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Original Research

Prevalence, Patterns, and Predictors of Multimorbidity in Adults With Acquired Brain Injury at Admission to Staged Community-Based Rehabilitation

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KEYWORDS
Brain injuries;
Comorbidity;
Multimorbidity;
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Abstract *Objectives:* To describe the prevalence, patterns, and predictors of multimorbidity in adults with an acquired brain injury (ABI) on presentation to a community-based neurorehabilitation service.
Design: Retrospective cohort study using routinely collected admissions and clinical data.
Setting: Community-based neurorehabilitation.
Participants: Individuals (N = 263) with non-traumatic brain injury (NTBI; n = 187 [71.1%]) versus traumatic brain injury (TBI; n = 76 [28.9%]).
Interventions: Not applicable.
Main Outcome Measures: Comorbidity was defined as the co-occurrence of at least one chronic condition in conjunction with a primary diagnosis of ABI. Multimorbidity was defined as the co-occurrence of 2 or more chronic conditions across 2 or more body systems, in conjunction with a primary diagnosis of ABI.
Results: Comorbidity was present in 72.2% of participants overall, whereas multimorbidity was present in 35.4% of the cohort. The prevalence of comorbidity (76% vs 63%; $P = .036$) and multimorbidity (40% vs 24%; $P = .012$) was higher in NTBI compared with participants with TBI. Participants with NTBI had a higher prevalence of physical health multimorbidities, including cardiovascular (44% vs 6%; $P < .001$) and endocrine (34% vs 10%; $P = .002$) disease, whereas participants with TBI had a higher prevalence of mental health conditions (79% vs 48%; $P < .001$). Depression (36.3%) and hypertension (25.8%) were the most common diagnoses. Increasing age was the only significant predictor of multimorbidity.

List of abbreviations: ABI, acquired brain injury; ICD-10, *International Classification of Diseases and Related Health Problems—10th Revision*; MHD, mental health disorder; NTBI, non-traumatic brain injury; SCBIR, staged community-based brain injury rehabilitation; TBI, traumatic brain injury; WA, Western Australia.

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Conclusions: Most participants experienced multimorbidity. Effective management of multimorbidity should be included as part of individual rehabilitation for ABI and planning of resource allocation and service delivery. The results of this study can help guide the provision of treatment and services for individuals with ABI in community-based rehabilitation. Our study highlights access to mental health, cardiovascular, endocrine, and neurology services as essential components of rehabilitation for ABI.

Acquired brain injury (ABI) is a leading cause of death and disability worldwide.[1] ABI is defined as any damage to the brain that occurs after birth and can be traumatic (TBI), caused by extrinsic forces to the head, or non-traumatic (NTBI), such as injury caused by stroke, alcohol or drug misuse, tumor, infection, hypoxia, or anoxia.[2,3]

In Australia, at least 1 in 45 individuals have an ABI with functional limitations.[4] Slow stream rehabilitation, which provides low-intensity, long-duration rehabilitation to individuals whose recovery is prolonged,[5] can provide significant gains in function and independence after ABI, with evidence supporting a number of interventions.[6,7] Staged community-based brain injury rehabilitation (SCBIR) is a novel model of care that provides postacute therapy and care services in a live-in, community-based facility to support ongoing recovery or management of chronic illness or disability,[5,8,9] responding to an individual's needs as they change over time. Studies have demonstrated the overall effectiveness of the model,[8] with evidence that functional improvements are possible more than 2 years after injury.[10]

However, multimorbidity, which is defined as any chronic conditions coexisting with an index disease,[11] can present challenges for rehabilitation. Multimorbidities may be preexisting and exacerbated by injury or occur as part of the sequelae of ABI, resulting from pathophysiological changes or maladaptive psychological responses to changes in abilities, social roles, relationships, and occupational functioning.[12] Factors that have been associated with multimorbidity include older age, female sex, and brain injury from non-traumatic causes.[13,14] Common multimorbidities in the ABI population include mental health, cardiovascular, endocrine disorders, and other neurologic conditions.[13,15]

Complex or poorly managed multimorbidity can affect the course and outcome of rehabilitation, including poorer functional gains[16-18] and restricted participation in activities of daily living and social roles.[19-21] This population is less likely to return to work and more likely to experience employment instability.[22,23] Multimorbidity is linked to poorer quality of life, reduced life satisfaction, increased risk of suicide, and more hospitalizations.[12,19,24] Complex and severe multimorbidity has been associated with worse functional independence and outcomes, longer stays in inpatient rehabilitation, and higher use and costs of health care services overall.[19,25,26]

Optimal management of multimorbidity can improve rehabilitation outcomes and reduce the cost of care.[27] However, effective treatment planning is challenging owing to a lack of multimorbidity research in the ABI population. The literature on stroke, for example, documents a need for education and training in multimorbidity and a lack of information to manage patients with multimorbidity in clinical guidelines.[28-30] Moreover, most epidemiologic studies to date have focused on TBI only,[2,19,31-36] with limited research on NTBI. Some research has examined multimorbidity in specific groups with NTBI (eg, individuals receiving rehabilitation for stroke[37,38]), with results highlighting differential profiles of comorbidity between individuals with stroke and TBI. However, it is not clear whether these differences apply to all NTBIs. Clearer understanding of the presentation of multimorbidity in individuals with ABI is needed to facilitate effective treatment planning, resource allocation, and service delivery.

This study describes the prevalence, patterns, and predictors of multimorbidity in a cohort of adults with ABI (NTBI and TBI) on presentation to a SCBIR service in Western Australia (WA). To facilitate treatment planning and service delivery, we aimed to: (1) determine the prevalence of multimorbidity in the cohort, (2) describe the most commonly occurring multimorbidity combinations in the overall cohort and by brain injury diagnosis (NTBI vs TBI), and (3) examine predictors of multimorbidity.

Methods

Study design and participants

This study was a cross-sectional, retrospective cohort study using a convenience sample of 263 adults with ABI admitted to a SCBIR service provided to individuals aged 18 to 65 years in WA between June 2009 and September 2018. All individuals with full data available were eligible for inclusion in the study.

Setting

Brightwater Care Group provides SCBIR for individuals living with an ABI in WA. Admissions are accepted any time since injury, and rehabilitation takes place in the individual's home or at a live-in facility. The facility is purpose built and designed to enable all stages of postacute community rehabilitation, ranging from stage 1 (full assistance and 24-h care) to stage 10 (full independence). On admission, individuals are assigned to the most appropriate residence

according to their stage and move through residences as they progress toward independence.

Data sources

Data were extracted from the Brightwater-ABI database, an administrative database of all individuals entering neurorehabilitation. ABI records include sociodemographic data (date of birth, sex, indigenous status, country of birth, marital status, number of dependents, occupation, education level, area of residence), clinical data from hospital discharge notes (ABI diagnosis, cause of ABI, date of injury, previous ABI, comorbidities), and data on Brightwater service use (admission date, discharge date, referral source, Brightwater Program).

Ethics

The data used in this analysis were fully anonymized and collected as part of routine operations of the SCBIR service, with the express purpose of improving service provision. Analysis of this data is classed as service evaluation and does not require ethical approval for research in Australia. All participants provided consent for the use of their clinical and demographic information as deidentified data on admission to the service.

Multimorbidity definitions

Comorbidity (1+) was defined as the co-occurrence of at least 1 chronic condition in conjunction with an ABI. Multimorbidity (2+) was defined in terms of a body systems approach, where the total number of different anatomic domains affected was considered instead of individual chronic conditions.[11,39,40] Clinically, patients with chronic conditions in different body systems require management from a number of specialists and higher levels of care coordination.[11,39,41] The body systems definition of multimorbidity therefore allows identification of patients with complex patterns of disease presentation and advanced care needs to facilitate treatment planning, resource allocation, and service delivery.

Broadly, multimorbidity (2+) was defined as the co-occurrence of 2 or more chronic conditions across 2 or more anatomic domains in conjunction with an ABI. We also examined prevalence of multimorbidity in 3 or more anatomic domains (3+) in conjunction with an ABI. Anatomic domains were defined according to a broad chapter categories approach using the *International Classification of Diseases and Related Health Problems—10th Revision* (ICD-10) disease systems.[42] The final list of chapter categories, along with their corresponding ICD-10 range of codes, is given in table 1.

Table 1 Multimorbidity categories, classified according to ICD-10 chapter categories

Full Category Name	ICD-10 Codes
Mental and behavioural disorders	F00-F99
Diseases of the circulatory system	I00-I99
Endocrine, nutritional, and metabolic diseases	E00-E90
Diseases of the nervous system	G00-G99
Diseases of the digestive system	J00-J99
Diseases of the musculoskeletal system and connective tissue	M00-M99
Diseases of the genitourinary system	N00-N99
Diseases of the eye and adnexa	H00-H59
Diseases of the ear and mastoid process	H60-H95
Diseases of the skin and subcutaneous tissue	L00-L99
Diseases of the blood and blood forming organs	D50-D89
Infectious and parasitic diseases	A00-B99

Data analysis

Data were analyzed using IBM SPSS Statistics, version 26.[a] Participants were classified into 2 diagnostic groups (TBI or NTBI) for comparison, and statistical significance was set at a *P* value of less than .05 (2-tailed). Demographic and diagnostic characteristics of the sample were expressed as means (± SD) for continuous variables and frequencies (percentages) for categorical variables. Demographic differences between the NTBI and TBI groups were examined using chi-square tests and independent samples *t* tests for categorical and continuous variables, respectively. For continuous data (ie, age), skewness (maximum, −0.83) and kurtosis (maximum, −1.27) values were within the recommended upper bounds of 2 and 7, respectively,[43] indicating that normal theory estimation was appropriate.

The crude prevalence of multimorbidity was calculated as the number of participants with conditions in 1+, 2+, and 3+ morbidity domains as a proportion of the total. Patterns of comorbidity presentation were examined for the ABI cohort overall and by brain injury diagnosis (TBI vs NTBI). The 5 most common comorbidity combinations across 1+, 2+ and 3+ domains were reported. Chi-square analyses were used to test for differences between diagnostic groups (NTBI vs TBI) in multimorbidity prevalence and patterns. Tests with expected cell frequencies greater than 1 were analyzed using Pearson chi-square; Fisher's exact *P* values were reported for analyses with expected cell frequencies less than 1.[44]

The association between demographics (age, sex, marital status) and brain injury diagnosis (NTBI vs TBI) and multimorbidity across 1+ and 2+ domains was examined using multiple logistic regressions. Missing data were handled using listwise deletion.

Results

Participant characteristics

Between 2009 and 2018, 263 individuals were admitted to the service and included in the analysis. Table 2 shows the demographic and diagnostic characteristics for the cohort. Age at admission ranged from 18 to 64 years (mean ± SD, 45.1±12.2y), with most aged between 41 and 60 years (62.3%). There were twice as many men (66.5%) as women (33.5%) in the cohort, and 46.4% were single at the time of admission. The majority of participants had NTBI (71.1%; 187

Table 2 Demographic and brain injury data for the total cohort and stratified by brain injury (TBI vs NTBI)

Characteristics	Total Cohort (N=263)	NTBI (n=187)	TBI (n=76)	*t* (*df*)	*P* value
Age, mean ± SD	45.1±12.2)	47.4±11.0	39.4±13.4	4.61 (118.15)	<.001
Age bracket, n (%)					
≤30 years	44 (16.7)	20 (10.7)	24 (31.6)		
31-40 years	38 (14.4)	22 (11.8)	16 (21.1)		
41-50 years	74 (28.1)	60 (32.1)	14 (18.4)		
51-60 years	90 (34.2)	70 (37.4)	20 (26.3)		
>60 years	17 (6.5)	15 (8.0)	2 (2.6)		
				χ^2	*P* value
Sex, n (%)				4.59	.032
Female	88 (33.5)	70 (37.4)	18 (23.7)		
Male	175 (66.5)	117 (62.6)	58 (76.3)		
Brain injury diagnosis, n (%)				–	–
Traumatic	76 (28.9)	–	–		
Nontraumatic	187 (71.1)	–	–		
Stroke	122 (46.4)	122 (65.2)	–		
Hypoxia	21 (8.0)	21 (11.2)	–		
Neoplasm/tumor	15 (5.7)	15 (5.3)	–		
Nontraumatic (other)	9 (3.4)	9 (4.8)	–		
Subarachnoid hemorrhage	8 (3.0)	8 (4.3)	–		
Encephalitis	7 (2.7)	7 (3.7)	–		
Neurologic condition	5 (1.9)	5 (2.7)	–		
Admitted from, n (%)				2.61	.106
Home	130 (49.4)	86 (46.0)	44 (57.9)		
Acute or postacute care	111 (42.2)	84 (44.9)	27 (35.5)		
Not recorded	22 (8.4)	17 (9.1)	5 (6.6)		
Marital status, n (%)				11.63	.001
Married/de facto relationship	77 (29.3)	66 (35.3)	11 (14.5)		
Divorced/separated/widowed	56 (21.3)	44 (23.5)	12 (15.8)		
Single	122 (46.4)	71 (38.0)	51 (67.1)		
Not recorded	8 (3.0)	6 (3.2)	2 (2.6)		

NOTE. Data rows labeled "Not recorded" refer to clients for whom relevant demographic data were not available from clinical notes. Marital status collapsed into 2 categories for analysis ("Married/de facto relationship" and "Single," which includes participants who were divorced, separated, widowed, or single). Significance tests and *P* values assessed differences between the NTBI and TBI groups.

of 263), with stroke being the most common cause of injury (46.4%; 122 of 263). Participants with TBI were more likely to be men ($P=.032$), younger ($P<.001$), and single ($P=.001$) on admission. Participants were admitted to the service at differing times since injury (median, 1.2y; interquartile range, 7.5mo-3y]), with 49.4% admitted from their home.

Prevalence of multimorbidity

Comorbidity was present in 72.2% of participants (190 out of 263) overall. Multimorbidity across 2+ domains was present in 35.4% of participants (93 out of 263), and 12.2% (32 out of 263) were affected across 3+ domains. A significantly higher proportion of participants with NTBI had comorbidity (75.9%; 142 of 187) compared with participants with TBI (63.2%; 48 of 76; $P=.036$). The prevalence of multimorbidity across 2+ domains was also significantly higher in the NTBI cohort (40.1%; 75 of 187) compared with the TBI cohort (23.7%; 18 of 76; $P=.012$), as was multimorbidity in 3+ domains (NTBI [15.0%; 28 of 187] vs TBI [5.3%; 4 of 76]; $P=.029$).

Patterns of multimorbidity

Table 3 displays the 5 most common multimorbidity domain combinations across 1+, 2+, and 3+ domains for the overall cohort and by ABI diagnosis. Mental and behavioral disorders were the most common multimorbidity overall, affecting 55.8% of participants with multimorbidity, followed by cardiovascular (34.7%) and endocrine conditions (27.9%).

Participants with TBI had higher prevalence of mental and behavioral disorders (79.2%) than the NTBI group (47.9%; $P<.001$), whereas participants with NTBI had a higher prevalence of co-occurring physical health conditions, including cardiovascular (TBI [6.3%] vs NTBI [44.4%]; $P<.001$) and endocrine diseases (TBI [10.4%] vs NTBI [33.8%]; $P=.002$).

Across 2+ domains, co-occurring cardiovascular disease with mental and behavioral disorders (37.3%) and endocrine disorders (33.3%) were the 2 most common domain combinations for participants with NTBI. This was in contrast to participants with TBI, in whom co-occurring mental and

Table 3 Prevalence of the 5 most common domain combinations for 1, 2+, and 3+ domains overall and stratified by brain injury (TBI vs NTBI)

Number of Domains	Domain	ICD-10 Code	Total Cohort, n (%)	NTBI, n (%)	TBI, n (%)	χ^2	*P* value
1+ (n=190)	Mental and behavioral	F00-F99	106 (55.8)	68 (47.9)	38 (79.2)	14.23	<.001
	Cardiovascular	I00-I99	66 (34.7)	63 (44.4)	3 (6.3)	22.99	<.001
	Endocrine	E00-E90	53 (27.9)	48 (33.8)	5 (10.4)	9.75	.002
	Nervous system	G00-G99	33 (17.4)	23 (16.2)	10 (20.8)	0.54	.464
	Digestive system	K00-K93	16 (8.4)	13 (9.2)	3 (6.3)	0.39	.531
2+ (n=93)	Cardiovascular + endocrine	–	29 (31.2)	28 (37.3)	1 (5.6)	8.63	.003
	Cardiovascular + mental and behavioral	–	26 (28.0)	25 (33.3)	1 (5.6)	7.32	.007
	Endocrine + mental and behavioral	–	23 (24.7)	19 (25.3)	4 (22.2)	0.86	.354
	Mental and behavioral + nervous system	–	12 (12.9)	6 (8.0)	6 (33.3)	4.15	.042
	Cardiovascular + nervous system	–	8 (8.6)	8 (10.7)	0 (0.0)	2.82	.093
3+ (n=32)	Cardiovascular + endocrine + mental and behavioral	–	15 (46.9)	14 (50.0)	1 (25.0)	2.98	.121*
	Cardiovascular + endocrine + nervous system	–	4 (12.5)	4 (14.3)	0 (0.0)	1.38	.574*
	Endocrine + mental and behavioral + nervous system	–	2 (6.3)	1 (3.6)	1 (25.0)	0.66	.442*
	Cardiovascular + digestive system + mental and behavioral	–	1 (3.1)	1 (3.6)	0 (0.0)	0.34	>.99*
	Cardiovascular + nervous system + mental and behavioral	–	1 (3.1)	1 (3.6)	0 (0.0)	0.34	>.99*

NOTE. NTBI cohort with comorbidity (n=142). TBI cohort with comorbidity (n=48). Chi square tests and *P* values assessed differences between the NTBI and TBI groups.

* Fisher's exact test reported as minimum expected cell frequencies less than 1.[44]

behavioral disorders with neurologic conditions (33.3%) and endocrine diseases (22.2%) were the most common combinations.

Figure 1 displays the 10 most common comorbidities for the total cohort and by diagnosis. Participants with TBI had a higher prevalence of depression ($P=.001$), anxiety ($P<.001$), and posttraumatic stress disorder ($P<.001$) than participants with NTBI. Participants with NTBI had a higher prevalence of hypertension ($P<.001$), diabetes mellitus ($P=.006$), and hypercholesterolemia ($P=.019$).

Predictors of multimorbidity

Table 4 displays results of logistic regressions predicting the presence of multimorbidity across the 1+ and 2+ domains. In both models, increasing age was the only significant predictor of multimorbidity, after controlling for sex, marital status, and brain injury diagnosis.

Discussion

Better understanding of multimorbidity in individuals receiving brain injury rehabilitation can promote a more holistic approach to recovery and support the multidisciplinary team and individual to focus on the whole of self, not only neurologic recovery and primary skill outcomes. Empowering individuals to manage their physical and psychosocial health should also facilitate improved personal well-being and support an individual's function and participation within their remaining deficits. Knowledge of commonly co-occurring conditions in this population can help guide recommendations for managing chronic conditions in community-based rehabilitation,[30] to provide more effective, comprehensive care and better align services with individual needs.

This study helps to meet these goals by providing descriptive data on the prevalence, patterns, and predictors of multimorbidity in individuals with ABI admitted to a SCBIR facility, which provides longer-term, live-in rehabilitation services for those with ongoing or complex needs. A significant number of individuals presented with multimorbidities on admission to the service, with close to three-quarters (72%) experiencing at least 1 long-term condition and approximately one-third (35%) presenting with conditions across 2 or more body domains, in conjunction with ABI. This is similar to previous estimates using data recorded on admission to acute inpatient rehabilitation for brain injury,[14,45] indicating that individuals with ABI continue to experience health complications when they reach rehabilitation services in the community. Mental health, followed by cardiovascular, endocrine, and neurologic conditions were the cohort's most common comorbidities. Older age, but not sex, marital status, or brain injury diagnosis, predicted prevalence of multimorbidity in multivariate models.

Consistent with previous research,[13,33] differential profiles of multimorbidity presentation and complexity were

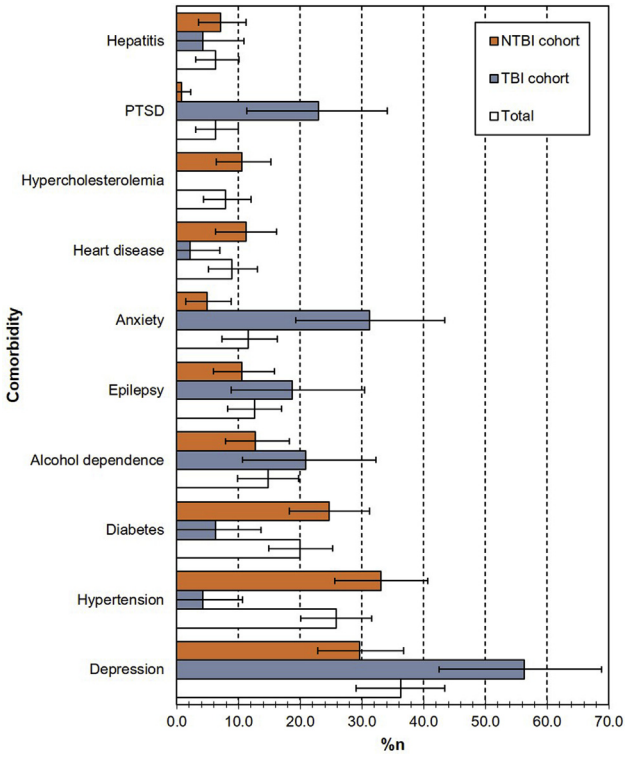

Fig 1 Common diagnoses as a proportion of all comorbidity presentations for the total cohort (n=190) and separated by TBI (n=48) versus NTBI (n=142). Error bars are 95% bootstrapped confidence intervals using 1000 simulations.

found in our cohort. Participants with TBI were generally younger and healthier at presentation to the service, with lower rates of multimorbidity compared with those with NTBI. Notably, participants with TBI were relatively physically healthier than those with NTBI at presentation to the service, most likely because road traffic collisions are the leading cause of injury in younger individuals,[46] not falls as is the case in elderly populations,[47] for whom the risk is exacerbated by preexisting medical conditions (eg, diabetes mellitus).[48] Participants with NTBI showed higher rates of physical health comorbidities, including hypertension, hypercholesterolemia, and diabetes mellitus. This finding is perhaps intuitive given that cardiovascular and endocrine conditions are known risk factors for stroke,[49-51] which was the most common NTBI in our cohort. In contrast, participants with TBI had significantly poorer mental health compared with participants with NTBI. These findings highlight the heterogeneous care needs of individuals with ABI and underscore the importance of rehabilitation support that focuses on the whole of self. Routine screening and early intervention are critical to prevent new comorbidities and manage existing ones. Furthermore, when recovery plateaus, empowering individuals to self-manage their mental and physical health should result in improved well-being and an extended ability to manage within the remaining deficits.

Table 4 Relation between sociodemographic and brain injury characteristics and the presence of comorbidity variables

Characteristics	OR	95% CI	*P* value
1+			
Age	1.04	1.01-1.06	**.004**
Female sex	0.91	0.49-1.67	.752
Single	0.72	0.38-1.37	.315
NTBI	1.58	0.83-3.00	.166
2+ domains			
Age	1.05	1.02-1.08	**<.001**
Female sex	1.33	0.75-2.36	.324
Single	0.55	0.30-1.01	.052
NTBI	1.64	0.85-3.17	.141

NOTE. A total of 255 participants were included in the analysis after excluding 8 participants with missing data on demographic predictors.
P values <.05 are shown in boldface.
Abbreviations: CI, confidence interval; OR, odds ratio.

Of note for service providers is the high prevalence of mental health comorbidities. Mental health disorders (MHD) affected 56% of individuals at presentation to the service and 79% of individuals with TBI. MHDs are among the most disabling consequences of brain injury, with research suggesting that ABI may predispose individuals to MHDs.[52] The estimated annual rate of MHDs in the general adult population in Australia is approximately 20%,[53] suggesting that individuals with ABI have significantly elevated relative risk of having a MHD. In line with our method of classifying disorders according to ICD-10 categories, depression, alcohol dependence, and anxiety were the most common diagnoses. MHDs can interfere with participation in rehabilitation and have been linked to poorer outcomes.[12,54,55]

The especially high prevalence of MHDs among participants with TBI is concerning but perhaps unsurprising, considering that this group was younger, more likely to be single, and relatively healthier before injury. Sudden traumatic injury and the major life changes that result (eg, disability, loss of independence, social changes, employment changes, etc) are known risk factors for MHDs, especially without adequate social and emotional support.[56-58] Transition back into community settings may be a particularly vulnerable period associated with multiple stressors,[59,60] offering an opportunity for intervention. However, individuals with ABI and their families have identified a lack of specialist services to address the dual needs of individuals with ABI and MHDs, as well as insufficient training for clinicians.[61] Early detection and treatment of MHDs is essential to maximize rehabilitation outcomes.

More than 1 in 3 individuals had complex or severe multimorbidity, with chronic conditions across 2 or more body systems in conjunction with an ABI. Complex multimorbidity presents a clinical challenge owing, in part, to current models of care which remain focused on treating single conditions.[28] Under this paradigm, chronic conditions in different body systems in the same individual often compete for treatment and resources,[39] resulting in "fragmented, incomplete, inefficient and ineffective"[62(p457)] management of multimorbidity. Effectively managing multimorbidity requires advanced care coordination to provide a coherent,

consistent, and integrated service response across different health service sectors. Our study highlights access to mental health, cardiovascular, endocrine, and neurology services as essential components of rehabilitation for ABI to aid service providers in planning and resource allocation.

Study limitations

Our study has some limitations. A simple count was used to define multimorbidity and, therefore, all conditions were assigned equal weighting. The effect of multimorbidity on the individual will vary according to both the combination and severity of conditions. Although an investigation of severity was beyond the scope of our descriptive analysis, it would be useful in the community rehabilitation context, as the nature of comorbidities may have the greatest effect on the course and outcome of rehabilitation. In addition, using an ICD-10 body systems approach to classify comorbidity was appropriate to provide a broad overview of conditions that commonly co-occur in individuals with ABI to guide service planning. However, this method is less informative than other methods of comorbidity ascertainment, which delineate between acquired versus nonacquired and communicable versus noncommunicable disease. Furthermore, we used convenience sampling of participants who had complete data, as we did not have access to population-level data at the time of analysis. Therefore, the results will be less generalizable.

Because we used routine clinical data, our study shares the limitations of other comorbidity studies, specifically a reliance on quality of data recording. Some morbidities are probably under-recorded, implying that the findings underestimate the actual prevalence of multimorbidity. In addition, owing to the nature of the routine clinical data used, we were unable to determine the temporal onset of comorbidities and analyze whether morbidities were preexisting or occurred after ABI. Finally, larger follow-up studies of adequate statistical power are needed to obtain more precise estimates. Although our data satisfy the 1:10 events per variable guideline for logistic regression (ie, results based on 10 or more events per variable are associated with negligible bias and adequate precision),[63] a sample of 500 was recently suggested to derive statistics that can adequately represent parameters in a population for observational studies.[64] Therefore, nonsignificant results may have clinical relevance in community settings.

Conclusions

Our analysis extends understanding of the prevalence, patterns, and predictors of multimorbidity to a novel SCBIR context. More individuals with NTBI were affected by multimorbidity, but individuals with TBI were especially vulnerable to experiencing MHDs. Although there is a need for more studies with greater numbers of participants to identify risk factors for comorbidity, multimorbidity, and MHDs in community rehabilitation settings, the results will help in planning rehabilitation services for individuals with ABI in community-based rehabilitation. A coherent, consistent, and integrated service response can optimize outcomes of community rehabilitation.

Supplier

a. IBM SPSS Statistics, version 26; IBM Australia Ltd.

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