



Published in final edited form as:

*J Rural Health*. 2021 June ; 37(3): 487–494. doi:10.1111/jrh.12530.

## Rural Primary Care Providers' Experience and Usage of Clinical Recommendations in the CDC Pediatric Mild Traumatic Brain Injury Guideline: A Qualitative Study

Jill Daugherty, PhD<sup>1</sup>, Dana Waltzman, PhD<sup>1</sup>, Shena Popat, MHA<sup>2</sup>, Amy Horn Groenendaal, BSW<sup>2</sup>, Margaret Cherney, BA<sup>2</sup>, Alana Knudson, PhD<sup>2</sup>

<sup>1</sup>Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, Division of Injury Prevention, Atlanta, Georgia <sup>2</sup>NORC at the University of Chicago, Bethesda, Maryland

### Abstract

**Purpose:** In 2018, the Centers for Disease Control and Prevention (CDC) released an evidence-based guideline on pediatric mild traumatic brain injury (mTBI) to educate health care providers on best practices of mTBI diagnosis, prognosis, and management/treatment. As residents living in rural areas have higher rates of mTBI, and may have limited access to care, it is particularly important to disseminate the CDC guideline to rural health care providers. The purpose of this paper is to describe rural health care providers' experience with pediatric mTBI patients and their perceptions on incorporating the guideline recommendations into their practice.

**Method:** Interviews with 9 pediatric rural health care providers from all US regions were conducted. Interview transcripts were coded and analyzed for themes for each of the main topic areas covered in the interview guide.

**Findings:** Common causes of mTBI reported by health care providers included sports and all-terrain vehicles. While health care providers found the guideline recommendations to be helpful and feasible, they reported barriers to implementation, such as lack of access to specialists. To help with uptake of the CDC guideline, they suggested the development of concise implementation tools that can be referenced quickly, integrated into electronic health record-based systems, and that are customized by visit type and health care setting (eg, initial vs follow-up visits and emergency department vs primary care visits).

**Conclusion:** Length, accessibility, and usability are important considerations when designing clinical tools for busy rural health care providers caring for pediatric patients with mTBI. Customized information, in both print and digital formats, may help with uptake of best practices.

---

For further information, contact: Jill Daugherty, PhD, Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, Division of Injury Prevention, 4770 Buford Highway NE, Atlanta, GA 30341; JDaugherty@cdc.gov.

**Publisher's Disclaimer:** The findings and conclusions in this manuscript are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

## Keywords

concussion; health disparities; health education; injury prevention; rural

---

Unintentional injuries, including traumatic brain injury (TBI), are the leading cause of death and disability in children in the United States.<sup>1</sup> A recent review found that rural pediatric TBIs were more likely to have increased injury severity and often involved higher velocity injury mechanisms than others.<sup>2</sup> Additionally, a retrospective study of children using data collected as part of the Oregon Trauma Registry found that children living in rural areas had a TBI incidence rate about 50% greater than children living in urban areas.<sup>3</sup> Children in rural locations also had nearly twice the crude odds (OR = 1.8) of mortality after sustaining a TBI than children in urban locations. This held true even after adjusting for age, gender, race, insurance status, injury severity, and type of TBI.<sup>3</sup>

Rural communities face many barriers to TBI treatment and care. For example, numerous studies have shown that people who sustain a TBI in rural areas have difficulty accessing appropriate initial and follow-up care, face challenges accessing emergency care, and have higher costs for care.<sup>4-7</sup> Some of the main barriers to seeking TBI-related care and services initially include not knowing about services that are available, inability to pay, and lack of access to services.<sup>8</sup> Further, for those seeking emergency care, ambulance and helicopter transport or transfer is often necessary due to the great distance to trauma centers (often >60 miles).<sup>9</sup> Furthermore, total TBI-related health care costs may be higher for children living in rural areas compared to children living in urban areas, despite children in rural areas having lower rates of utilization of particular services (eg, speech therapy and mental health services).<sup>10</sup> Lastly, rural TBI patients are at risk of delays in care due to transport, weather, and mis-triage to non-trauma centers.<sup>2</sup>

Mild TBIs (mTBIs) make up the preponderance of pediatric TBI cases.<sup>11</sup> Thus, it is important that health care providers understand the best practices related to mTBI care. To help educate health care providers on the best practices of mTBI diagnosis, prognosis, and management for their pediatric patients, the United States Centers for Disease Control and Prevention (CDC) released a pediatric mTBI guideline in September 2018.<sup>12</sup> To help facilitate implementation of the guideline into clinical practice, CDC developed free and publicly available guideline implementation tools including a return-to-school letter for school staff and a checklist and fact sheets that summarize the clinical recommendations for health care providers. Materials for patients and their families included discharge instructions and a recovery tips handout.<sup>13</sup>

There has also been a concomitant recent focus at the CDC on improving the health and safety of rural populations<sup>14</sup> and reducing documented health disparities.<sup>15</sup> As research has highlighted that rural residents have both a higher TBI incidence and mortality rate than do residents of urban areas,<sup>3,4,16,17</sup> CDC sought opportunities to increase uptake of the guideline recommendations by rural health care providers. Moreover, as mTBI resources in rural areas may differ from those in urban areas, it is important to determine if current CDC guideline recommendations and implementation materials meet the needs of rural providers, as well as those of their pediatric patients and families.

The current qualitative study is a partnership between CDC and NORC at the University of Chicago's Walsh Center for Rural Health Analysis, an objective, non-partisan research institution. The purpose of this study was to (1) assess rural providers' experience in caring for pediatric patients with mTBI, (2) gather information on the perception of the clinical recommendations in the CDC's new pediatric mTBI guideline, and (3) determine the best way to present information to improve its usage.

## Methods

### Sample Selection

This qualitative study was carried out in spring 2019 following approval from the NORC Institutional Review Board. To ensure diverse representation (eg, geography, provider type, practice setting) in the sample, the research team recruited participants through targeted email outreach to 6 State Offices of Rural Health, 6 rural hospital executives, and 1 rural health researcher who identified organizations and individuals that met study criteria. A convenience sample of 4 respondents was then recruited via email through the members of the National Rural Health Association (NRHA) and individual emails to NRHA members that met the study criteria. Five respondents were recruited through National Organization of State Offices of Rural Health and National Association of Rural Health Clinics listserv announcements and targeted outreach. Providers were selected so that multiple health care settings (eg, primary care practice, emergency department [ED], and geographic regions) and provider types (medical doctors [MDs], nurse practitioners [NPs], and physician assistants [PAs]) were represented in the sample as TBIs can be diagnosed and managed in these various settings and by different types of providers (Table 1). Providers were also sampled so that all 4 US census regions were represented. Due to time and funding constraints, we were unable to recruit a larger study population. All in-depth interviews were conducted by telephone and scheduled at the providers' convenience. This approach was chosen as it allowed for flexibility with the providers' schedules and eliminated any need for travel.

### CDC Pediatric mTBI Guideline

The CDC pediatric mTBI guideline was developed based on findings of a rigorous systematic review that employed a modified GRADE (Grading of Recommendations Assessment, Development, and Evaluations) methodological approach.<sup>18</sup> The literature search that informed the systematic review identified more than 34,000 articles spanning over 25 years of research and was guided by 6 clinically relevant questions. The resultant guideline is inclusive of 19 sets of evidence-based clinical practice recommendations. Of these, 5 key practice-changing recommendations are as follows: (1) do not routinely image pediatric patients to diagnose mTBI; (2) use validated, age-appropriate symptoms scales to diagnose mTBI; (3) assess evidence-based risk factors for prolonged recovery; (4) provide patients with instructions on return to activity customized to their symptoms; and (5) counsel patients to return gradually to nonsports activities after no more than 2–3 days of rest.

In addition to the guideline itself, CDC created a suite of implementation tools to be used by health care providers. Available on the CDC website is a checklist on diagnosis and

management; Acute Concussion Evaluation (ACE) forms (for patient assessment); at-a-glance 1-page fact sheets on diagnosis, prognosis, and treatment; and a letter to schools to be filled out by a child's health care provider. Additionally, there is a "HEADS UP to healthcare providers" online training focused on the pediatric mTBI guideline, which is available for CME credits, and resources for patients and families. All of this information is provided at no cost to providers and families and has been disseminated through health care provider organizations and social media.

### Data Collection and Structured Interviews

Data were collected by trained female moderators (AK, SP, and AH). Each moderator had prior training and experience conducting qualitative research and other credentials (PhD, MHA, and BSW, respectively). All moderators were social science researchers at the time of the study. A structured interview guide containing 13 structured, open-ended questions, with follow-up questions asked when appropriate, was used. The interview questions were developed based on identified gaps in the literature. The full interview guide (see Appendix A in the Supporting Information) included 4 main topics: (1) background information about providers' mTBI practice, (2) challenges providers face in their mTBI practice, (3) recommended changes to the CDC pediatric mTBI guideline, and (4) feasibility of recommendations for implementation into practice. At least 2 weeks prior to their interview, each provider was given the full list of the 19 recommendation sets that are contained within the CDC pediatric mTBI guideline. The guideline recommendations that were shared with providers can be found in Appendix B in the Supporting Information and the full guideline and associated materials may be found online at <https://www.cdc.gov/traumaticbraininjury/PediatricmTBIGuideline.html>. A description of the study purpose was provided and oral consent to participate in a 30-minute interview and be audio-recorded was obtained before the start of each interview session. Each interview included the participant, one moderator, one notetaker, and up to one observer (another member of the research team). Study procedures were pilot tested with a retired rural physician prior to administration. Please see Appendix C in the Supporting Information for the full consolidated criteria for reporting qualitative research (COREQ) checklist.

### Analysis

We used a grounded theory approach to the analysis, which allowed for the examination of the providers' experiences and perceptions without predetermined themes or hypotheses.<sup>19</sup> This approach uses a set of procedures to identify themes that arise directly from the data. The themes are designed to capture the main concerns or feedback provided by study participants.<sup>19,20</sup> The interviews were recorded and transcribed verbatim. One researcher coded and analyzed the transcripts for themes using NVivo 12 (QSR International, Burlington, MA, 2018). The analysis explored emergent themes for the 4 main topic areas covered in the interview guide. Codes were compared to verify their descriptive content and to confirm that they were indeed grounded in the data. Nine interviews were conducted with rural health care providers but research staff reached data saturation after 7 interviews. This article represents a thematic reconstruction of the rural health care providers' responses to the interview questions.

## Results

The results are first organized by interview guide topic (large unbolded font); specific themes that arose from the interviews are indicated by large bolded font.

### **Information About Rural providers' Pediatric Patients with mTBI and Providers' Pediatric mTBI Practices**

#### **Sports and All-terrain Vehicles were Identified as Common Causes of mTBI—**

Most of the providers cited sports activities (such as football, cheerleading, bicycling, volleyball, and rock climbing) as common causes of mTBI among their pediatric patients. Many felt that football receives too much attention and requested data about other activities that cause mTBI. Four providers also shared that all-terrain vehicle (ATV) use is a frequent cause of mTBI among their pediatric patients, something they believe has received relatively little focus in mTBI prevention messaging thus far. A greater focus on ATV helmet usage was cited as an important need. Provider 1 remarked, “We see an awful lot of ATVs [causing injuries]. I can’t remember the last time I had a kid that was injured on an ATV that was actually wearing a helmet.”

#### **Pediatric Patients with mTBI Often Seek Care at an ED**

Seven of the 9 rural providers mentioned that at least some of their patients will first present to the local ED with a suspected mTBI. One mentioned:

“People in this community really look at the ER [emergency room] as 24-hour primary care. So, consequently, if a kid comes home from school and says they got a blow to the head on the playground or whatever and parents are concerned, they’re just going to show up in the ER... For those families this is an emergency and it has to be taken care of now.”

–Provider 1

Another said that the ED is only used if the TBI happens at night or if it seems to be more severe.

#### **Providers Do Not Consistently Use Validated Tools to Assess Pediatric Patients with mTBI**

In general, age-appropriate symptom scales that are recommended in the CDC pediatric mTBI guideline<sup>12</sup> are not being utilized. There was a desire expressed by many rural providers for more information about available assessments, as some conveyed that they do not have a standardized method for testing for mTBI and then determining its severity. Five providers mentioned using the Pediatric Emergency Care Applied Research Network (PECARN) prediction rules.<sup>21</sup> The PECARN algorithm is valuable for the determination of whether a pediatric patient should be referred for computerized tomography (CT) imaging. However, it is not an mTBI diagnostic tool that assesses symptom severity, balance, or cognitive issues. In place of symptom scales, providers mentioned using physical evaluations and the Glasgow Coma Scale to assess for mTBI.

Two providers mentioned using computerized neurocognitive tests to inform their evaluation. Typically, these tests are conducted at the beginning of a sports season to assess a

pediatric patient's baseline functioning. Then, if the patient later comes in with a suspected head injury, a patient's current functioning can be compared to their baseline to determine if there are changes in neurocognition.

### Challenges Rural Providers Face in Their mTBI Practice

**Rural Providers Lack Access to mTBI Specialists**—A key CDC guideline recommendation describes the need to assess pediatric patients with mTBI for risk factors for prolonged recovery. Patients with a prolonged recovery, lasting more than 4–6 weeks, should be referred to a specialist with experience in evaluating and treating mTBI patients.<sup>12</sup> However, most providers mentioned that they lack access to mTBI specialists (mostly due to distance and transportation concerns) to whom they can refer their pediatric patients for care when needed. One provider noted that the closest neuropsychologist was 500 miles away and the closest pediatric neurologist was 4.5 hours away. Thus, most of the specialized follow-up care for those with prolonged symptoms is provided “in-house” by the provider, and the providers did not always feel they had enough training and education to provide the best mTBI care. One provider stated:

“I know that downtown, at the big [hospital], the pediatrics department and the neurology folks, they've got a whole staff designed around taking care of kids with concussions. We don't have that here, so we end up sort of doing it by the seat of our pants, so to speak.”

–Provider 1

**Parents Often Request a CT Scan for Their Children after a Suspected mTBI**—Most of the providers reported struggling with implementing the CDC recommendation regarding CT imaging. The primary challenge was convincing parents of pediatric patients with mTBI that their child does not need imaging. Primary care providers, in particular, reported that some parents are adamant that a CT scan is needed and will take their child to an ED if they cannot obtain a referral to get one. One primary care provider stated:

“I'll see a patient and [won't refer them to] get a CT. Then I sign my note the next day and look, oh jeez, there they went to the ED and they felt pressed by the parents and did order a CT.”

–Provider 1

One provider noted that parents may be even more likely to request CT imaging from PA/NPs as compared to physicians. To address challenges with parent's perception of CT imaging, one provider mentioned the need to educate parents about the role of CT imaging in identifying pediatric patients with intracranial injury, versus serving as a diagnostic tool for mTBI. Moreover, it was suggested that education for parents should cover the potential health risks of CT for young patients.

### Rural Providers' Perceptions of the CDC Pediatric mTBI Guideline Recommendations and Implementation Tools

**mTBI Guideline Clinical Recommendations are Too Long**—First and foremost, rural providers wanted shortened versions of the recommendations. As Provider 3 concisely

remarked, “In the format they are right now, the providers are going to get brain fatigue.” Another remarked:

“I think some of the kind of general recommendations that are there are nice to know—the information about malignancy and CT scan and a few things like that, but am I going to go through these guidelines every time I see a patient in the ED with a blow to the head? Probably not.”

–Provider 1

**Not All the Recommendations are Feasible in Rural Areas**—Rural providers commented that certain recommendations, such as having “medical and school-based teams counsel the student and family” and “emphasizing social support and return to school recommendations” after an mTBI, are not practical in rural areas. Some shared that this will likely never be feasible in the rural setting, as there is not access nor funding to do this.

“They have a lot of recommendations that are wonderful, but to “assist children returning to school following mTBI, medical and school-based teams should counsel the student and family.” That is a great idea, but who establishes the team? Who compensates the people serving on the teams? ... There has to be real people spending real amounts of time doing the advising, doing the evaluating. Do they put that on the school nurse? Do they hire a consultant to work with the school? There is going to be a financial burden with that. That is a great idea, but you have to fund that in order for that to happen.”

–Provider 4

**Recommendations may be More feasible if Changes are Made**—Most providers thought that the CDC recommendations were helpful and reasonable to implement. However, they had several suggestions to make uptake of the recommendations more feasible for rural health care providers. First, providers suggested that the CDC create an executive summary of the clinical recommendations or a checklist with reminders. For example, one provider recommended creating a 1-page or laminated card with the recommendations, “something that can be grabbed on the way to seeing a patient,” with a suspected mTBI. Provider 3 shared, “... if you have those point-of-care tools ready at the front, easy to use, and succinct, you are going to have a lot better adoption and implementation.” The second most common recommendation was to link directly to clinical tools, such as the age-appropriate validated mTBI screening tools recommended by CDC. The providers did not want to have to decide between a set of equally good tools—they would rather be told which tool was best. Providers suggested integrating links, such as for a selected screening tool, into their Electronic Health Record (EHR) systems for easy use. Finally, providers believed that implementation tools should be customized for different health care settings and visit types. For example, one set of materials should be tailored for primary care offices, another set for EDs; one set of materials could be tailored for the initial visit, another set for follow-up.

**More Educational Tools are Needed for the Public About mTBI**—To support their implementation of the CDC guideline recommendations, rural providers requested CDC-

branded educational handouts or pamphlets to go over with patients and their families. One provider shared that they would like specific resources:

“It would be nice to have some of the educational material available to go over it with concerned family members. Like ‘here, I’m going to give you a pamphlet and let me go over it with you.’”

–Provider 3

Providers commented that it is helpful to have some information to send home with parents in case they are not able to remember everything conveyed during the office or ED visit. Several providers stated that the guideline recommendations can only go so far if the parents are not “on-board” with them. To reach a large number of parents, one provider mentioned that her state has a law in which parents of student-athletes are required to take a concussion education course before the sport season starts. Importantly, providers mentioned that mTBI educational materials for the public should follow best practices regarding health literacy.

Providers would also like assistance with prevention. Some providers felt overwhelmed and unable to help their pediatric patients in what is often a preventable injury. They would like more resources, both tangible (such as funding for helmets) and informational, for their patient population. Some providers believed that many of their patients and their parents may think that injuries are simply a part of growing up and need more encouragement to try to prevent mTBIs. Providers also felt that it is critical to get parents involved in TBI prevention and management. They need parental “buy-in” in order to make sure that children are evaluated if they have a suspected mTBI and discharge instructions are appropriately followed.

## Discussion

As evidence suggests that rural communities have higher rates of TBI than urban communities,<sup>2,3,17</sup> it is important to ensure that providers who treat patients in these communities have the most up-to-date information about TBI best practices. Findings from this qualitative study provide insight into the perception and use of the CDC pediatric mTBI guideline among pediatric rural health care providers. Generally, the providers appreciated the clinical recommendations in the guideline, but thought some were too long and cumbersome to feasibly implement into their practice. To address this, participants proposed the development of implementation tools that included shortened versions of the recommendations, along with direct links to relevant clinical tools. Other examples included creation of a laminated card providers could use as a quick reference, integration of the recommendations and tools into EHRs, and customizing the implementation tools to include clinical recommendations for visit types and health care settings, such as primary and emergency care. A previous study supports the use of mTBI-specific educational tools (eg, checklists for health care and handouts for patients) and EHR-based decision support tools to improve adherence to guideline recommendations.<sup>22</sup> While not explicitly part of this study, the providers did not seem to be aware that CDC already has made available some implementation tools that correspond to the guideline. It is critical that CDC ensures that providers working in rural areas are aware of and comfortable using these resources.



Findings from this study also demonstrate opportunities to improve mTBI education in rural settings. First, one of the themes that emerged was the importance of expanding mTBI education for parents and the public overall. Recognizing, reporting, and seeking care for an mTBI soon after the injury is crucial to help mitigate long-term sequelae and lessen prolonged recovery.<sup>23</sup> To help improve public awareness, in 2003 CDC launched the HEADS UP campaign ([www.cdc.gov/headsup](http://www.cdc.gov/headsup)), which is a series of educational initiatives for health care providers, parents, athletes, school professionals, and coaches. Second, while the pediatric mTBI guideline was focused on diagnosis and management, rural providers in this study indicated that they would like assistance with and information about prevention. While outside the scope of the current guideline, CDC HEADS UP is one resource that provides information about concussion behavior change and a culture of safety and prevention.

The providers also noted some challenges they face in their mTBI practice. Foremost was lack of access to mTBI specialists and convincing some parents that their children do not need imaging. To address the issue of lack of access to specialists in rural communities, there are several projects that may help. One example is Project ECHO (<https://echo.unm.edu/about-echo/model/>), which is a telementoring program that connects primary care providers in rural areas with specialty care teams at hub sites using a case-based learning approach. Project ECHO is designed to be a low-cost, high-impact intervention that pairs primary care providers with specialists to build capacity for the treatment and management of pediatric patients with complex conditions in their own community.<sup>24,25</sup> This is a program that could be successfully employed to expand the reach of TBI expertise from large urban areas or academic centers to rural primary care providers.

An additional challenge that rural providers reported was feeling pressure from parents to order a CT scan for their child. Based on available evidence, the CDC pediatric mTBI guideline workgroup concluded that health care providers should not routinely image pediatric patients with a suspected mTBI for diagnostic purposes, which is also endorsed by the American Academy of Neurology<sup>26,27</sup> and the American Medical Society for Sports Medicine.<sup>27,28</sup> Instead, health care providers should use validated clinical decision rules to identify children at risk for intracranial injury to determine if imaging is warranted.<sup>23</sup> Therefore, the providers' hesitance to order a CT scan for children presenting with a suspected mTBI was well-founded; however, they need additional support in conveying this message to worried parents. Small-scale educational interventions, such as the targeted dissemination of educational handouts to parents,<sup>29</sup> and the promotion of extended clinical observation of patients in the ED have been shown to lower CT usage rates.<sup>30</sup>

## Strengths and Limitations

This study explores opportunities to support rural health care providers as they diagnose, treat, and manage mTBI. The study included a mix of provider types (MDs, NPs, and PAs) that practiced in rural communities representing all 4 census regions and 8 states. Respondents practiced in diverse rural communities and settings, including primary care practices, urgent care centers, and emergency departments.

The number of respondents was limited to 9 for this study. With a limited sample size, it is likely that additional experiences and viewpoints were not captured. For example, different states have different regulations regarding concussion reporting, return-to-play, etc., and practicing in certain states may affect how providers treat their pediatric mTBI patients. However, because of the repetition of responses that we received, we feel that the data that we did collect would likely represent the experiences and perceptions of many rural health care providers.

## Conclusions

Results of this study will inform CDC's future efforts to improve the adoption and implementation of the pediatric mTBI guideline and implementation tools in rural settings. The findings of this study may also inform how CDC and other organizations disseminate health information to rural health care providers. Length, accessibility, and usability are important considerations when designing clinical tools for rural health care providers who are seeing a wide range of health concerns within a given day. Additionally, tailored information, such as to the health care setting, allows for health care providers to quickly refer to these tools when needed.

Furthermore, there are opportunities to enhance information for parents, educators, and coaches about mTBI prevention and what to expect during assessment, treatment, and management should a child experience a head injury. Specifically, additional information related to mTBI, imaging, and the importance of TBI prevention may be topics that would benefit from new resources tailored to rural residents.

As CDC continues to address TBI disparities in rural areas, it will explore new dissemination strategies specific to rural stakeholders. In addition to partnerships with national and state professional associations, partnerships with state rural health associations, State Offices of Rural Health, and rural health networks can further facilitate the dissemination of evidence-based tools. Public information campaigns targeting rural communities may also be appropriate.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## References

1. Borse NN, Gilchrist J, Dellinger AM, Rudd RA, Ballesteros MF, Sleet DA. CDC Childhood Injury Report: Patterns of Unintentional Injuries among 0–19 Year Olds in the United States, 2000–2006. Atlanta, GA: Centers for Disease Control and Prevention; 2008.
2. Yue JK, Upadhyayula PS, Avalos LN, Cage TA. Pediatric traumatic brain injury in the United States: rural-urban disparities and considerations. *Brain Sci.* 2020;10(3):135.
3. Leonhard MJ, Wright DA, Fu R, Lehrfeld DP, Carlson KF. Urban/rural disparities in Oregon pediatric traumatic brain injury. *Injury Epidemiol.* 2015;2(1):32.
4. Johnstone B, Nossaman LD, Schopp LH, Holmquist L, Rupright SJ. Distribution of services and supports for people with traumatic brain injury in rural and urban Missouri. *J Rural Health.* 2002;18(1):109–117. [PubMed: 12043749]

5. Johnstone B, Price T, Bounds T, Schopp LH, Schootman M, Schumate D. Rural/urban differences in vocational outcomes for state vocational rehabilitation clients with TBI. *Neurorehabilitation*. 2003;18(3):197–203. [PubMed: 14530584]
6. Spearman RC, Stamm BH, Tivis LJ. Traumatic brain injury state planning grant: preparing for change in a rural state. *Brain Injury*. 2007;21(8):837–849. [PubMed: 17676441]
7. Murphy J Care of the patient with traumatic brain injury: urban versus rural challenges. *Adv Emerg Nurs J*. 2004;26(3):231–236.
8. Solovieva TI, Walls RT. Barriers to traumatic brain injury services and supports in rural setting. *J Rehabil*. 2014;80(4):10.
9. Branas CC, MacKenzie EJ, Williams JC, et al. Access to trauma centers in the United States. *JAMA*. 2005;293(21):2626–2633. [PubMed: 15928284]
10. Graves JM, Mackelprang JL, Moore M, et al. Rural-urban disparities in health care costs and health service utilization following pediatric mild traumatic brain injury. *Health Serv Res*. 2019;54(2):337–345. [PubMed: 30507042]
11. Carroll L, Cassidy JD, Peloso P, et al. Prognosis for mild traumatic brain injury: results of the WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury. *J Rehabil Med*. 2004;36(0):84–105.
12. Lumba-Brown A, Yeates KO, Sarmiento K, et al. Centers for Disease Control and Prevention guideline on the diagnosis and management of mild traumatic brain injury among children. *JAMA Pediatr*. 2018;172(11): e182853. [PubMed: 30193284]
13. Centers for Disease Control and Prevention. CDC pediatric mTBI guideline: take action to improve the care of children with mTBI. 2018. <https://www.cdc.gov/traumaticbraininjury/PediatricmTBIGuideline.html>. Accessed October 21, 2019.
14. Centers for Disease Control and Prevention. MMWR rural health series. 2017. [https://www.cdc.gov/mmwr/rural\\_health\\_series.html](https://www.cdc.gov/mmwr/rural_health_series.html). Accessed October 31, 2019.
15. Centers for Disease Control and Prevention. Rural health. 2018. <https://www.cdc.gov/ruralhealth/index.html>. Accessed October 31, 2019.
16. Chapital AD. *Traumatic Brain Injury: Outcomes of a Rural Versus Urban Population Over a 5 Year Period*. Manoa, HI: University of Hawaii Biomedical Sciences, University of Hawaii; 2005.
17. Bazarian JJ, McClung J, Shah MN, Ting Cheng Y, Flesher W, Kraus J. Mild traumatic brain injury in the United States, 1998–2000. *Brain Injury*. 2005;19(2):85–91. [PubMed: 15841752]
18. Lumba-Brown A, Yeates KO, Sarmiento K, et al. Diagnosis and management of mild traumatic brain injury in children: a systematic review. *JAMA Pediatr*. 2018;172(11):e182847. [PubMed: 30193325]
19. Glaser BGSAL. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. New Brunswick/London: AldineTransaction; 1967.
20. Draper AK. Workshop on ‘Developing qualitative research method skills: analyzing and applying your results’, The principles and application of qualitative research. *Proc Nutr Soc*. 2004;63:641–646. [PubMed: 15831137]
21. Kuppermann N, Holmes JF, Dayan PS, et al. Identification of children at very low risk of clinically-important brain injuries after head trauma: a prospective cohort study. *Lancet*. 2009;374(9696):1160–1170. [PubMed: 19758692]
22. Arbogast KB, Curry AE, Metzger KB, et al. Improving primary care provider practices in youth concussion management. *Clin Pediatr*. 2017;56(9):854–865.
23. Centers for Disease Control and Prevention. Report to Congress: The Management of Traumatic Brain Injury in Children. Atlanta, GA: National Center for Injury Prevention and Control; Division of Unintentional Injury Prevention; 2018.
24. Carlin L, Zhao J, Dubin R, Taenzer P, Sidrak H, Furlan A. Project ECHO telementoring intervention for managing chronic pain in primary care: insights from a qualitative study. *Pain Med*. 2018;19(6):1140–1146. [PubMed: 29036381]
25. De Witt Jansen B, Brazil K, Passmore P, et al. Evaluation of the impact of telementoring using ECHO(c) technology on healthcare professionals’ knowledge and self-efficacy in assessing and managing pain for people with advanced dementia nearing the end of life. *BMC Health Serv Res*. 2018;18(1):228. [PubMed: 29606132]

26. Giza CC, Kutcher JS, Ashwal S, et al. Summary of evidence-based guideline update: evaluation and management of concussion in sports Report of the Guideline Development Subcommittee of the American Academy of Neurology. *Neurology*. 2013;80(24):2250–2257. [PubMed: 23508730]
27. West TA, Marion DW. Current recommendations for the diagnosis and treatment of concussion in sport: a comparison of three new guidelines. *J Neurotrauma*. 2014;31(2):159–168. [PubMed: 23879529]
28. Harmon KG, Drezner JA, Gammons M, et al. American Medical Society for Sports Medicine position statement: concussion in sport. *Br J Sports Med*. 2013;47(1):15–26. [PubMed: 23243113]
29. Reisner A, Burns TG, Hall LB, et al. Quality improvement in concussion care: influence of guideline-based education. *J Pediatr*. 2017;184:26–31. [PubMed: 28233546]
30. Nigrovic LE, Kuppermann N. Children with minor blunt head trauma presenting to the emergency department. *Pediatrics*. 2019;144(6): e20191495. [PubMed: 31771961]

Table 1

## Demographic Profile of Health Care Providers in Sample

	Sex	Profession	Healthcare Setting	US Census Region	TBI Burden in Practice
Provider 1	Male	Physician assistant	Hospital/ED/urgent care	Midwest	Sees patients with head injury 2–3 times/month
Provider 2	Female	Physician	Primary care/urgent care	West	Sees patients with head injury once/week
Provider 3	Male	Physician	Primary care	West	Sees patients with head injury less than once/week
Provider 4	Male	Physician	ED	Northeast	Sees patients with head injury 4 times/week
Provider 5	Male	Physician	Level IV ED	Midwest	Sees patients with head injury at least once/shift
Provider 6	Female	Physician	Family medicine practice	Northeast	Sees patients with head injury 1–5 times/month
Provider 7	Female	Physician assistant	Family medicine practice	West	Sees patients with head injury once/week during sports seasons
Provider 8	Female	Nurse practitioner	Primary care practice	South	Sees patients with head injury less than once/week
Provider 9	Female	Nurse practitioner	Pediatric primary care practice	South	Sees patients with head injury less than once/week