, it might be expected that in comparison to their urban counterparts, rural adults of the present generation would report higher levels of ACE exposure in the families they grew up in. On the other hand, older cohorts tend to report fewer ACEs,[5,30] and average age is higher in rural than in urban populations.[31] In addition, older people with elevated ACE scores may have been less likely to participate in ACE surveys because they had higher rates of disability and death relative to their age peers with lower ACE scores. Although it has been suggested that older people may report fewer ACEs because they have more limited recall or are less willing to acknowledge potentially stigmatizing experiences, these explanations are less consistent with the finding that ACE scores show a graded relationship to health outcomes in older cohorts.[30] These factors might diminish any effects of rural residence on ACE prevalence.

APPROACH

In this study, we examined the rural prevalence of individual ACE categories and assessed overall levels of exposure to ACEs in rural settings. We also tested for rural-urban differences on each type of ACE and on overall ACE exposure.

Data Sources

The study was based on data from the Behavioral Risk Factor Surveillance System (BRFSS), a telephone survey designed by the Centers for Disease Control and Prevention (CDC) and conducted by state health departments in collaboration with the CDC.[32] States select random survey samples from adults living in households with landline telephones and from adult users of cellular telephones.[32] Sampling and weighting procedures ensure that each state's data are representative of its adult, non-institutionalized population.

Core BRFSS questions that must be administered to all survey participants each year include items on demographics, health insurance status, perceived overall health, chronic health conditions, and health behaviors.[33-35] The BRFSS also includes an optional module on ACEs.[36] States can choose to administer this module to all their BRFSS participants or to subsets of their survey samples.[32] All data are self-reported.[32]

We obtained BRFSS data from 11 states that included the ACE module in their surveys for one or more years between 2011 and 2013. We received 2011 data from Maine,[37] Minnesota,[38] Montana,[39] Nebraska,[40] Nevada,[41] Vermont,[42] and Washington;[43] 2012 data from Connecticut,[44] Iowa,[45] and North Carolina;[46] and 2013 data from Iowa,[45] and Utah.[47] We combined these state data for both landline and cellular telephone respondents into a single analytic file according to guidelines published by the CDC.[48-50]

Variables

Dependent Variables

Our dependent variables included eight types of ACEs assessed in the original ACEs study by Felitti, Anda, and colleagues (see Background section above for list).[1,51-52]

For analyses examining overall ACE exposure, we devised an ACE summary score with values ranging from zero to eight by counting the ACE types reported by each respondent.[53] Using this score, we created a three-level ACE summary variable that classified respondents as having no ACEs, one to three ACEs, or four to eight ACEs. We also constructed a dichotomous summary measure that distinguished respondents who reported four or more ACES from those who reported fewer than four. In choosing this cut point, we followed the example of recent studies based on the ACE module of the BRFSS: these studies demonstrated that ACE scores of four or higher identified adults at elevated

risk for a range of negative health outcomes in adults.[23,45,54,55]

Independent Variables

In bivariate and multivariate analyses, the primary independent variable of interest was rural residence. Our rural residence measure was based on the 2013 Rural-Urban Continuum Code (RUCC) system devised by the United States Department of Agriculture's Economic Research Service.[56] The RUCC system classifies metropolitan counties by the population size of their metropolitan areas, and non-metropolitan counties by their degree of urbanization and adjacency to metropolitan areas. Application of these criteria results in a 9-level continuum from large metropolitan (RUCC 1) to completely rural and non-adjacent to metropolitan areas (RUCC 9). Some states in our sample provided us with the RUCCs associated with their data, and others supplied us with county codes that we converted to RUCCs. RUCCs 1 through 3 designated metropolitan counties of varying population sizes, and RUCCS 4 through 9 reflected degrees of rurality within non-metropolitan counties. In order to achieve adequate cell sizes in our analyses, we collapsed RUCCS 4 through 9 into a single rural category. We also collapsed RUCCs 1 through 3 into one level representing urban areas. Thus, we created a dichotomous variable classifying counties as either rural or urban.

Covariates

For our adjusted analysis, we selected the following covariates with demonstrated or hypothesized associations with rural residence, level of ACE exposure, or both: age, gender, and race/ethnicity.

Analyses

We conducted chi-square analyses to test for bivariate differences by rural residence in individual ACEs and level of ACE exposure (i.e., summary score level). We used logistic regression analysis to assess the main effect of rural residence on overall ACE exposure, controlling for the covariates described above. Because of the complex sampling structure of the BRFSS, all analyses were conducted with weighted data in SUDAAN using Taylor series linearization techniques. None of the findings reported here are derived from calculations with unweighted denominators less than 50, unweighted numerators less than 30, or relative standard errors greater than 30%. Unless otherwise stated, all reported findings are statistically significant at the 0.01 level or lower. Ninety-five percent confidence intervals (CI) are indicated for each estimate.

FINDINGS

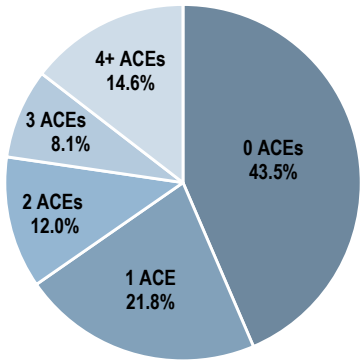
Sample Characteristics

A total of 103,203 respondents were included in our analytic sample. Of these, 78.4% (CI = 77.9-78.9) were White, 7.9% (CI = 7.5-8.2) were African American, 7.4% (CI = 7.1-7.8) were Hispanic, and 6.4% (CI = 6.1-6.7) belonged to other ethnic groups. (Percentages given for White, African American, and other ehtnic groups all refer to respondents who described themselves as non-Hispanic.) Approximately one quarter of the sample (27.2%, CI = 26.8-27.6) lived in rural areas. More than one third (40.6%, CI = 40.0-41.1) reported no ACES, 44.2% (CI = 43.7-44.8) reported one to three ACES, and 15.2% (CI = 14.8-15.7) reported four or more ACES.[57]

Patterns of ACEs in Rural Populations

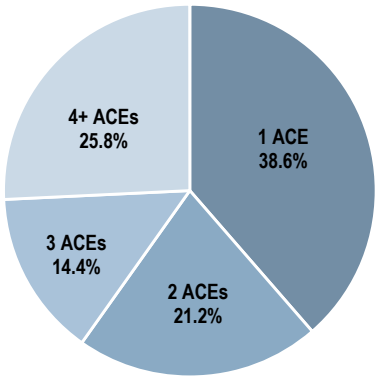
Results demonstrate that ACEs are common among rural residents. Over half (56.5%, CI = 55.6-57.3) of rural respondents indicated that they had been exposed to at least one ACE (see Figure 1). About one fifth (21.8%, CI = 21.1-22.6) reported only one ACE, 12.0% (CI = 7.7-8.7) reported two ACEs, 8.1% (CI = 7.7-8.7) reported three ACEs, and 14.6% (CI = 13.9-15.2) stated that they had experienced four or more ACEs.

Figure 1. Prevalence of Overall ACE Exposure among Rural Adults



Source: 2011-2013 Behavioral Risk Factor Surveillance System-11 states

Figure 2. Prevalence of Overall ACE Exposure among Rural Adults with One or More ACEs



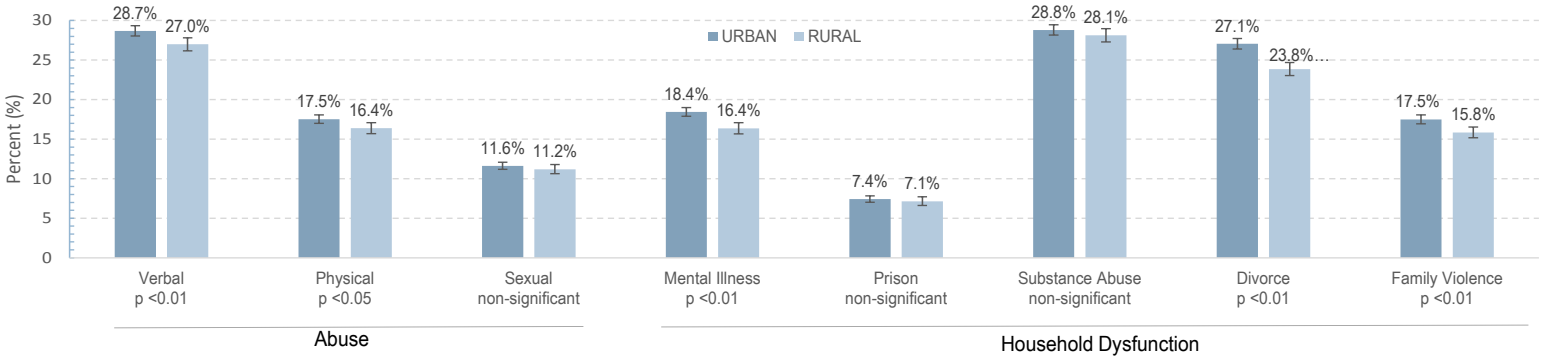
Source: 2011-2013 Behavioral Risk Factor Surveillance System-11 states

In addition, ACEs often occur together in rural populations. Figure 2 displays the distribution of overall ACE scores for rural residents who reported at least one ACE in their histories. As shown, 21.2% (CI = 20.2-22.3) of this group had two ACEs, 14.4% (CI = 13.6-15.3) had three ACEs, and over one quarter (25.8%, CI = 24.7-26.9) had four or more ACEs.

(rural 11.2%, CI = 10.6-11.8 versus urban 11.6%, CI = 11.2-12.1), incarceration of family members (rural 7.1%, CI = 6.6-7.7 versus urban 7.4%, CI = 7.0-7.8), or substance abuse in the household (rural 28.1%, CI = 26.4-27.7 versus urban 28.8%, CI = 28.1-29.5).

Further unadjusted chi-square tests demonstrated that relative to those in urban areas, rural residents

Figure 3. Prevalence of ACE Types in Rural and Urban Adults



Source: 2011-2013 Behavioral Risk Factors Surveillance System-11 states

Patterns of ACEs in Rural and Urban Populations: Similarities and Differences

The rank ordering of ACE types by prevalence appears to be similar across rural and urban respondents. The most common ACE in both rural and urban settings was childhood exposure to a household member's abuse of alcohol or drugs (see Figure 3). For both rural and urban groups, verbal abuse and parental separation/divorce were the second and third most prevalent ACE categories, respectively, whereas indirect exposure to family violence, direct experiences of sexual abuse, and the incarceration of a household member were the three least prevalent.

CChi-square tests unadjusted for demographic factors showed that rural residents were slightly but significantly less likely than their urban peers to report exposure to five types of ACES (see Figure 3). These five categories included verbal abuse (27.0%, CI = 26.2-27.8 versus 28.7%, CI = 28.1-29.3), physical abuse (16.4%, CI = 15.7-17.1 versus 17.5%, CI = 17.0-18.1, $p < 0.05$), mental illness in the family (16.4%, CI = 15.7-17.1 versus 18.4%, CI = 17.9-19.0), witnessing family violence (15.8%, CI = 15.2-16.5 versus 17.5%, CI = 16.9-18.1), and parental separation/divorce (23.8%, CI = 23.1-24.7 versus 27.1%, CI = 26.4-27.7). There were no significant rural-urban differences on reported prevalence of childhood sexual abuse

were more likely to report that they had no ACEs in their history (43.5%, CI = 42.7-44.4 versus 39.4%, CI = 38.8-40.1), less likely to report one to three ACEs (42.0%, CI = 41.0-42.8 versus 45.1%, 44.4-45.8), and less likely to report four or more ACEs (14.6%, CI = 13.9-15.2 versus 15.5%, 15.0-16.0). The lower unadjusted levels of ACEs in rural settings appeared at least partially attributable to the fact that rural residents were more likely to be 45 years of age or older (57.8%, CI = 56.9-58.7 versus 51.3%, CI = 50.6-51.9). Age, in turn, was inversely related to overall ACE exposure. The proportion of respondents reporting zero ACEs was 34.7% (CI = 33.8-35.7) for those in the 18-to-44 age range, 39.7% (CI = 39.0-40.5) for those aged 45 to 64, and 57.1% (CI = 56.2-58.0) for those aged 65 and older.

A logistic regression model of main effects was constructed to assess the relationship between place of residence and overall ACE exposure after controlling for demographic characteristics including age, gender, and ethnicity. Results are presented in Table 1. The odds ratio of 0.98 indicated that the odds of exposure to four or more ACEs was 2% lower for rural than for urban residents. As indicated in the table, this finding was non-significant. In other words, after adjustment for demographics, the odds of high ACE exposure did not differ significantly across rural and urban groups (see Table 1).

Table 1: Adjusted Odds of Overall Exposure to Adverse Childhood Experiences (ACEs)

Characteristic (Referent)	Overall ACE Exposure	
	OR	95% CI
Residence (urban)		
Rural	0.98[n.s.]	0.91-1.05
Age (45 -64)		
18-44	1.41****	1.32-1.52
65+	0.34****	0.31-0.38
Gender (male)		
Female	1.44****	1.34-1.55
Ethnicity (White, non-Hispanic)		
Black, non-Hispanic	0.87[n.s.]	0.74-1.03
American Indian/Alaskan Native/Other, non-Hispanic	1.25**	1.09-1.44
Hispanic	0.92[n.s.]	0.79-1.07
	N	93,328
	df	7

Data: 2011-2013 Behavioral Risk Factor Surveillance System, 11 states
* p < 0.05, ** p < 0.01, ***p < 0.001, **** p < 0.0001, [n.s.]non-significant

DISCUSSION

Results of this investigation suggest that ACEs are a significant problem among rural adults. Over half of rural residents described experiencing at least one ACE, and more than one in ten reported high overall ACE levels (four or more ACEs). Although unadjusted analyses indicated that rural residents reported lower levels of overall ACE exposure than their urban counterparts, this rural-urban difference did not persist after controlling for age, gender, and ethnicity. Moreover, the rank ordering of the eight ACE categories by prevalence was nearly identical for rural and urban populations, with exposure to a family member's substance abuse being the most common type of ACE in each setting. Thus, in both its extent and its nature, the ACE burden borne by adults appears similar across rural and urban contexts.

Limitations

Characteristics of the data set used in this investigation limit its generalizability. To begin with, the states contributing data to our study had a higher proportion of White, non-Hispanic residents than the nation as a whole. Whereas non-Hispanic White respondents made up 64.6% of the national BRFSS sample in 2013,[58] they comprised over three quarters of the study sample. Therefore, our findings may not adequately reflect the experience of non-White, ethnic minorities or Hispanic people. In addition, a relatively large proportion of participants—10.3% of the weighted sample--had missing data on four or more ACE categories,[59] and summary scores could not be calculated for these individuals.

Other limitations to the study include the fact that its cross-sectional design does not permit us to draw conclusions about temporal or causal associations between independent and dependent variables. Moreover, because it was necessary for us to combine geocodes reflecting gradations of rurality into a single rural category in order to ensure adequate cell sizes, our findings may underestimate the strength of relationships between rural residence and dependent variables.

Policy Implications

This investigation suggests that, relative to their urban peers, rural adults have experienced comparable exposure to ACEs. Thus, in rural and urban populations alike, ACEs may be an important factor increasing risk for poor health outcomes[1,2,8,16] and disturbances in family relationships.[10,13,14] In light of this finding, it appears that efforts to prevent ACEs and reduce ACE-related morbidity are warranted in rural as well as urban settings. However, ACE-focused initiatives in rural communities will need to account for the distinctive

features of local rural cultures and rural health delivery systems.

In the discussion that follows, we briefly describe promising practices for reducing the prevalence and impact of ACEs. Next, we note factors that could impede implementation of such practices in rural contexts. Finally, we suggest ways that stakeholders and policy makers can help craft effective rural responses to ACEs.

Recommended Practices for ACE Prevention

Secure, nurturing relationships within families are essential to ACE prevention. Positive family relationships can reduce the incidence of child maltreatment, while at the same time helping children to develop resilience,[17,20] the constellation of social and self-regulation skills that have been shown to buffer people from the harmful effects of ACE-related stress.[7,30,60,61]

Experts suggest that primary care providers play a key role in ACE prevention and resilience-building. In the context of well-child visits beginning in infancy, providers can offer families routine anticipatory guidance to promote positive parenting practices, caregiver well-being, and collaborative relationships among all caregivers in the family.[17] The *Bright Futures* framework for pediatric health supervision is one widely recognized resource on how to provide such guidance.[18] Providers can also screen families for ACE risk factors and facilitate referrals to appropriate services.[18] These might include treatment for behavioral health issues in children or parents; community-based, empirically supported parent training such as the Triple P[62] or Incredible Years[63] programs; and evidence-based home visiting models such as the Nurse-Family Partnership.[20] Physician practices can enhance referral impact by coordinating any services families receive.

Physician practices that deliver care to families according to the guidelines described above will be serving many of the core functions of the family-centered medical home (FCMH). The FCMH, which shares key features with the patient-centered medical home,[64] is a practice model in which patients receive readily accessible, comprehensive, continuous, and culturally competent care that empowers parents as decision-makers for their children.[65] Research has demonstrated that when families receive care consistent with the FCMH model, children have fewer ACEs and show greater resilience,[60] while parents report less caregiving stress.[66]

Recommended Practices for Decreasing the Health Impacts of ACE Exposures

Primary care providers who identify ACE exposures in child or adult patients are advised to incorporate principles of trauma-informed care[67] into their work with these patients. Within the framework of trauma-informed care, providers recognize that ACEs can increase risk for health-harming behaviors while at the same time leading to difficulties with patient engagement in treatment.[11,67] To mitigate these effects, providers who deliver trauma-informed care adopt measures to strengthen their therapeutic alliances with patients and, as appropriate, with their families. These measures may include educating patients about ACEs and health, collaborating with patients on clinical decision-making, explicitly respecting patient choices, and linking patients to trauma-specific services as needed.[11,67] Trauma-informed approaches are believed to improve treatment adherence,[19] experience of care,[19] and outcomes[68] in patients with ACE histories

Rural Implementation Considerations

Rural health care environments are often characterized by inadequate funds,[69] primary care workforce shortages,[69,70] and barriers to the implementation of electronic health records.[71] Behavioral health treatment and evidence-based family supports may also be scarce, due to the limited supply of behavioral health professionals in rural areas.[69,70] For all these reasons, rural pediatric and primary care practices may find it challenging to implement the screening, preventive interventions, referrals, and care coordination that are recommended as measures to address ACEs.[70-72] Moreover, because concerns about behavioral health-related stigma are prominent in rural areas,[73-75] rural patients may be especially reluctant to engage with providers in discussing ACE risk factors, ACE exposures, or behavioral health needs stemming from ACEs. They may also hesitate to make use of treatment and supports.

Strategies for Strengthening Rural Capacity to Respond to ACEs

To overcome the lack of formal resources for combatting ACEs in rural regions, health care organizations serving rural areas could design delivery system improvement projects with ACE-focused components. Three new grant programs administered by the Federal Office of Rural Health Policy could serve as potential funding sources for such efforts: these include the Rural Health

Care Coordination,[76] Rural Health Network Development,[77] and Small Health Care Provider Quality Improvement[78] programs.

The federal Home Visiting Program (HVP)[79] represents another possible source of resources for enhancing rural ACE prevention. Administered by the Health Resources and Services Administration in partnership with Administration for Children and Families, the HVP awards grants to states to facilitate delivery of empirically supported, home-based services designed to prevent adverse child outcomes in vulnerable families.[79] In 2014, HVP services were provided in 30% of urban counties and in only 17% of rural counties.[79] Rural stakeholders and policy makers could consider advocating for increased rural access to HVP funding.

As a further measure for building capacity, rural primary care providers could forge ACE-focused interest groups with representatives from local community mental health centers, public health departments, schools, and other agencies. In rural environments where stigma strongly influences prevailing attitudes about behavioral health, the active involvement of trusted local organizations may be critical to the success of any ACE-focused initiatives. With the participation of such stakeholders, provider-led community partnerships would be well positioned to raise public awareness about ACEs, conduct ACE-related community needs assessments, and work toward creating new services, both in the community and in health care settings.[17] Policy makers should devise mechanisms for funding these ACE-focused collaboratives. Activities along these lines could help form a basis for long-term, population-based approaches to preventing ACEs and decreasing their impact in rural America.

Acknowledgments

We thank the following state agencies for providing us with data from their state Behavioral Risk Factor Surveillance System (BRFSS) surveys: Health and Surveillance Statistics Section, State of Connecticut, Department of Public Health; Iowa Department of Public Health; Maine Center for Disease Control and Prevention; Behavioral Risk Factor Surveillance System Office, Montana Department of Public Health and Human Services; Epidemiology and Informatics Unit, Division of Public Health, Nebraska Department of Health and Human Services; Division of Public and Behavioral Health, Nevada Department of Health and Human Services; Office of Public Health Assessment, Utah Department of Health; Division of Health Surveillance, Vermont Department of Health; Center for Health Statistics, Washington State Department of Health.

We also thank the following state agencies for providing us with Rural-Urban Continuum Codes to link to BRFSS public use files: Center for Health Statistics, Minnesota Department of Health; State Center for Health Statistics, Division of Public Health, North Carolina Department of Health and Human Services.

The state agencies listed above bear no responsibility for our use of BRFSS data or for our interpretations and inferences based on such uses.

Approved by the Federal Office of Rural Health Policy, February 2016. Approved for release by Montana, Nebraska, and Utah, April 2016.

Endnotes

1. Felitti VJ, Anda RF, Nordenberg D, et al. Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults. The Adverse Childhood Experiences (ACE) Study. *Am J Prev Med*. May 1998;14(4):245-258.
2. Anda RF, Brown DW, Dube SR, Bremner JD, Felitti VJ, Giles WH. Adverse Childhood Experiences and Chronic Obstructive Pulmonary Disease in Adults. *Am J Prev Med*. May 2008;34(5):396-403.
3. Anda RF, Croft JB, Felitti VJ, et al. Adverse Childhood Experiences and Smoking During Adolescence and Adulthood. *JAMA*. Nov 3 1999;282(17):1652-1658.
4. Dube SR, Anda RF, Felitti VJ, Edwards VJ, Croft JB. Adverse Childhood Experiences and Personal Alcohol Abuse as an Adult. *Addict Behav*. Sep-Oct 2002;27(5):713-725.
5. Dube SR, Felitti VJ, Dong M, Chapman DP, Giles WH, Anda RF. Childhood Abuse, Neglect, and Household Dysfunction and the Risk of Illicit Drug Use: The Adverse Childhood Experiences Study. *Pediatrics*. Mar 2003;111(3):564-572.
6. Kendall-Tackett K. Psychological Trauma and Physical Health: A Psychoneuroimmunology Approach to Etiology of Negative Health Effects and Possible Interventions. *Psychol Trauma*. 2009;1(1):35-48.
7. Shonkoff JP, Garner AS. The Lifelong Effects of Early Childhood Adversity and Toxic Stress. *Pediatrics*. Jan 2012;129(1):e232-246.
8. Widom CS, Horan J, Brzustowicz L. Childhood Maltreatment Predicts Allostatic Load in Adulthood. *Child Abuse Negl*. 2015;47:59-69.
9. Chartier MJ, Walker JR, Naimark B. Childhood Abuse, Adult Health, and Health Care Utilization: Results from a Representative Community Sample. *Am J Epidemiol*. May 1 2007;165(9):1031-1038.

10. Dixon L, Browne K, Hamilton-Giachritsis C. Risk Factors of Parents Abused as Children: A Mediational Analysis of the Intergenerational Continuity of Child Maltreatment (Part I). *J Child Psychol Psychiatry*. Jan 2005;46(1):47-57.

11. Machtinger EL, Cuca YP, Khanna N, Rose CD, Kimberg LS. From Treatment to Healing: The Promise of Trauma-Informed Primary Care. *Womens Health Issues*. May-Jun 2015;25(3):193-197.

12. Zen AL, Whooley MA, Zhao S, Cohen BE. Post-Traumatic Stress Disorder Is Associated with Poor Health Behaviors: Findings from the Heart and Soul Study. *Health Psychol*. Mar 2012;31(2):194-201.

13. Ehrensaft MK, Cohen P, Brown J, Smailes E, Chen H, Johnson JG. Intergenerational Transmission of Partner Violence: A 20-Year Prospective Study. *J Consult Clin Psychol*. 2003;71(4):741-753.

14. Noll JG, Trickett PK, Harris WW, Putnam FW. The Cumulative Burden Borne by Offspring Whose Mothers Were Sexually Abused as Children Descriptive Results from a Multigenerational Study. *Journal of Interpersonal Violence*. 2009;24(3):424-449.

15. Korhonen MJ, Halonen JI, Brookhart MA, et al. Childhood Adversity as a Predictor of Non-Adherence to Statin Therapy in Adulthood. *PLoS One.* 2015;10(5):e0127638.

16. Ballard ED, Van Eck K, Musci RJ, et al. Latent Classes of Childhood Trauma Exposure Predict the Development of Behavioral Health Outcomes in Adolescence and Young Adulthood. *Psychol Med*. 2015;45:3305-3316.

17. Garner AS, Shonkoff JP, Committee on Psychosocial Aspects of C, et al. Early Childhood Adversity, Toxic Stress, and the Role of the Pediatrician: Translating Developmental Science into Lifelong Health. *Pediatrics*. Jan 2012;129(1):e224-231.

18. Hagan J, Shaw J, Duncan P. *Bright Futures: Guidelines for Health Supervision*. Elk Grove Village, IL: American Academy of Pediatrics;2008.

19. Kaiser Permanente, National Council for Behavioral Health. *Trauma-Informed Primary Care Initiative*. Presented at the Learning Community Informational Webinar; April 15-16, 2015.

20. National Center for Injury Prevention and Control, Division of Violence Prevention. *Essentials for Childhood: Steps to Create Safe, Stable, Nurturing Relationships and Environments*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control; August, 2014.

21. Baum A, Peterson-Hickey M. *Adverse Childhood Experiences in Minnesota*. St. Paul, MN: Minnesota Department of Health;2011.

22. Gudmonson CG, Ryherd LM, Bougher K, Downey J, Zhang D. *Adverse Childhood Experiences in Iowa: A New Way of Understanding Lifelong Health*. ACEs 360 Iowa;2013.

23. Oreskovich J, Ballew C. *The Prevalence of Adverse Childhood Experiences (ACEs) and Their Association with Current Health, Montana Behavioral Risk Factor Surveillance System (BRFSS), 2011*. Helena, MT: Montana Department of Public Health and Human Services;2013. Montana Fact[or]s; No. 1.

24. United States Department of Health and Human Services, Health Resources and Services Administration. *The Health and Well-Being of Children in Rural Areas: A Portrait of the Nation 2011-2012*. Rockville, MD: HRSA; April, 2015.

25. O'Hare W, Curry-White B. *The Rural Underclass: Examination of Multiple-Problem Populations in Urban and Rural Settings*. Washington, D.C.: Population Reference Bureau, Inc.; January, 1992.

26. Doan SN, Dich N, Evans GW. Childhood Cumulative Risk and Later Allostatic Load: Mediating Role of Substance Use. *Health Psychol*. Nov 2014;33(11):1402-1409.

27. Dubowitz H, Kim J, Black MM, Weisbart C, Semiatin J, Magder LS. Identifying Children at High Risk for a Child Maltreatment Report. *Child Abuse Negl*. Feb 2011;35(2):96-104.

28. Escaravage JH. Child Maltreatment Entrenched by Poverty: How Financial Need Is Linked to Poorer Outcomes in Family Preservation. *Child Welfare*. 2014;93(1):79-98.

29. Sintov ND, Kendler KS, Walsh D, Patterson DG, Prescott CA. Predictors of Illicit Substance Dependence among Individuals with Alcohol Dependence. *J Stud Alcohol Drugs*. Mar 2009;70(2):269-278.

30. Possible reasons for higher overall ACE scores in younger cohorts include increases over time in rates of divorce, incarceration, and illicit drug use. See: Logan-Greene P, Green S, Nurius PS, Longhi D. Distinct Contributions of Adverse Childhood Experiences and Resilience Resources: A Cohort Analysis of Adult Physical and Mental Health. *Soc Work Health Care*. 2014;53(8):776-797.

31. Cromartie J, Nelson P. *Baby Boom Migration and Its Impact on Rural America*. Washington, DC: Economic Research Service, U.S. Department of Agriculture;2009.

32. Centers for Disease Control and Prevention. The BRFSS Data User Guide. [web page]. 2013, August 15. Available at: **http://www.cdc.gov/brfss/data_documentation/PDF/UserguideJune2013.pdf**. Accessed September 23, 2015.

33. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire. [web page]. 2011, January 27. Available at: **http://www.cdc.gov/brfss/questionnaires/pdf-ques/2011brfss.pdf**. Accessed September 23, 2015.

34. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire. [web page]. 2012, January 6. Available at: **http://www.cdc.gov/brfss/questionnaires/pdf-ques/2012_brfss.pdf**. Accessed September 23, 2015.

35. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Questionnaire. [web page]. 2013, December 28. Available at: **http://www.cdc.gov/brfss/questionnaires/pdf-ques/2013%20brfss_english.pdf**. Accessed September 23, 2015.

36. Bynum L, Griffin T, Ridings DL, et al. Adverse Childhood Experiences Reported by Adults — Five States, 2009. *Morbidity and Mortality Weekly Report*. December 17 2010;59(49):1609-1613.

37. Maine Center for Disease Control and Prevention. *Maine Behavioral Risk Factor Surveillance System Survey Data*. Augusta, ME: Maine Center for Disease Control and Prevention;2011.

38. Centers for Disease Control and Prevention. *Behavioral Risk Factor Surveillance System Survey Data*. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention;2011.

39. Montana Department of Public Health and Human Services. *Montana Behavioral Risk Factor Surveillance System*. Helena, MT: Montana DHHS, Behavioral Risk Factor Surveillance System Office;2011.

40. Nebraska Department of Health and Human Services. *Nebraska Behavioral Risk Factor Surveillance System Survey Data*. Lincoln, NE: Nebraska DHHS, Division of Public Health, Epidemiology and Informatics Unit;2011.

41. Nevada Division of Public and Behavioral Health. *Nevada Behavioral Risk Factor Surveillance System Survey Data*. Carson City, NV: Nevada Department of Health and Human Services;2011.

42. Vermont Department of Health. V*ermont Behavioral Risk Factor Surveillance System Survey Data*. Burlington, VT: Vermont Department of Health, Division of Health Surveillance;2011.

43. Washington State Department of Health. *Behavioral Risk Factor Surveillance System*. Spokane, WA: Washington State Department of Health, Center for Health Statistics;2011.

44. Connecticut Department of Public Health. *Connecticut Behavioral Risk Factor Surveillance System Survey Data*. Hartford, CT: Connecticut Department and Public Health, Health Statistics and Surveillance Section;2012.

45. Iowa Department of Public Health. *Iowa Behavioral Risk Factor Surveillance System Survey Data, 2012-2013*. [web page]. 2016. Accessed February 17, 2016.

46. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System Annual Survey Data. [web page]. 2016. Available at: **http://www.cdc.gov/brfss/annual_data/annual_data.htm**. Accessed February 17, 2016.

47. Utah Department of Health. *Utah Behavioral Risk Factor Surveillance Survey Data*. Salt Lake City, UT Utah Department of Health,Office of Public Health Assessment;2013.

48. Centers for Disease Control and Prevention. Preparing 2011 BRFSS Module Data for Analysis. 2013. Available at: **http://www.cdc.gov/brfss/annual_data/2011/BRFSS2011_Analysis.pdf**. Accessed September 23, 2015.

49. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System: Module Data for Analysis for 2012 BRFSS. 2013, July 15. Available at: **http://www.cdc.gov/brfss/annual_data/2012/pdf/analysisofmodules_2012.pdf**. Accessed September 23, 2015.

50. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System: Module Data for Analysis for 2013 BRFSS. 2014, August. Available at: **http://www.cdc.gov/brfss/annual_data/2013/pdf/analysisofmodules_2013.pdf**. Accessed September 23, 2015.

51. The ACE module includes 11 questions that yield eight categories of ACEs. Respondents were told that questions referred to the time when they were less than 18 years old. For a full description of each question in the ACE module, see: Bynum L, Griffin T, Ridings D, et al. Adverse Childhood Experiences Reported by Adults — Five States, 2009. *Morbidity and Mortality Weekly Report*. 2010; 59(49):1609-1613.

52. Across the 11 ACE items, the weighted proportions of respondents answering 'don't know/not sure' ranged from 0.2% to 1.1%, and the proportion who refused to answer ranged from 0.5% to 1.1%. Items were recoded so that 'don't know/not sure' responses, refusals, and missing data were all defined as missing.

53. Those who had missing responses on four or more of the eight ACE categories were assigned a value of missing on the two-level ACE summary score.

54. Campbell JA, Walker RJ, Egede LE. Associations between Adverse Childhood Experiences, High-Risk Behaviors, and Morbidity in Adulthood. *Am J Prev Med*. 2015.

55. Font SA, Maguire-Jack K. Pathways from Childhood Abuse and Other Adversities to Adult Health Risks: The Role of Adult Socioeconomic Conditions. *Child Abuse Negl*. 2015;51:390-399.

56. United States Department of Agriculture, Economic Research Service. Rural-Urban Continuum Codes. Overview. Documentation. 2013. Available at: **http://www.ers.usda.gov/data-products/rural-urban-continuum-codes.aspx**. Accessed August 6, 2015.

57. In their 2010 analysis of data from the five states that administered the ACE module in the 2009 BRFSS, CDC researchers reported nearly identical frequencies across these categories (40.6%, 44.3%, and 15.2%, respectively). See: Bynum L, Griffin T, Ridings DL, et al. Adverse Childhood Experiences Reported by Adults — Five States, 2009. *Morbidity and Mortality Weekly Report*. December 17 2010;59(49):1609-1613.

58. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System 2013 Codebook Report. 2014, October 24. Available at: http://www.cdc.gov/brfss/annual_data/2013/pdf/codebook13_llcp.pdf. Accessed September 23, 2015.

59. Factors contributing to this high percentage of missing ACE data may have been the sensitive nature of the questions and the position of the ACE questions in the BRFSS survey. Like all optional BRFSS modules, the ACE module is administered toward the end of the survey, when respondents are more likely to discontinue their participation due to fatigue. See: Centers for Disease Control and Prevention. The BRFSS Data User Guide. [web page]. 2013, August 15. Available at: http://www.cdc.gov/brfss/data_documentation/PDF/UserguideJune2013.pdf. Accessed September 23, 2015

60. Bethell CD, Newacheck P, Hawes E, Halfon N. Adverse Childhood Experiences: Assessing the Impact on Health and School Engagement and the Mitigating Role of Resilience. *Health Aff (Millwood)*. December 1, 2014 2014;33(12):2106-2115.

61. Wrenn GL, Wingo AP, Moore R, et al. The Effect of Resilience on Posttraumatic Stress Disorder in Trauma-Exposed Inner-City Primary Care Patients. *J Natl Med Assoc*. Jul 2011;103(7):560-566.

62. Prinz RJ, Sanders MR, Shapiro CJ, Whitaker DJ, Lutzker JR. Population-Based Prevention of Child Maltreatment: The U.S. Triple P System Population Trial. *Prev Sci*. Mar 2009;10(1):1-12.

63. Borden LA, Schultz TR, Herman KC, Brooks CM. The Incredible Years Training Program: Promoting Resilience through Evidence-Based Prevention Groups. *Group Dyn*. 2010;14(3):230-241.

64. American Academy of Family Physicians, American Academy of Pediatrics, American College of Physicians, American Osteopathic Association. Joint Principles of the Patient-Centered Medical Home. [web page]. 2007, February. Available at: http://www.aafp.org/dam/AAFP/documents/practice_management/pcmh/initiatives/PCMHJoint.pdf. Accessed November 20, 2015.

65. Medical Home Initiatives for Children With Special Needs Project Advisory Committee, American Academy of Pediatrics. The Medical Home. *Pediatrics*. July 1 2002;110(1).

66. Ghandour RM, Perry DF, Kogan MD, Strickland BB. The Medical Home as a Mediator of the Relation between Mental Health Symptoms and Family Burden among Children with Special Health Care Needs. *Acad Pediatr*. Mar-Apr 2011;11(2):161-169.

67. Substance Abuse and Mental Health Services Administration. *SAMHSA's Concept of Trauma and Guidance for a Trauma-Informed Approach*. Rockville, MD: Substance Abuse and Mental Health Services Administration;2014.

68. Yoe J, Goan SK, Hornby H. *THRIVE: Maine's Trauma-Informed System of Care*. South Portland, ME: Hornby Zeller Associates;2012. Final Evaluation Report.

69. Hauenstein EJ. Building the Rural Mental Health System: From De Facto System to Quality Care. *Annu Rev Nurs Res*. 2008;26:143-173.

70. Semansky R, Willging C, Ley DJ, Rylko-Bauer B. Lost in the Rush to National Reform: Recommendations to Improve Impact on Behavioral Health Providers in Rural Areas. *J Health Care Poor Underserved*. May 2012;23(2):842-856.

71. Gale JA, Hartley D, Croll Z. *Meaningful Use of Electronic Health Records by Rural Health Clinics*. Portland, ME: University of Southern Maine, Muskie School of Public Service, Maine Rural Health Research Center; February, 2014. Working Paper #52.

72. MacKinney AC, Ullrich F, Mueller K. *Patient-Centered Medical Home Services in 29 Rural Primary Care Practices: A Work in Progress*. Iowa City, IA: RUPRI Center for Rural Health Policy Analysis, University of Iowa College of Public Health, Department of Health Management and Policy; September, 2011.

73. Hoyt DR, Conger RD, Valde JG, Weihs K. Psychological Distress and Help Seeking in Rural America. *Am J Community Psychol*. Aug 1997;25(4):449-470.

74. Murry VM, Heflinger CA, Suiter SV, Brody GH. Examining Perceptions About Mental Health Care and Help-Seeking among Rural African American Families of Adolescents. *J Youth Adolesc*. Sep 2011;40(9):1118-1131.

75. Rost K, Smith GR, Taylor JL. Rural-Urban Differences in Stigma and the Use of Care for Depressive Disorders. *J Rural Health*. Winter 1993;9(1):57-62.

76. United States Department of Health and Human Services, Health Resources and Services Administration. Rural Health Care Coordination Network Partnership Program (Care Coordination Program). [web page]. 2016. Available at: http://www.hrsa.gov/ruralhealth/community/index.html. Accessed February 17, 2016.

77. United States Department of Health and Human Services, Health Resources and Services Administration. Rural Health Network Development Program. Available at: http://www.hrsa.gov/ruralhealth/community/index.html. Accessed October 20, 2015.

78. United States Department of Health and Human Services, Health Resources and Services Administration. Small Health Care Provider Quality Improvement. Available at: http://www.hrsa.gov/ruralhealth/about/community/smallhealthcare.html. Accessed October 20, 2015.

79. U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau. *The Maternal, Infant, and Early Childhood Home Visiting Program: Partnering with Parents to Help Children Succeed*. Rockville, MD: HRSA;2015.

Maine Rural Health Research Center
http://usm.maine.edu/muskie/cutler/mrhrc
Muskie School of Public Service, 34 Bedford Street
PO Box 9300, Portland, Maine 04104

RHRC
Rural Health Research & Policy Centers
Funded by the Federal Office of Rural Health Policy
www.ruralhealthresearch.org
CA#U1CRH03716

UNIVERSITY OF SOUTHERN MAINE
Muskie School of Public Service