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BRIEF REPORT

The effect of self-reported balance confidence on community integration after brain injury: an observational study

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Abstract

Objective: To evaluate the correlation between self-reported balance confidence and community integration related to home management for community-dwelling adults with acquired brain injury (ABI).

Methods: This is a study of 141 participants over the age of 18 with a history of ABI, living in the community, who completed an online survey. The survey included a series of demographic questions followed by the Activities-Specific Balance Confidence Scale (ABC) and the Home Integration subscale of the Community Integration Questionnaire (CIQ-H).

Results: Data from 119 completed surveys were included in the analysis. Significant positive correlations were found between the ABC and the CIQ-H total scores ($r_s = 0.241$, $p = 0.008$). There was no significant difference between CIQ-H total scores in individuals by injury type (traumatic vs non-traumatic) or by level of severity (mild, moderate, severe) ($p > 0.05$). There was no significant difference between ABC total scores by injury type ($p > 0.05$).

Conclusions: Higher levels of balance confidence may be associated with improved community integration related to home management for individuals with traumatic and non-traumatic BI. This study's results support future research to evaluate the integration of strategies to improve balance confidence as a component of interdisciplinary assessment and rehabilitation to maximize community integration in community-dwelling adults with ABI.

Keywords: Home management; acquired brain injury; Activities-Specific Balance Confidence Scale; Community Integration Questionnaire

Introduction

An acquired brain injury (ABI) is defined as a non-hereditary, post-birth injury to the brain resulting in neurological pathology and is categorized as traumatic or non-traumatic (Teasell et al., 2007). More than 3.6 million people sustain ABIs annually in the United States, with 2.8 million injuries specifically from a traumatic event (Taylor, Bell, Breiding & Xu, 2017). ABI severity is determined by various factors and categorized as mild, moderate, or severe (O'Neil et al., 2013). Physical limitations, cognitive impairments and behavioral changes associated with all ABI severity levels can influence one's ability and/or willingness to resume previous levels of activity within the home and community (Basford et al., 2003). These changes can increase the risk of impaired functional independence, restricted community integration, and limited social interactions in individuals with ABI.

Community integration is a multi-faceted activity that can be integral to one's overall quality of life (QOL). Increased community integration for individuals with ABI is associated with positive social outcomes including greater self-esteem, higher cognitive functioning, and better emotional and physical health (Cicerone, Mott, Azulay & Friel, 2004; Doninger et al., 2003; Juengst, Arenth, Raina, McCue & Skidmore, 2014). Community integration includes participation across multiple domains, beginning in the home and progressing to social settings and/or occupational environments (Parvaneh & Cocks, 2012). Individuals with disabilities associate a sense of belonging within their community with owning a residence, accessing services and activities, and being comfortable in their own home (Sander, Pappadis, Clark & Struchen, 2011). Specifically, when community integration is restricted for external reasons, such as the COVID-19 pandemic, integration within the home environment is crucial for maintaining skills to reintegrate into larger community settings. Skills required for successful integration within the home and community domains can include cognitive, behavioral, physical, and psychological factors, all of which can be affected by ABI. While physical function, such as balance capacity, is often a straightforward factor assessed by clinicians, additional determinants play a role in community integration. Research suggests that interdisciplinary assessment and treatment for community integration should also include psychological components, such as balance confidence (Gerber, Gargaro & McMackin, 2016).

Balance confidence is formed by self-efficacy and refers to an individual's beliefs in their ability to perform balance-challenging activities (Torkia, Best, Miller & Eng, 2016). Limitations in balance confidence often connect to a fear of falling, which can result in restricted activity participation in the home and community. This is due to the fact that individuals are often unwilling to attempt activities that they fear will result in a fall, despite having the physical ability to participate. Studies show that low balance confidence is a stronger predictor of falling than the Timed 'Up & Go' Test, the current gold standard for fall risk prediction (Landers, Oscar, Sasoaka & Vaughn, 2015; Buisseret et al., 2020). Landers et al. (2015) further demonstrates that history of falls, pathology, and physical balance tests are less predictive of falls compared to psychological outcomes, therefore suggesting clinicians also use psychometric measurements when assessing fall risk. Current practice guidelines (McCulloch et al., 2016) focus on evaluation of physical mobility and balance, however, recommendations for assessment of balance confidence are not well-represented in the literature. One study (Holmberg & Lindmark, 2008) found that clinicians consistently evaluate body function, activity and participation for patients with ABI, but do not consistently include an assessment of personal or environmental factors. They concluded that future research is indicated to explore methods and instruments which assess all aspects of the individuals' needs for rehabilitation post-ABI. Assessing balance confidence as a personal factor, in addition to balance capacity and physical mobility may provide clinicians with a greater understanding of potential factors limiting community integration.

The objective of this study was to evaluate the correlation between balance confidence and community integration related to home management of community-dwelling adults with ABI. Home integration was highlighted secondary to current limitations in community access due to COVID-19 pandemic restrictions. The authors hypothesized that higher levels of balance confidence may be positively associated with greater levels of home integration for individuals with ABI.

Methods

Participants

Following approval from the Institutional Review Board of Kean University, participants voluntarily completed an online survey using Qualtrics Survey Software[XM] between April and September 2020. Participants were recruited via email invitations sent to directors of outpatient

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ABI rehabilitation programs and ABI support groups throughout the United States, and via snowball sampling.

Inclusion criteria included adults over 18 years of age, that are community-dwelling (not in an inpatient facility), their own legal guardian, and have a history of ABI.

After providing informed consent via an electronic form, individuals answered demographic questions regarding sex, age, duration since initial injury, severity of injury and type of injury. The following definitions, as outlined in O'Neil et al. (2013), were provided within the answer choices for severity of injury: (1) Mild ABI: No abnormal imaging (MRI, CT, etc); loss of consciousness for less than 30 min; confusion for less than 24 h; difficulty with memory for initial 24 h after injury, (2) Moderate ABI: Normal or abnormal imaging (MRI, CT, etc); loss of consciousness between 30 min and 24 h immediately after injury; difficulty with memory for 1–7 days after injury, (3) Severe ABI: Normal or abnormal imaging (MRI, CT, etc), loss of consciousness for more than 24 h after injury; difficulty with memory for more than 7 days after injury. The following explanations were provided for type of injury: (1) traumatic: due to an external force or impact (ie fall, car accident, etc) or (2) non-traumatic: due to internal damage to the brain (ie stroke, tumor, lack of oxygen, etc).

The exclusion criteria included individuals under 18 years of age, that reside within an inpatient facility, are not their own legal guardian, have no history of ABI and/or not able to either read or understand English.

Measures

The Activities-specific Balance Confidence Scale (ABC) together with the Community Integration Questionnaire (CIQ) reflect abilities, self-efficacy and participation in community-dwelling individuals (Inness et al., 2011). Due to the deployment of the survey during the COVID-19 pandemic, the Home Integration Subscale of the CIQ (CIQ-H) was highlighted to focus on the home environment, which is central to QOL and the foundation for further community integration.

Activities-Specific Balance Confidence Scale (ABC)

The ABC is a self-reported fear of falling measure that examines balance confidence in progressively more challenging community activities such as reaching for an item, getting in/out of a car, and walking on icy sidewalks (Powell & Myers, 1995). Participants score 16 components from 0-100%. A score of 0% indicates no confidence in their balance during that activity, denoting a greater fear of falling, and 100% indicates complete confidence with no fear of falling. Furthermore, each activity score can be divided into levels of functioning of the individual. A study by Myers, Fletcher, Myers & Sherk (1998) determined that ABC scores lower than 50 were indicative of a low level of physical function, characteristic of elders receiving home care. ABC scores between 50 and 80 indicated a moderate level of functioning, which is characteristic of elders living in retirement homes or individuals with chronic health issues. ABC scores between 80 and 100 are indicative of a high level of function associated with physically active adults. The scale has high test–retest reliability, internal consistency and content validity in studies of various community-dwelling populations, including ABI. Multiple studies have identified significant positive correlations between the ABC and the Community Balance and Mobility Scale, a tool frequently used to measure physical balance performance after ABI (Inness et al., 2011; Hays et al., 2019). This demonstrates the ABC's construct validity as a psychometric measure of balance confidence for the ABI population.

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Community Integration Questionnaire – Home Integration subscale (CIQ-H)

The CIQ assesses the degree of community integration limitations experienced by individuals with ABI compared to those without ABI. This tool has high test–retest reliability, internal consistency, and construct validity (Hirsh, Braden, Craggs & Jensen, 2011; Tomaszewski & Mitrushina, 2016; Willer, Rosenthal, Kreutzer, Gordon & Rempel, 1993). Willer, Ottenbacher and Coad (1994) reported test–retest reliability coefficients of 0.91 for the overall CIQ, and coefficients ranging from 0.83 to 0.97 for the subscales for participants with ABI. Willer et al. (1993) found the internal consistency of the CIQ to be adequate with a coefficient alpha of 0.76 for the overall CIQ and 0.93 for the CIQ-H subscale. The CIQ produces a score on each of three subscales including Home Integration, Social Integration and Productive Activities. An overall total CIQ score is calculated by adding the three subscale scores with a higher score indicating a higher level of community integration (Geurtsen et al., 2011). Intercorrelations between the subscales and total score of the CIQ suggest that an accurate assessment of community integration can be made by solely completing the CIQ Home Integration (CIQ-H) subscale (Gontkovsky, Russum & Stokic, 2009). Some studies (Kratz, Chadd, Jensen, Kehn & Kroll, 2015; Tomaszewski & Mitrushina, 2016) have found that the CIQ-H has the most stability and internal reliability ($\alpha = 0.81$) of the questionnaire's three subscales, and the highest correlation ($\alpha = 0.844$) to the CIQ total score. This study provided participants with the CIQ-H to measure the home management aspect of community integration. Within the CIQ-H, participants are asked to respond to each question by indicating who completes each activity, either, 'Yourself alone (2), Yourself and someone else (1), or Someone else (0)'.

Procedure

Participants answered a series of demographic questions, followed by completion of the ABC and CIQ-H. The Home Integration subscale of the CIQ was utilized due to community restrictions imposed by the COVID-19 pandemic. Upon completing the survey, participants were debriefed and responses were anonymously recorded. If the participant was unable to physically complete the survey, a caregiver or research assistant read the questions aloud and clicked the participant's verbally stated answer.

Statistical analysis

Data was transferred from Qualtrics to SPSS for analysis. Descriptive statistics including means and standard deviations (SD) were reported for participant demographics. A Mann–Whitney U test assessed differences in ABC total and CIQ-H total by injury type (traumatic vs non-traumatic). Kruskal-Wallis tests were used to determine if the total ABC or CIQ-H scores varied by level of injury severity and level of function. A Pearson Correlation (r) was used for quantifying the association between total ABC and CIQ-H scores due to the large sample size. A Spearman's rho was used to evaluate the association between total ABC and CIQ-H scores when considering injury severity, level of function and type of injury. A p value of $p < 0.05$ was used to determine statistical significance and a power of 0.80 was used to determine if the sample size was adequate, using SPSS version 27 (IBM Corporation, Armonk, NY).

Results

Participant demographics

Of the 141 surveys collected, 22 were incomplete, yielding 119 completed surveys that were included in the analysis. Participant characteristics are summarized in Table 1. A power analysis indicated that the study was sufficiently powered (>0.80).

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Table 1. Participant Demographics

Characteristic		Participants ($n = 119$)
Sex	Male	54 (45.4%)
	Female	65 (54.6%)
Age (years)	*M* (SD)	46.3 (16.8)
	Minimum	18
	Maximum	80
Duration since initial injury	Less than 1 Year	5 (4.2%)
	Between 1–5 Years	47 (39.5%)
	Between 5–10 years ago	31 (26.1%)
	More than 10 years ago	36 (30.3%)
Severity of brain injury	Mild	20 (16.8%)
	Moderate	26 (21.8%)
	Severe	67 (56.3%)
	Prefer not to answer	6 (5.0%)
Type of brain injury	Traumatic	92 (77.3%)
	Non-Traumatic	27 (22.7%)

Table 2. CIQ-H and ABC Total Scores in Traumatic vs Non-traumatic Brain Injury

					95% confidence interval for mean		
		N	Mean	SD	Lower bound	Upper bound	Significance
CIQ-H score total	Traumatic	92	5.64	2.91	5.04	6.24	0.985
	Non-traumatic	27	5.63	3.13	4.39	6.87	
	Total	119	5.64	2.94	5.10	6.17	
ABC score total	Traumatic	92	71.87	23.32	67.04	76.70	0.507
	Non-traumatic	27	69.38	23.39	60.13	78.63	
	Total	119	71.30	23.26	67.08	75.53	

ABC and CIQ-H correlations

A Pearson's correlation indicated there was a significant, but weak, positive correlation of 0.241 between ABC and CIQ-H total scores ($p = 0.008$). A Spearman's rho analysis indicated no associations between severity of injury, type of injury or level of function ($p > 0.05$).

Total ABC and CIQ-H scores

A Mann–Whitney U test revealed no significant difference between ABC total scores ($p = 0.507$) or CIQ-H total scores ($p = 0.985$) in individuals with a traumatic vs non-traumatic injury ($p > 0.05$). The ABC total and CIQ-H total scores are summarized by type of injury in Table 2.

The six participants who chose 'prefer not to answer' regarding severity of injury were excluded from analysis. A Kruskal-Wallis Test of 113 participants determined that while there was no

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Table 3. CIQ-H and ABC Total Scores Based on Severity of Injury

					95% confidence interval for mean		
		N	Mean	SD	Lower bound	Upper bound	Significance
CIQ-H score total	Mild	20	5.24	2.69	3.98	6.50	0.800
	Moderate	26	5.54	2.79	4.41	6.67	
	Severe	67	5.76	3.12	4.99	6.52	
	Total	113	5.63	2.94	5.10	6.17	
ABC score total	Mild	20	82.67	12.76	76.69	88.63	0.010
	Moderate	26	61.12	25.06	51.00	71.24	
	Severe	67	71.20	24.25	65.28	77.11	
	Total	113	71.30	23.25	67.08	75.52	

Significance: $p < 0.05$.

Table 4. Mean ABC and CIQ-H Score Based on Level of Function

				95% confidence interval for mean		
ABC total score function level	N	Mean	SD	Lower bound	Upper bound	Significance
Low level function	19	30.55	16.06	22.81	38.29	$p < 0.001$
Mod level function	46	65.11	8.22	62.67	67.55	
High level function	54	90.92	6.20	89.23	92.61	
Total	119	71.30	23.26	67.08	75.53	
CIQ-H total score function level						
Low level function	19	4.52	3.08	3.04	6.01	$p > 0.05$
Mod level function	46	5.40	2.76	4.58	6.22	
High level function	54	6.24	2.96	5.43	7.04	
Total	119	5.64	2.94	5.10	6.17	

Significance: $p < 0.01$.

significant difference in the CIQ-H score based on injury severity, there was a significant difference in ABC score based on severity of injury. A Dunn's post hoc test indicated a significant difference between the pair of mild-moderate ($p < 0.008$), and no significant difference between the pairs mild-severe and moderate-severe ($p > 0.05$). The ABC total and CIQ-H total scores are summarized by level of injury severity in Table 3.

ABC and CIQ-H scores by level of function

Table 4 summarizes the ABC total scores and CIQ-H scores by level of function. Mean total ABC scores for low, moderate and high level functioning individuals were 30.55/100 (SD = 16.06), 65.11/100 (SD = 8.22), and 90.92 (SD = 6.20), respectively. Mean CIQ-H scores for low, moderate and high level of functioning individuals were 4.52/10 (SD = 3.08), 5.40/10 (SD = 2.76), and 6.24/10 (SD = 2.96), respectively.

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Discussion

This study found a statistically significant positive correlation between total ABC and CIQ-H scores. Thus, individuals who reported higher balance confidence tended to report higher community integration participation for home management, supporting the authors' hypothesis. Likewise, individuals who reported lower balance confidence reported a lower level of participation in community integration for home management. The results of this study suggest that greater levels of balance confidence may be a contributing factor to community integration for home management in individuals with ABI.

No significant difference was identified between the ABC and CIQ-H correlations for individuals with traumatic vs non-traumatic ABIs. This lack of significance difference yields support that the relationship between balance confidence and home integration exists independently of injury type. There are limited studies on how the recovery of those with non-traumatic ABI differs from those with traumatic ABI, and future research is indicated to investigate the differential profiles of these two groups (Cullen, Park & Bayley, 2008; Colantonio et al., 2011). Balance confidence may be important for clinicians to assess when determining community integration status, regardless of whether a patient incurs a traumatic vs non-traumatic ABI, however, this needs to be validated with larger-scale studies.

When comparing CIQ-H scores across levels of severity, no significant differences were found. Although only the home integration component of the CIQ was assessed, findings are consistent with current literature which reports that injury characteristics, including severity, has a negligible-weak relationship with community integration (Kersey, Terhorst, Wu & Skidmore, 2019). Community integration can be impacted in any individual with ABI, therefore future studies assessing community integration after ABI should assess all levels of severity.

Significant differences were found in total ABC scores based on injury severity, indicating that participants in this study with mild ABIs were more likely to exhibit higher levels of balance confidence, as compared to those with moderate or severe injuries. These results are supported by Myers et al. (1998). However, while many studies utilize the ABC to assess balance confidence in individuals ranging from mild to severe ABI, there continues to be a lack of research comparing the three levels of severity (Hays et al., 2019; Maskell, Chiarelli & Isles, 2006; Thornton et al., 2005).

Analysis of the results indicates a significant difference in mean total ABC scores, where individuals with higher levels of balance confidence tend to have higher levels of physical functioning, a crucial component for integration into the home and community. This supports previous studies' results which reported that individuals demonstrating higher degrees of balance confidence exhibit higher levels of balance capacity and mobility during activities of daily living both inside and outside the home (Inness et al., 2011). This is further supported by the positive correlations found between the ABC and clinical measures of balance and mobility (Hays et al., 2019). However, the lack of correlation between level of function and CIQ-H score indicates that the level of physical functioning is not the only determinant of successful integration in the home and community. Kersey et al. (2019) determined that there are many possible predictors of community integration including mood, disability, social support, and social obstacles. The positive correlation between ABC scores and CIQ-H scores from this study suggest that balance capacity may be an additional determinant for clinicians to consider and should be explored in future studies.

The results of this study provide limited evidence to support the use of the ABC in conjunction with the CIQ-H when evaluating the home and community integration levels of individuals with ABI. Disciplines such as physical and occupational therapies may be able to incorporate the ABC as part of their assessment of community integration after ABI. However, as suggested by McCulloch (2007), other more specialized clinicians such as neuropsychological counselors or psychologists may need to be consulted to better address the cognitive or psychological

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components of balance such as balance confidence. Incorporating these two tools into an evaluation has the potential to assist clinicians in determining whether balance confidence may be contributing to restrictions in community integration, and therefore design a more comprehensive plan of care. Future studies are indicated to assess integration of strategies to improve balance confidence as a component of balance recovery training during rehabilitation for increasing community integration in community-dwelling adults with ABI.

There are limitations to this study. A relatively small number of participants volunteered, including those via non-purposive sampling, and the study results revealed a small effect size. Therefore, these results may not represent the wider population of persons with ABI. While the self-reported measures are validated in the ABI population, no objective measures of balance were used in this study. The survey format of this study also creates a potential response bias. Future research is indicated to compare self-reported measures for balance confidence and community integration with objective measures of balance within the community in a larger sample size. This study assessed participants with both traumatic and non-traumatic ABI, as well as all levels of severity. Additional studies are recommended to assess each specific level of severity and/or type of ABI. Response rate was unable to be tracked secondary to the use of snowball sampling. Lastly, the data collection for this study unexpectedly took place during the COVID-19 pandemic when imposed restrictions required individuals to quarantine in their homes for months leading up to survey deployment. Therefore, the information provided by the participants was subject to recall bias regarding social interaction and productive activity prior to quarantine restrictions. Future research is indicated post-pandemic to assess for additional significant correlations with greater strengths between total scores of the ABC and CIQ, without the barrier of recall bias during pandemic restrictions.

Conclusion

The findings of this study suggest that balance confidence may be positively correlated with community integration for individuals with ABI.

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Conflicts of interest. Authors have no conflicts of interest to disclose.

Ethical standards. The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

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