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“I just don’t want them to be my patient again”: An exploratory mixed-methods study examining provider home safety concerns for adolescents with acquired brain injuries in the US Midwest

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Abstract

Objective: Adolescents with acquired brain injuries are at risk for additional injuries after hospital discharge. We asked healthcare providers to identify and prioritize urgent hazards in the home setting for this population.

Methods: We used a convergent mixed methods approach. Healthcare providers who do discharge planning and community re-integration for adolescent patients with brain injury were recruited from hospitals in the US Midwest. Participants completed two structured surveys, semi-structured interviews, and a Hazard Prioritization Matrix Activity. We analyzed quantitative data via descriptive statistics and qualitative data via inductive thematic analysis to identify hazards, urgency, interactive themes, and generate a conceptual model.

Results: All participants validated four pre-identified hazards in the surveys and the interviews: slippery objects on floor, large furniture/objects in path of travel, unattended open flames, and inappropriate use of cooking appliances. Fifty-nine hazards were self-identified during the Hazard Priority Matrix Activity and assigned an urgency rating, with 12 (20.3%) urgent, 20 (33.9%) major, 19 (32.2%) moderate, and 8 (13.6%) minor risks. We identified seven interactive themes about hazard factors: hazardous activities, hazardous situations, hazardous objects, hazardous others, hazardous spaces, harms, and client factors. A conceptual model for home safety concerns links hazards, risks, and harms.

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Conclusions: Adolescents with acquired brain injuries need healthcare providers to recognize unique and complex hazards in their homes that could lead to harm. Mitigating home hazards may prevent additional unintentional injury for these adolescents. More research is needed to generalize this information for this population across clinical settings.

Keywords

traumatic brain injury; adolescent; risk perception; mixed methods; rehabilitation

INTRODUCTION

Each year in the United States, an estimated 800,000–1,000,000 children and youth visit the Emergency Department (ED) with a Traumatic Brain Injury (TBI) [1], and approximately 37,000–60,000 are hospitalized. [1, 2] Adolescents aged 15–19 years old are at high risk for TBI [3], with impairments that persist beyond the acute phase of injury. [4] Regardless of severity, impairments can impact a wide range of functions, including motor, cognitive, behavioral, mental health, sensory, communication, and social emotional health. [5] In the general TBI population, unintentional injury is a leading cause of death within the first year after TBI [6, 7] and 6% experience a recurrent TBI, which increases the risk for additional injuries. [8]

Most adolescents with Acute Brain Injury (ABI), of which TBI is one form, are discharged directly home from the ED or hospital [9] without adequate support to return to their daily routines or manage their needs upon discharge. [10] Homes contain many hazards for injury, particularly for people with cognitive or physical impairments. [11] Within the home, children and adolescents have increased risk of injury due to hazards such as falls and burns, and inadequate fire emergency responses. [2, 12, 13]

Current educational interventions to reduce hazards in the home for recovering adolescent patients with ABI may not meet the needs of this population. It is not clear that adolescents or their caregivers can accurately predict how changes after an ABI will impact home safety without having additional knowledge from healthcare providers about hazards, risk, and the potential for harm, including a recurrent ABI. There are likely unique risks for the adolescent population as compared to the general and child populations.

To develop a feasible and effective educational intervention for adolescents with ABI and their caregivers, it is important to identify and prioritize possible home hazards after being discharged to the home. This convergent mixed methods study aimed to identify and prioritize home safety hazards and concerns for adolescents with ABI for rehabilitation professionals (e.g., occupational therapists, physical therapists, and speech and language pathologists) with experience caring for this population.

METHODS

Study design and setting

This study is part of a larger effort to identify educational needs for adolescents with ABI from the perspectives of multiple stakeholders, including patients and their caregivers.

[14] Our objective was to identify and prioritize urgent hazards in the home setting for adolescents with ABI. All study activities occurred remotely or in person at a large academic medical center or the local children's hospital in the US Midwest. This study was approved by the local children's hospital's institutional review board (STUDY00001368) and registered through www.clinicaltrials.gov (NCT04768946).

Participants

We recruited providers using a convenience and snowball sampling method, via referrals from personal networks and posts to the children's hospital listservs from May 1, 2021, to May 18, 2022. Our inclusion criteria were: 1) currently being a healthcare professional involved in discharge planning and community re-integration for adolescent patients (aged 12–19) with ABI, 2) able to participate in a 2-hour interview, 3) able to understand and communicate in English, and 4) able to attend interviews either in-person or online via their own means. Participants received a \$25 gift card.

Procedures and measures

After enrollment, participants completed a demographic questionnaire and a questionnaire about home hazards electronically in REDCap (Version 10.0.28). The hazard questionnaire included these areas: slip or trip (11 items), lifting (6 items), electrical (10 items), fire (16 items), environmental (19 items), and pet or pest (5 items). For each item, participants indicated if 1) they were concerned about the hazard and 2) if the hazard could lead or had led to harm. Members of the research team developed the hazard questionnaire which lists potential home safety hazards that were previously identified and tested among home healthcare workers. [15] Thirteen participants completed the questionnaires. Between June 7, 2021, and May 18, 2022, twelve of the thirteen participants completed a 40-minute semi-structured individual or group interviews of 2–4 participants, in person (n=2) or over Zoom (n=10), facilitated by a group of 1–3 researchers [SA, SP, TS, JL, AD]. Next, participants completed the Hazard Prioritization Matrix activity, where they identified and rated no more than their five highest priority hazards on 1) frequency: rarely, sometimes, or often; and 2) severity: minor, moderate, or major consequences. Urgent hazards occurred often and had major consequences. The hazard prioritization activity was also used previously among home healthcare workers. [16] The entire session was audio and video recorded and transcribed using Express Scribe into Microsoft Word by trained researchers followed by independent verification by a second researcher. In-person participants completed this activity with sticky notes on a large whiteboard or paper template, and online participants completed this activity verbally or through Zoom chat while a facilitator populated a text document shared on the screen.

Data analysis

Study data were collected and managed using REDCap electronic data capture tools hosted by the Clinical and Translational Science (CCTS) at The Ohio State University Center. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies. It provides an intuitive interface for validated data entry, audit trails for tracking data manipulation, automated export procedures for seamless

data downloads to common statistical packages and procedures for importing data from external sources. [17]

Our overall approach was convergent mixed methods, aimed both at validating pre-identified hazards and risk factors (frequency and severity) with quantitative data, and discovering unexpected hazards and risk factors with qualitative data. [18] We generated descriptive statistics from the questionnaire and prioritization data using Microsoft Excel. We used a grounded theory approach [19] to guide the analysis of our interview transcripts and prioritization activity data. We used Dedoose software V9.0.107 to identify themes relevant to our aims on home safety hazards and associated risk factors. Three trained coders iteratively and independently created descriptive codes using constant comparison [19] and organized them into categories. A consensus on all codes and categories was achieved through discussion. One principal investigator [SA] used inductive thematic analysis to look at relationships across the data set [20] to generate themes and sub-themes related to concepts, which led to the conceptual model. We handled missing data by deleting the case with the missing values from that item's data analysis – one participant did not complete the interview or hazard prioritization portions of the study and thus only twelve participants were included in those analyses.

Patient and public involvement

No patients (i.e., individuals with similar characteristics to our participants) were involved in the development, procedural, or dissemination activities of this study. As part of our snowball sampling recruitment process, we did ask participants to refer others who may be eligible to participate in this study. Additionally, several co-authors currently hold and/or previously held similar professional roles to our participant population [SA, JL]. We plan to include representatives from our participant populations as clinical research partners in future endeavors to help us develop, deliver, and disseminate our research.

Ethics statement

We obtained approval from the local children's hospital's institutional review board (STUDY00001368) to conduct this study. During the consent process, participants were instructed on the study goals, procedures, risks, and benefits. This included the voluntary nature of their participation and the collection of identifiable audio and video recordings. All enrolled participants provided their written or verbal informed consent prior to participating in the study.

RESULTS

Participant characteristics

Thirteen participants completed the demographic questionnaire, which included personal information (Table 1) and client caseload characteristics (Table 2). Twelve participants were recruited from the local children's hospital, and one participant from a local hospital system that primarily served adults but whose caseload sometimes included adolescents. While our participants were primarily occupational therapists (OT), physical therapists (PT),

and speech-language pathologists (SLP), one neuropsychologist and one rehabilitation case manager also participated.

Pre-identified home safety hazards

Thirteen participants completed the hazards questionnaire and were included in the analysis. Figure 1 summarizes the responses to pre-identified hazard concerns and harms across 67 items in six categories. All participants agreed that seven (10%) hazards from three categories were concerns: 1) slip/trip: snow or ice on surfaces, slippery objects on the floor, large furniture/objects in the path of travel, 2) lift: inappropriate assistive equipment, 3) fire/burn/explosion: unattended open flames, smoke alarm not working, inappropriate use of cooking appliances. For most hazard categories, most participants believed the hazards to be concerns but not necessarily ones that could lead to harm.

Figure 2 examines the proportion of pre-identified hazard concerns as distributed across professions. By profession, OTs had the highest agreement with pre-identified hazards, PTs had the next highest, and SLPs had the lowest. OT providers agreed that more than 90% of the hazards in each category were concerning.

Self-identified home safety hazards

Twelve of the thirteen participants who completed the questionnaires participated in the interviews and were included in the analysis. The participant who did not complete the study was a PT and was lost to lack of follow-up. Figure 3 describes the proportion of pre-identified hazards discussed in the interviews. Few of the pre-identified hazards were self-identified by participants during interviews, and most of the fire (68.75%), electrical (80%), environmental (84.21%), and pet/pest (80%) hazards were not discussed. Of the seven items confirmed as hazards by all participants in the pre-identified hazard survey, participants self-identified four of them during the interviews: slippery objects on the floor, large furniture/objects in the path of travel, unattended open flames, and inappropriate use of cooking appliances.

Twelve of the thirteen participants who completed the questionnaires participated in the interviews and were included in the analysis. The participant who did not complete the study was a PT and was lost to lack of follow-up. Fifty-nine hazards were self-identified and assigned an urgency rating, with 12 (20.3%) urgent, 20 (33.9%) major, 19 (32.2%) moderate, and 8 (13.6%) minor risks. The urgent hazards, occurring often and with major negative consequences, were: 1) shower transfer/water, 2) getting up and down steps into home or bedroom, 3) risky behavior when spending time with family/friends, 4) ability to exit house in an emergency (emergency preparedness), 5) supervision in home/community, 6) getting into the home, 7) entryways, 8) independence/supervision, 9) stove use, hot appliances in kitchen, 10) stairs, 11) rugs, and 12) bathroom accessibility.

Table 3 lists the themes and sub-themes from the interviews with definitions, illustrative quotes, and cross-references to urgency ratings. The seven interactive themes were: hazardous activities, hazardous situations, hazardous objects, hazardous others, hazardous spaces, harms, and client factors. When the 59 self-identified hazards from the Hazard Prioritization Matrix Activity were qualitatively analyzed, we identified 116 distinct home

safety hazard factors aligning with our seven themes, illustrating that these factors often interact to create hazards.

Conceptual model

Figure 4 describes the conceptual model for home safety concerns – linking hazards, risks, and harms from the perspective of healthcare providers. Hazards are an integration of multiple factors and include how the adolescent interacts with objects and others within several contextual layers. Risks are a calculation of urgency based on the frequency of hazard occurrence and the severity of resulting harm. These determinations of concern can also change across settings and systems as the hazard factors and levels of risk change. Healthcare providers can intervene at every layer and step of this process.

DISCUSSION

Adolescents with ABI and their caregivers need support from healthcare providers to identify and mitigate hazards in the home setting, to reduce their risk of injury. In this mixed-methods study, we conducted interviews and distributed surveys to healthcare providers who treat adolescents with ABI. We aimed to identify and prioritize the home safety hazards that providers are concerned about for adolescents with ABI.

During this study, providers validated several known hazards and identified many new hazards in the home setting. Many of the self-identified hazards discussed were consistent with prior research about home safety for adults with ABI [21, 22], including among healthcare providers: falls, harmful others, leisure activities, fires and burns, sharp objects, and emergency response. [23] However, the lack of overlap between the pre-identified and self-identified home safety hazards in our study implies that hazards for adolescents with ABI are unique from other populations, something others have noted when developing adult-focused measures. [23] Therefore, efforts should be made to develop adolescent-focused tools for home safety evaluation and intervention. Additionally, firearms and drug use were hardly discussed in this study, while they now contribute to a larger proportion of unintentional and intentional injuries and deaths [24, 25] Other research on home safety among adults has noted firearms and poisoning (e.g., drug use) as areas of concern. [22, 23] Adolescents with ABI may be particularly vulnerable to opioid misuse, gun violence, and adverse mental health outcomes due to the circumstances of their initial injury and the resulting impacts of their ABI. Therefore, these safety hazards warrant increased investigation among adolescents with ABI. Finally, while others have included community safety hazards (e.g., driving, pedestrian navigation) in their examination of safety hazards for adults with ABI [23], we did not investigate these topics in-depth as the focus of this study was home safety specifically. However, it should be noted that several community spaces (e.g., school) and activities (e.g., driving) were also prioritized by our participants, indicating that community safety is important to address for this population of adolescent with ABI who are re-integrating back into their communities.

Using our Hazard Prioritization Matrix Activity, participants were able to prioritize their self-identified hazards across levels of urgency. Providers judged many home hazards to occur frequently with the potential for moderate to high severity, leading to moderate or

major risk urgency ratings. This risk matrix rating, borrowing from the “decision matrix risk assessment (DMRA) technique” [26], is a novel approach to research examining home safety for adolescents with ABI. Risk matrices have been used to understand and prevent injury in other populations, such as athletes [27] and workers. [28] To our knowledge, only one existing measure of home safety among adults with ABI includes risk assessment through an examination of hazard likelihood. [23] After the identification of potential safety hazards, conducting risk assessment is a necessary second step to determine the urgency of the hazard, prior to attempting to control the risks. [28] Measures of home safety for adolescents with ABI must include a determination of risk to aid in prioritizing hazards.

Our conceptual model of healthcare provider home safety concerns for adolescents with ABI organizes our themes from participant discussions and describes how home safety concerns consist of a calculated progression from hazard to risk, to harm. While this model arose from an inductive approach to thematic analysis, it remains consistent with existing themes and models related to home safety and injury prevention by including an interaction between person, environment, behavior, and outcome factors. [23, 29] Like these models, our model integrates elements of the Social-Ecological Model [30], the Dynamic Interactional Model of Cognition [31], and the Person-Environment-Occupation-Performance Model [32] to describe factors that create a hazard. Uniquely, our model also integrates the Risk Management Process and Decision Matrix Risk Assessment [26] to describe and include the risk assessment process as driving the determination of hazards to harms. However, like other models [23, 29], our model should be expanded to include safety interventions and outcomes assessment. Additionally, as our model is unique to healthcare provider perspectives, it should also be expanded to include caregiver and adolescent perspectives as families may identify other factors that providers do not consider. As such, more research is needed to understand these topics of home safety clinical practice and family perspectives, to develop a comprehensive model that can aid in the triangulation of targeted care.

Limitations

This study was limited by its small sample size as fewer participants completed the study than we had planned. This was likely due to the ongoing impact of the COVID-19 pandemic adding additional strain to healthcare providers and hospital systems. The sample of participants who enrolled may not have been representative of the whole population of healthcare providers as they were all white, mostly female, and mostly from a large children’s hospital in large midwestern city. Other relevant professions were not represented in this sample (e.g., therapeutic recreation). Our location could also create bias as most children who experience TBI are not treated at a children’s hospital [33], and other regions may have a higher prevalence of different hazards. While we employed methodological rigor, due to the nature of our study design and qualitative exploratory approaches, there will always be risk of bias in the interpretation of the results, limiting their generalization to a more diverse population.

CONCLUSION

Home safety is an active concern among various healthcare providers who address discharge planning and community re-integration for adolescents following ABI. Providers validated many of our pre-identified home safety hazards and self-identified many more that they actively consider when working with this population. Additionally, themes from our data illustrate how home safety concerns are a complex interaction between various hazardous factors, risk urgency, and potential harms. This research aims to help healthcare providers and researchers target specific home safety hazards to prioritize. Prioritized home hazards can enhance relevance, usefulness, and effectiveness of patient and caregiver education to improve home safety. This research is appropriate as pilot data for the continued investigation of this issue with more rigorous research methodologies. Future research should include the development of comprehensive home and community safety assessments and educational tools.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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This research was disseminated as part of a doctoral dissertation which is publicly available on ProQuest, and at several conferences: 2023 and 2024 AOTA conferences, the 2022 IPBIS & NABIS Joint Conference on Brain Injury, the 2024 Conference on Brain Injury, the 2023 OT Summit of Scholars, and the 2024 CBI Research Day.

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KEY MESSAGES**What is already known on this topic:**

Adolescents with acquired brain injuries are at greater risk for unintentional injury due to their physical, cognitive, sensory, and behavioral impairments. Homes are a primary source of unintentional injury, yet little is known about the home safety hazards present for this population.

What this study adds:

Healthcare providers are actively concerned about home safety, which consists of multi-factored hazards, risk-urgency calculations, and potential harms. Some hazards are specific to adolescents, who require separate considerations than adults or younger children.

How this study might affect research, practice, or policy:

These study results can inform the development of novel clinical tools for assessment and intervention that can support providers in addressing home safety among adolescents with acquired brain injuries and their caregivers.

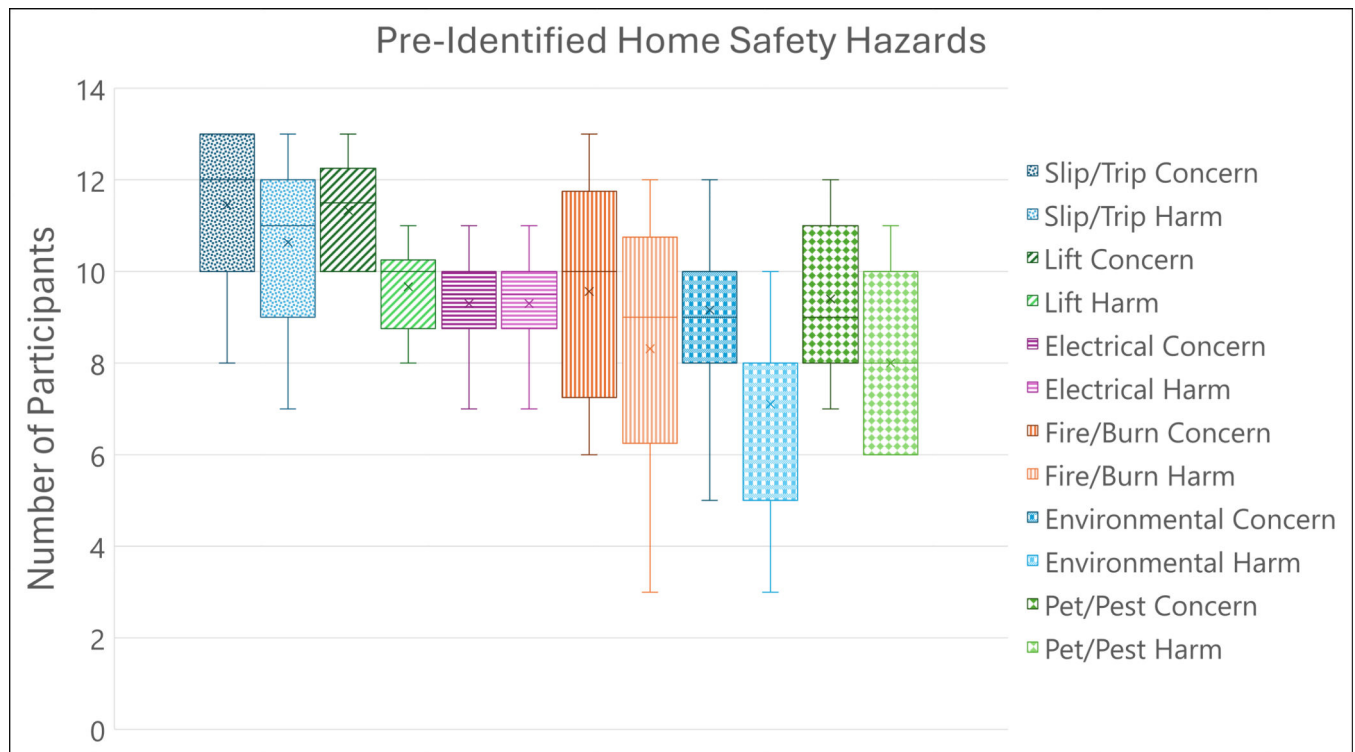


Figure 1.
US Midwest healthcare provider participants' (n=13) agreement with pre-identified hazards as concerning and harmful collected from May 2021–2022

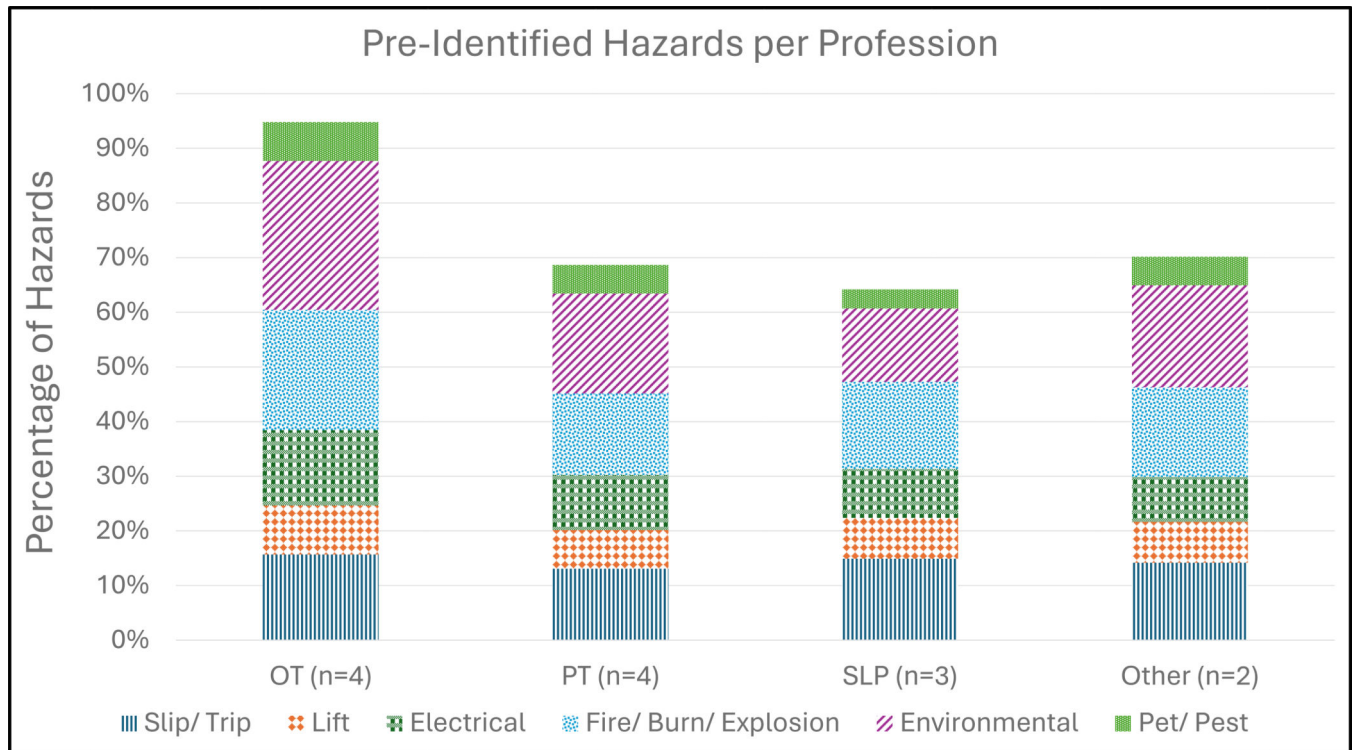


Figure 2.

Proportion of US Midwest healthcare provider participants' (n=13) agreement with pre-identified hazards by profession collected from May 2021–2022

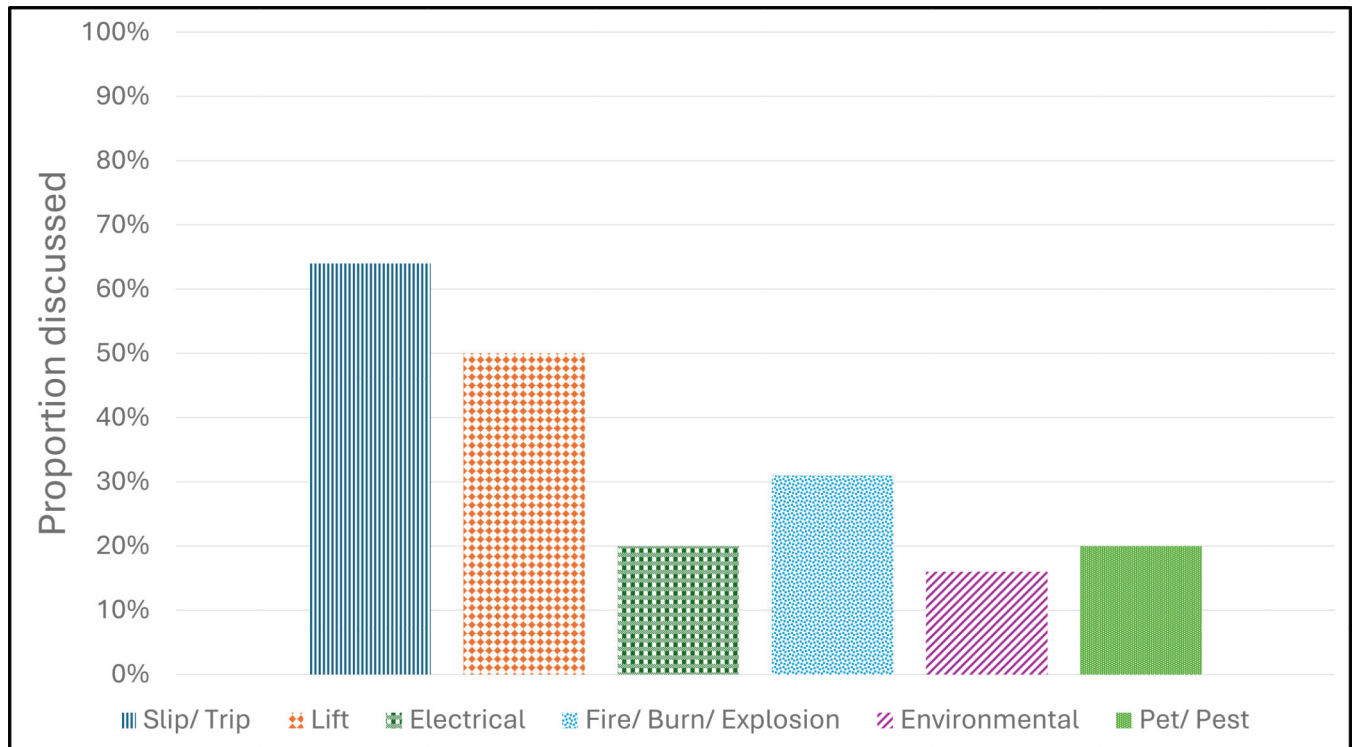


Figure 3.

Proportion of pre-identified hazards discussed by US Midwest healthcare provider participants (n=12) during interviews by category collected from May 2021–2022

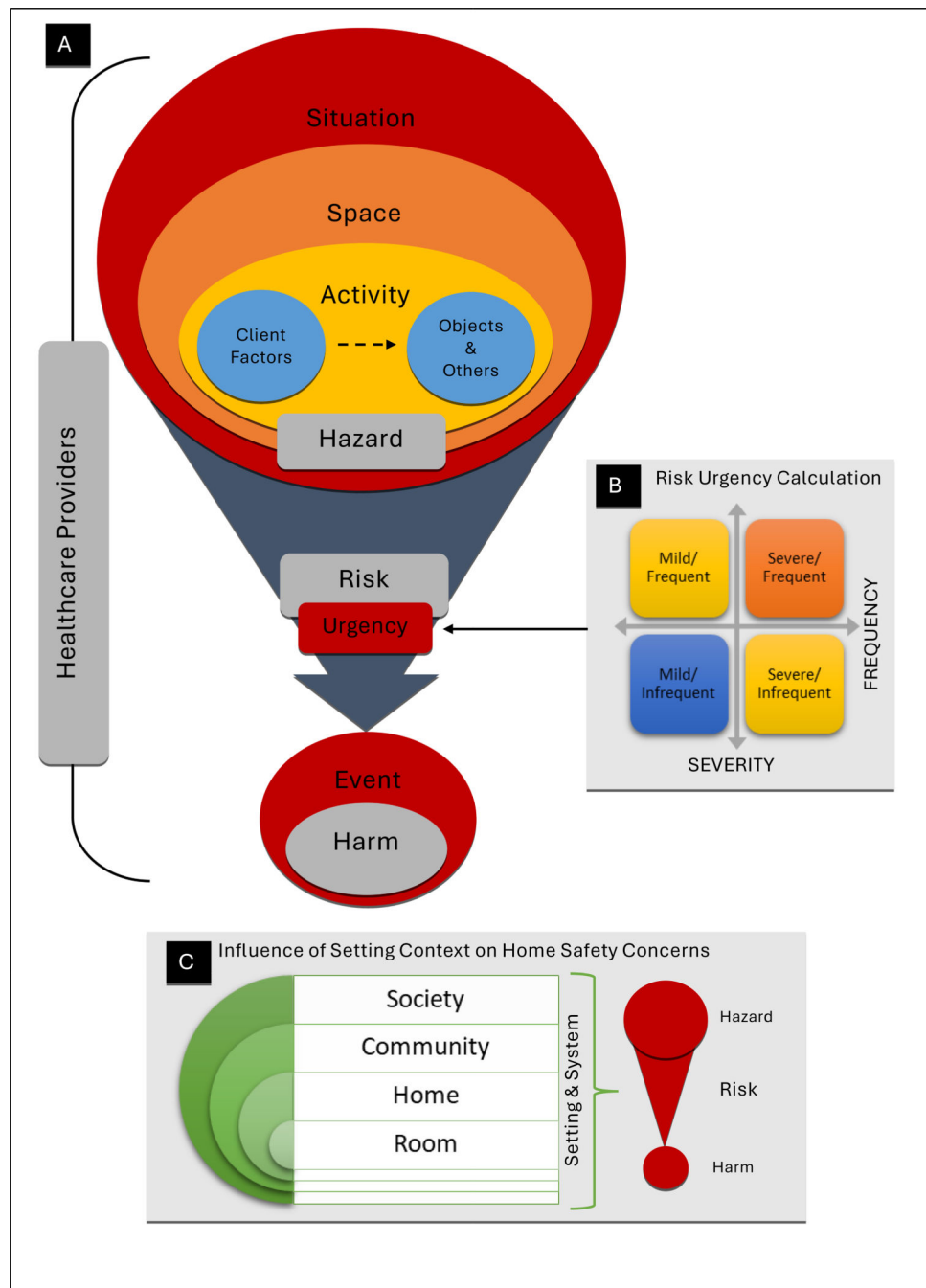


Figure 4. Conceptual model of US Midwest healthcare provider participants' (n=12) home safety concerns collected from May 2021–2022: A) hazards, risks, and harms; B) risk assessment matrix; and C) home safety concerns across settings

Table 1.

Demographics of US Midwest healthcare provider participants (n=13) collected from May 2021–2022

	N (%)
<i>Age (years), mean ($\pm$ SD)</i>	37.5 ($\pm$ 9.5)
<i>Sex</i>	
Male	1 (7.7%)
Female	12 (92.3%)
<i>Race and ethnicity</i>	
White	13 (100%)
Hispanic/Latino	1 (7.7%)
Non-Hispanic/Latino	12 (92.3%)
<i>Education</i>	
Bachelor's degree	3 (23.1%)
Master's Degree	4 (30.8%)
Clinical Doctorate degree	5 (38.5%)
Research Doctorate degree	1 (7.7%)
<i>Profession</i>	
Physical Therapist (PT)	4 (30.8%)
Occupational Therapist (OT)	4 (30.8%)
Speech Language Pathologist (SLP)	3 (23.1%)
Other	2 (15.4%)
<i>Clinical experience (years), mean ($\pm$ SD)</i>	12.6 ($\pm$ 10.5)
<i>Practice setting</i>	
Inpatient Rehabilitation	8 (61.5%)
Outpatient Rehabilitation	5 (38.5%)
Rural	1 (7.7%)
Suburban	2 (15.4%)
Urban	10 (76.9%)

Table 2.

Clinical characteristics of US Midwest healthcare provider participant (n=13) caseloads collected from May 2021–2022

	N (%)
<i>Prevalence of ABI in caseload</i>	
Less than 25%	3 (23.08%)
About 25%	4 (30.77%)
About 50%	4 (30.77%)
About 75%	1 (7.69%)
Greater than 75%	1 (7.69%)
<i>Most treated age groups</i>	
Children (0–5 years)	1 (7.69%)
Children (6–11 years)	0 (0%)
Adolescents (12–17 years)	11 (84.62%)
Young Adults (18–21 years)	1 (7.69%)
<i>Etiology</i>	
TBI	13 (100%)
Brain tumor	10 (76.92%)
Anoxic brain injury/ hypoxia	5 (38.46%)
Stroke	4 (30.77%)
Infection	2 (15.38%)
Other	1 (7.69%)
Toxins/ poisoning	0 (0%)
<i>Injury severity</i>	
Mild	1 (7.69%)
Moderate	6 (46.15%)
Severe	4 (30.77%)
N/A	2 (15.38%)

Table 3.

Themes of US Midwest healthcare provider participants' (n=12) self-identified home safety concerns for adolescents with ABI collected from May 2021–2022

Themes	Definition and Supporting Quote				Sub-Themes
Hazardous Activities	Hazards in and around the home that relate to participation in inherently risky activities or contextually risky activities. <i>"kiddos who've been re-admitted for the same type of injury that they were admitted for the first time because of risky behaviors"</i>				1. Daily Occupations 2. Risky Behaviors
Total: 35	Urgent: 7	Major: 17	Moderate: 5	Minor: 6	
Hazardous Situations	Hazards consisting of the adolescent and family home contexts which may mediate the risk of harm in other hazards. <i>"supervision is the biggest thing and... along with that comes all the issues related to safety. You know because if they're not being adequately supervised, there's a lot more opportunity to get into trouble"</i>				1. Lack/Limited Resources 2. Lack/Limited Support & Supervision 3. Lack/Limited Accessibility
Total: 13	Urgent: 3	Major: 3	Moderate: 5	Minor: 2	
Hazardous Objects	Hazards in and around the home consisting of inherently or contextually risky physical objects that could cause harm when interacted with. <i>"no matter how hard anybody tries everybody's house is gonna have stuff around to trip on"</i> <i>"I think hot things are the hardest thing, whether or not to like deal with, handle coordination, to remember if it's hot or not, um so yeah hot things I would say is #1"</i>				1. Sharps & Weapons 2. Obstacles in Path of Travel 3. Heat & Flame Producers 4. Transfer Surfaces 5. Technology & Electricity 6. Consumables
Total: 21	Urgent: 4	Major: 8	Moderate: 7	Minor: 2	
Hazardous Others	Hazards in and around the home that are alive, non-static, and have independent interactions. <i>"being coerced into risky behaviors by peers, um the peers taking advantage of their cognitive deficits"</i>				1. People 2. Pets
Total: 9	Urgent: 2	Major: 4	Moderate: 2	Minor: 1	
Hazardous Spaces	Hazards consisting of the home's construction, rooms, and structural features. <i>"one of the first areas I bring up is the bathroom... that's a priority area that's pretty obvious for families."</i>				1. Rooms in Home 2. Features of Home
Total: 16	Urgent: 7	Major: 3	Moderate: 5	Minor: 1	
Harms	Harms are negative events or outcomes which can be physical or intangible and immediate or delayed. <i>"somebody cooking something, setting something in the microwave, setting something on fire"</i>				1. Physical Harm 2. Intangible Harm 3. Harmful Events 4. Future Harm
Total: 14	Urgent: 0	Major: 6	Moderate: 7	Minor: 1	
Client Factors	Factors intrinsic to the adolescent relating to personal identity, impairments, and level of independence, which could mediate risk of harm from hazards. <i>"the biggest barriers are just their cognition, their memory, decreased insight into their deficits, decreased safety awareness."</i>				1. Motor Impairment 2. Cognitive Impairment 3. Functional Independence 4. Identity
Total: 8	Urgent: 1	Major: 1	Moderate: 3	Minor: 3	