ORIGINAL ARTICLE

Hospital psychosocial interventions for patients with brain functional impairment: A retrospective cohort study

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ABSTRACT: Psychosocial interventions could improve health and care outcomes, however, little is known about their use for patients with complex needs in the acute hospital care setting. This study aimed to evaluate factors associated with psychosocial intervention use when treating patients with brain functional impairment during their hospital care. The all-inclusive New South Wales (NSW) Admitted Patient Data were employed to identify patients with neurodevelopment disorders, brain degenerative disorders, or traumatic brain injuries admitted to NSW public hospitals for acute care from July 2001 to June 2014. We considered receipt of psychosocial interventions as the primary outcome, and used mixed effect logistic models to quantify factors in relation to outcome. Of important note, psychosocial intervention use was more common in principal hospitals, and amongst those receiving intensive care or having comorbid mental disorders in the study populations. Approximate 70.8% of patients with traumatic brain injuries did not receive psychosocial interventions, despite attempts to target those in need and an overall increasing trend in adoption. Continuing efforts are warranted to improve service delivery and uptake.

KEY WORDS: brain degenerative disorders, hospital psychiatry, neurodevelopment disorders, psychosocial intervention, traumatic brain injuries.

INTRODUCTION

People with neurodevelopment disorders (NDD) such as autism, intellectual learning disability and attention deficit disorders; brain degenerative disorders (BDD)

such as Alzheimer disease and other degenerative diseases of the nervous system; or traumatic brain injuries (TBI), have a high disease burden due in part to impaired brain functioning, experience challenges in their life situations, and require urgent clinical care at times (Fecteau *et al.* 2013; Garvin & Mangat 2017; Ghroubi *et al.* 2016; Gutierrez *et al.* 2008; Howe 2008; Kopecky *et al.* 2013). Most of these patients experience neuropsychiatric symptoms such as depression and anxiety (Garvin & Mangat 2017; Howe 2008; Kopecky *et al.* 2013), as well as impaired self-efficacy (Ownsworth *et al.* 2010; Ponsford *et al.* 2016). Patients, who experience likely deterioration in their mental and social health, may also develop disruptive behaviours such as agitation, aggression, and resistance-to-care (Fecteau *et al.* 2013; Ghroubi *et al.* 2016). These secondary disorders and disruptive behaviours are associated with a decreased quality of care and an increased

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risk of unintentional physical harm for hospitalised patients (Ghroubi *et al.* 2016; Gutierrez *et al.* 2008). Moreover, self-harm or suicidal attempts were reported during their acute hospital care, e.g., 27.3% of veterans with a TBI history were found to have self-harm behaviours or to have made a single or multiple suicide attempts during their hospitalisations (Gutierrez *et al.* 2008).

Needs for mental health care and support are frequently seen in patients with NDD, BDD, or TBI, however, conventional pharmaceutical interventions have not been found to achieve permanent successful results for these patients with their complex physical and psychosocial needs (Gallagher & Herrmann 2015; Leskovec *et al.* 2008; McConeghy *et al.* 2012; Mercken *et al.* 2011; Vandenberghe *et al.* 2016). In addition to the lack of convincing evidence on efficacy, these pharmaceutical treatments are expensive and most have side effects that adversely impact physical function in these patients or require acute hospital care (Zhou *et al.* 2019).

To address mental health challenges and improve health and social outcomes in these patients, there is growing interest in psychosocial interventions, encompassing interpersonal or informational activities to improve mental health and social functioning, relieve existing deficits, and prevent future disorders (Bourbonnais *et al.* 2011; Chown 2015). These interventions demonstrate a greater reduction in mental health care burdens and achieve a greater gain in psychosocial function and quality of life compared with traditional therapeutic regimens, and are now recommended for patients with NDD, BDD, or TBI during their clinical care (Ballard Clive *et al.* 2009; Lerner *et al.* 2012; Ponsford *et al.* 2016).

The adoption of such psychosocial interventions for these patients during acute hospital care is largely unknown. We aim to evaluate factors associated with the use of psychosocial interventions and the variation in the adoption of psychosocial interventions during hospitalisation in patients with NDD, BDD, or TBI.

METHODS

Data source

This multi-center retrospective cohort study employed routinely collected hospital administrative data from the NSW Admitted Patient Data Collection (APDC), which is a complete census of hospital separation records for all patients admitted to NSW public

hospitals. For each de-identified record, age, sex, post-codes of usual residence, marital status, intensive care, insurance status, medical diagnoses, procedures, and disposition status were extracted from the APDC over a 13-year period from July 2001 to June 2014. We only considered cases for acute hospital care to reduce multiple counting of admissions. Medical diagnosis was coded at separation using the ICD-10 Australian Modification (National Centre for Classification in Health, 2010). The Australian National University Science & Medical Delegated Ethics Review Committee approved this study (#2016/030).

Study population

The study considered inpatients with NDD (including autism, intellectual learning disability and attention deficit disorder using diagnosis codes F70–98), BDD (including Alzheimers and other degenerative diseases of the nervous system using diagnosis codes G30–32), or TBI (diagnosis codes: S00.2, S02.1, S06), who were admitted to NSW public hospitals for acute care in an emergency situation during the study period.

Study outcome

The primary outcome was the use of psychosocial intervention during acute hospital care, categorised as yes or no, using the ICD-10-AM procedure codes (National Centre for Classification in Health, 2010). We also considered whether a patient was transferred at the end of care (yes or no) as the secondary outcome.

Sociodemographic and clinical variables

We considered sociodemographic variables and classified age into five groups in years (i.e., <18, 18–44, 45–64, 65–84, 85+) allowing for its possible non-linear relationship with the study outcome and its indication for healthcare resource allocation (e.g., pediatric or geriatric groups); socioeconomic status into five quintile groups (i.e., 1st as the most disadvantaged, 2nd, 3rd, 4th, or 5th as the most advantaged quintile using the Index of Relative Socio-Economic Disadvantage) (Australian Bureau of Statistics (ABS) 2006); sex as male or female; rurality of residence as ARIA+ based urban, or rural; private insurance as yes or no; marital status as partnered or single. A separate category of unknown was created for those with unclassifiable information.

We also considered clinical variables and classified the number of comorbid mental disorders into five

groups (i.e., none, 1, 2, 3 and ≥ 4 illnesses); severity of comorbidity using modified Charlson Index into three groups (i.e., minor if total score of 0, moderate if total score of 1 or 2, or severe if total score of ≥ 2) (Charlson *et al.* 1987); and determined whether receipt of intensive care; as well as whether being admitted to principal referral hospitals (with >20 000 separations, and regional hospitals with >16 000 separations per annum), based on the Australian Institute of Health and Welfare classification system (Australian Institute of Health and Welfare (AIHW) 2014). Financial year of separation was treated as continuous.

Statistical analysis

Stata version 14.0 was used for all data analysis. Numbers and proportions of NDD, BDD, and TBI patients who received a psychosocial intervention in each hospital were calculated. Mixed-effect logistic regressions were used to explore receipt of psychosocial intervention in association with demographic and clinical variables. A model-derived intraclass correlation coefficient (ICC) was used to estimate to what extent hospital variability contributed to the total variation of use. Additional modelling was conducted to examine whether being transferred at the end of care was associated with the receipt of psychosocial interventions adjusting for the same set of demographic and clinical characteristics used. Box and whiskers plots with the 1.5 $\times$ Interquartile Range rule were also created to visualise variation in the use of psychosocial interventions across different hospitals. A sensitivity analysis was conducted excluding patients with coexisting NDD, BDD, or TBI.

RESULTS

Patients with NDD

For people with NDD, receiving psychosocial intervention was observed in nearly 43.2% ($n = 15\,769$) of the study population, showing an increase of 8% per annum during the study period (Table 1, Fig. 1). Approximate 15.7% of these 36 537 patients ($n = 5729$) were transferred at the end of acute care. There were more male patients (59.1%, $n = 21\,601$), and those aged 0–17 ($n = 12\,117$) or 18–44 years ($n = 12\,259$) accounted for the majority, with 38.6% and 48.0% receiving psychosocial interventions, respectively (Table 1).

TABLE 1: Associations between characteristics and use of psychosocial intervention for NDD patients

Characteristics	Number	Use (%)	Adjusted OR (95% CI)	P-value
Age group (years)				
0–17	12 117	38.6		
18–44	12 259	48.0	0.77 (0.72, 0.82)	<0.001
45–64	7483	41.8	0.73 (0.67, 0.80)	<0.001
65–84	3949	42.8	0.74 (0.67, 0.82)	<0.001
85+	729	52.7	0.78 (0.65, 0.93)	0.005
Sex				
Male	21 601	41.6		
Female	14 936	45.5	1.21 (1.15, 1.27)	<0.001
Rurality of Residence [†]				
Urban	34 136	43.1		
Rural	1584	30.7	1.12 (0.96, 1.31)	0.140
Private Insurance				
No	31 916	44.2		
Yes	4,621	36.0	0.72 (0.67, 0.78)	<0.001
Socioeconomic status [†]				
1st (most disadvantaged)	8,926	42.1		
2nd	7,517	41.1	0.94 (0.87, 1.02)	0.121
3rd	8,592	41.0	0.92 (0.85, 0.99)	0.021
4th	6,625	45.2	0.91 (0.84, 0.99)	0.020
5th (most advantaged)	4,057	45.3	0.91 (0.82, 1.00)	0.060
Intensive care				
No	34 044	42.6		
Yes	2493	50.2	1.74 (1.59, 1.90)	<0.001
Severity of comorbidities				
Minor	28 404	42.8		
Moderate	6079	43.2	1.04 (0.98, 1.11)	0.204
Severe	2054	48.6	1.50 (1.35, 1.66)	<0.001
Number of comorbid mental disorders				
1	21 312	30.7		
2	9870	57.0	2.60 (2.46, 2.75)	<0.001
3	4106	65.7	3.54 (3.27, 3.83)	<0.001
≥ 4	1249	72.1	4.60 (4.01, 5.28)	<0.001
Principal referral hospital				
No	9515	44.5		
Yes	27 022	42.7	2.72 (1.81, 4.11)	<0.001
Marital status [†]				
Partnered	2801	52.5		
Single	32 736	42.1	0.75 (0.69, 0.82)	<0.001
Financial year	36 537	43.2	1.08 (1.07, 1.09)	<0.001

[†]Results for unknown category were not presented.

Bold values indicate the results of statistical significance at significance level of 0.5%.

Receiving psychosocial intervention was positively associated with being under 18 years, female, without private insurance, having a partner, receiving intensive care, with increasing number of comorbid mental disorders (Table 1). Admission to principal referral hospitals was associated with greater adoption of psychosocial interventions (OR: 2.72, 95%CI: 1.81–4.11).

FIG. 1: Hospital volume (n) and adjusted rate of psychosocial intervention use (%) in patients with neurodevelopment disorders (NDD), brain degenerative disorders (BDD), or traumatic brain injuries (TBI) during the 13-year study period.

These principal hospitals had a much higher NDD patient volume on average (mean: 1,454; standard deviation: 5.78) than their counterparts (424; 3.00). Compared with patients who did not receive psychosocial interventions, patients receiving psychosocial interventions were more likely to be transferred (OR: 1.22, 1.14–1.31).

Amongst a total of 98 hospitals providing acute care for patients with NDD, most hospitals ($n = 86$) adopted psychosocial interventions, however, patients from non-principal hospitals with low volume were less likely to receive psychosocial interventions than their counterparts from principal hospitals with high volume (Fig. 2). The hospital-level difference (ICC) contributed to 39.6% total variation in the receipt of psychosocial interventions.

Patients with BDD

For people with BDD, receiving psychosocial intervention was observed in approximately 48.1% ($n = 24\,454$) of the study population with an increase of 3% per annum during the study period (Table 2, Fig. 1). Older patients with BDD (aged 65+ years) accounted for 90.2% of the total patients (Table 2). Patients with BDD ($n = 1573$) living in rural areas were less likely to receive psychosocial interventions than their urban counterparts (OR: 0.81, 0.66–0.99) (Table 2). Receipt of psychosocial interventions was more likely for males, those without private insurance, having a partner, receiving intensive care, and with an increasing number of comorbid mental disorders (Table 2). Admission to principal referral hospitals in comparison with non-principal hospitals was associated with more use of

psychosocial interventions (OR: 5.03, 2.33–10.86). These principal hospitals had a much higher BDD patient volume on average (mean: 2,117; standard deviation: 6.26) than their non-principal counterparts (536; 3.69). Patients receiving psychosocial interventions were more likely to be transferred compared with those who did not receive any psychosocial interventions (OR: 1.56, 1.50–1.62).

Amongst a total of 121 hospitals, a quarter of them (26.4%) did not provide psychosocial interventions for people with BDD. Patients from non-principal hospitals with low volume were less likely to receive psychosocial interventions than their counterparts from principal hospitals with high volume (Fig. 2). Between-hospital difference accounted for 48.8% of total variation in use of psychosocial interventions.

Patients with TBI

For people with TBI, receiving psychosocial intervention was observed in approximately 29.2% ($n = 20\,440$) of the study population, with an increase of 6% per annum during the study period (Table 3, Fig. 1). Patients living in rural areas accounted for 19.7% of the TBI group, who were more likely to receive psychosocial interventions than their urban counterparts (OR: 1.22, 1.10–1.35) (Table 3). Use of psychosocial interventions was more likely in those with older age, female, being single, without private insurance, receiving intensive care, and with an increasing number of mental disorders (Table 3). Admissions to principal referral hospitals were associated with greater adoption of psychosocial interventions (OR: 10.19, 6.28–16.55). These principal hospitals had a much higher TBI

FIG. 2: Hospital-specific use of psychosocial intervention in patients with neurodevelopment disorders (NDD), brain degenerative disorders (BDD), or traumatic brain injuries (TBI).

patient volume on average (mean: 3,298; standard deviation: 7.52) than their non-principal counterparts (392; 2.87). Compared with patients who did not receive psychosocial interventions, those who received psychosocial interventions were more likely to be transferred (OR: 1.39, 1.33–1.45).

Amongst a total of 120 hospitals, 40 hospitals (33.3%) did not provide psychosocial interventions for TBI patients during their urgent care. It was rare for low volume hospitals to adopt psychosocial interventions (Fig. 2). Between-hospital difference accounted for 48.1% of total variation in use of psychosocial interventions.

Variation in use for different patient groups

The observed variability in use of psychosocial interventions for patients with BDD or TBI was less than those with NDD, with the rate of use for patients with TBI being the lowest (Fig. 2). Despite the increase in use over time, the majority of patients with NDD (56.8%), BDD (51.9%) or TBI (70.8%) did not receive psychosocial interventions.

Sensitivity analysis

After excluding patients with coexisting of NDD, BDD, or TBI, there were no significant changes to the ICC estimates (NDD: 39.6%, BDD: 48.8%, and TBI: 48.1%), and the use of psychosocial interventions in relation to demographic and clinical factors as well as the likelihood of being transferred.

DISCUSSION

This study demonstrates an increase over time in the use of hospital based psychosocial interventions for patients with brain functional impairment, reflecting the acceptance of psychosocial interventions as an alternative non-pharmacological therapy (Bracher 2012). Psychosocial interventions have demonstrated clear advantages when compared with conventional therapies such as developing positive behaviors, reducing mental disorders and increasing quality of life (Ownsworth *et al.* 2010; Ponsford *et al.* 2016).

Variation between different hospitals for NDD, BDD and TBI patients receiving psychosocial

TABLE 2: Associations between characteristics and use of psychosocial intervention for BDD patients

Characteristics	Number	Use (%)	Adjusted OR (95% CI)	P-value
Age group (years)				
0–17	219	31.1		
18–44	731	40.4	1.33 (0.75, 2.35)	0.330
45–64	4,025	51.3	1.97 (1.13, 3.43)	0.016
65–84	27 991	49.2	1.80 (1.04, 3.13)	0.037
85+	17 837	46.3	1.60 (0.92, 2.79)	0.094
Sex				
Male	23 541	49.4		
Female	27 262	47.0	0.93 (0.89, 0.97)	<0.001
Rurality of Residence [†]				
Urban	48 765	49.2		
Rural	1583	12.1	0.81 (0.66, 1.00)	0.049
Private Insurance				
No	39 319	47.8		
Yes	11 484	49.2	0.99 (0.95, 1.04)	0.781
Socioeconomic status [†]				
1st (most disadvantaged)	9510	44.5		
2nd	10 900	56.0	0.85 (0.80, 0.91)	<0.001
3rd	10 299	53.6	0.90 (0.84, 0.97)	0.003
4th	10 906	48.4	0.88 (0.82, 0.94)	<0.001
5th (most advantaged)	8,732	45.6	0.93 (0.85, 1.01)	0.089
Intensive care				
No	49 322	52.0		
Yes	1481	46.7	1.27 (1.14, 1.42)	<0.001
Severity of comorbidities				
Minor	4674	44.7		
Moderate	35 089	47.5	0.88 (0.81, 0.95)	<0.001
Severe	11 040	51.5	1.01 (0.93, 1.09)	0.869
Number of comorbid mental disorders				
None	5751	39.5		
1	39 774	47.5	1.48 (1.38, 1.58)	<0.001
2	4650	61.1	2.38 (2.18, 2.60)	<0.001
3	558	69.0	3.11 (2.54, 3.79)	<0.001
>=4	70	75.7	4.72 (2.66, 8.39)	<0.001
Principal referral hospital				
No	12 727	45.6		
Yes	38 076	49.0	5.03 (2.33, 10.86)	<0.001
Marital status [†]				
Partnered	22 030	49.3		
Single	27 231	47.5	0.94 (0.90, 0.98)	0.003
Financial year [‡]	50 803	48.1	1.03 (1.02, 1.04)	<0.001

[†]Results for unknown category were not presented.

[‡]Effect for financial year was adjusted for gender, socioeconomic status, comorbid mental disorder, principal referral hospital, and marital status to avoid problematic model convergence.

Bold values indicate the results of statistical significance at significance level of 0.5%.

interventions were substantial, which might be partly attributable to access, service delivery, and policy implementation in place. Patients admitted to principal referral hospitals had greater access to psychosocial

TABLE 3: Associations between characteristics and use of psychosocial intervention for TBI patients

Characteristics	Number	Use (%)	Adjusted OR (95% CI)	P-value
Age group (years)				
0–17	9,478	21.6		
18–44	23 910	26.9	1.09 (1.01, 1.17)	0.026
45–64	12 372	28.6	1.12 (1.03, 1.22)	<0.001
65–84	16 474	33.3	1.42 (1.31, 1.54)	<0.001
85+	7689	38.1	1.85 (1.69, 2.02)	<0.001
Sex [†]				
Male	47 182	27.8		
Female	22 740	32.3	1.23 (1.18, 1.28)	<0.001
Rurality of Residence [‡]				
Urban	64 198	29.6		
Rural	4316	19.7	1.22 (1.10, 1.35)	<0.001
Private Insurance				
No	53 706	29.9		
Yes	16 217	27.0	0.78 (0.75, 0.82)	<0.001
Socioeconomic status [‡]				
1st (most disadvantaged)	14 743	28.0		
2nd	14 105	26.9	0.95 (0.89, 1.00)	0.069
3rd	13 656	28.2	0.93 (0.87, 0.99)	0.025
4th	13 338	31.0	0.86 (0.81, 0.92)	<0.001
5th (most advantaged)	12 651	31.2	0.75 (0.70, 0.80)	<0.001
Intensive care				
No	58 512	23.9		
Yes	11 411	56.7	3.63 (3.46, 3.80)	<0.001
Severity of comorbidities				
Minor	56 259	26.0		
Moderate	10 113	40.9	1.42 (1.35, 1.49)	<0.001
Severe	3551	47.3	1.74 (1.61, 1.88)	<0.001
Number of comorbid mental disorders				
None	51 054	25.7		
1	16 613	36.3	1.40 (1.34, 1.46)	<0.001
2	1959	53.4	2.54 (2.30, 2.82)	<0.001
3	260	66.5	4.26 (3.20, 5.67)	<0.001
>=4	37	83.8	13.02 (5.02, 33.79)	<0.001
Principal referral hospital				
No	10 877	14.5		
Yes	59 046	31.9	10.19 (6.28, 16.55)	<0.001
Marital status [‡]				
Partnered	24 403	28.3		
Single	41 866	29.1	1.11 (1.06, 1.15)	<0.001
Financial year	69 923	29.2	1.06 (1.05, 1.06)	<0.001

[†]Result for one observation with missing sex information was not presented.

[‡]Results for unknown category were not presented. Bold values indicate the results of statistical significance at significance level of 0.5%.

interventions as principal referral hospitals with high patient volume offer more specialised psychiatric services when compared with their counterparts (South Western Sydney Local Health District 2016; Australian Institute of Health and Welfare (AIHW) 2018), which

may explain the observed positive association between admission to principal referral hospitals and use of psychosocial interventions for all three patient groups. In addition, lack of access to psychosocial services was reported in rural areas (Murphy & Ruble 2012), which might contribute to the observed variation in this study, for example, fewer patients with brain functional impairment received psychosocial interventions in rural areas compared with their counterparts in urban areas. Although telehealth approaches demonstrated feasibility to delivery psychosocial interventions in access-limited environment (Hepburn *et al.* 2016), robust evaluation of population-based effectiveness was lacking and the usability of such new technology was somewhat problematic during implementation. In the absence of effective countermeasures to eliminate practical barriers, increasing universal access to psychosocial services in patients with brain function impairment remains a challenge.

In this study, use of psychosocial interventions increased in association with receiving intensive care or having comorbid mental illnesses. While these groups were more likely to receive psychosocial interventions compared with their counterparts, there were still a large number of patients who received intensive care (49.8% of NDD patients, 53.3% of BDD patients, and 43.3% of TBI patients) or who were diagnosed with comorbid mental illnesses (56.8% of NDD patients, 51.8% of BDD patients, 61.2% of TBI patients) did not receive any psychosocial interventions. This service gap indicates a clear need for psychosocial support, with whereby the possible focus is on offering interventions to patients who receive intensive care or who have comorbid mental illnesses. This specific finding suggests it would be beneficial to establish mental health evaluation programs in hospitals and incorporate psychosocial interventions into routine hospital care for patients with NDD, BDD, or TBI, especially those with comorbid mental illnesses or patients who receive intensive care.

Currently, the Australian government authorities have funded very few hospital based programs designed to benefit inpatients with complex needs (Australian Government Department of Health, 2017; Victorian Government Department of Health, 2013), despite a strong focus on provision of primary mental health care. We found NDD and TBI patients with public insurance, during their acute hospital care, were more likely to receive psychosocial interventions than patients with private insurance, indicating a heavy reliance on psychological programs funded by the government. Given comorbid mental disorders are common

in patients with NDD (Khan *et al.* 2012), BDD (Espiritu *et al.* 2001) or TBI (Corrigan & Deuschle 2008) and they were admitted to hospitals with anxiety about their physical conditions as well as family and financial matters, additional mental health training and support becomes more necessary for hospital clinicians and nurses to comprehend these psychosocial needs and uphold the whole-person approach for better care and better outcomes. Future initiative to bridge primary and tertiary healthcare as well as private and public schemes would likely encourage the use of psychosocial interventions to aid patients' recovery.

Other sociodemographic factors associated with greater use of psychosocial interventions were identified as age (0–17 years for NDD patients; >18 years for TBI patients; 45–84 years for BDD patients) and being socioeconomically advantaged. Although these groups had a higher rate of receiving of psychosocial interventions compared with their counterparts, it should be noted that over 50% of all patients did not receive any psychosocial interventions, perhaps because of the barrier created by the economic burden. Furthermore, we are unable to determine whether there are cultural barriers or language barriers preventing patients from receiving psychosocial interventions due to a lack of causal data, such as ethnic background or type of the first language spoken. In this case, future research is recommended that focuses on contextual information about hospital based mental health care, which is essential to encourage the provision of services by hospitals and governments.

In the current study setting, compared with patients who did not receive psychosocial interventions, patients who underwent psychosocial interventions were more likely to be transferred. Recently, patients with TBI demonstrated the need for continuing rehabilitation after they had been stabilised and transferred to general mental health institutes or long-term care facilities (Takada *et al.* 2017). However, identifiers for receiving facilities were unavailable, and therefore it was difficult to determine whether patients were transferred for rehabilitation or for other reasons.

In this situation, we were unable to determine whether the use of psychosocial interventions contributed to a better recovery outcome. Being transferred is perhaps a proxy measure of a psychosocial therapy failure in those who requiring more specialised care at the receiving mental health hospital. Several articles mention that typical psychosocial interventions are not always effective (Green *et al.* 2015; Wittenberg 2016). Further research with a focus on the effectiveness of psychosocial interventions for hospitalised

patients with brain functional impairment is necessary if we are to encourage the provision of psychosocial interventions by hospitals and governments.

LIMITATIONS

Although the dataset in this study includes a large sample size over a long period, these data were lacking narrative descriptions of clinical status, mental health status, pharmacotherapy with psychotropic medications, and psychosocial modalities for these patients with complex needs as these data were routinely collected for administrative purposes only. Compared with coded data, narrative information may assist in identifying more detailed psychosocial intervention strategies. For example, investigation of patient's progress notes might enhance our understanding of the relative contribution of different psychosocial therapies towards the amelioration of symptoms and improvement in resilience and wellbeing in patients with these chronic conditions.

Also an issue was the ambiguity of coding of some demographic variables as unclassifiable. Nearly 1,000 observations have unclassifiable values for marital status, so there might be certain biases in this regard. Although we repeated the analysis by excluding these unclassifiable observations and observed little changes in effect estimates, results should be interpreted with caution. Another limitation is that of attributed to confounding, possibly due to the existence of unmeasured risk factors, which might influence the results concluded in this study. For example, active engagement with patients' families may play an important role in improving uptake of evidence based services (Masi *et al.* 2003; Snell-Johns *et al.* 2004). At a certain point throughout their episodes of acute care, patients might have received motivational family coping support strategies or services, which was unfortunately lacking in the data collection. Nevertheless, when treating people with brain functional impairment, healthcare providers are encouraged to keep their families actively engaged in mental health services. Moreover, the effectiveness of psychosocial interventions is not verified in this study setting, and therefore further research is recommended to examine whether psychosocial interventions assist patients' recovery.

IMPLICATIONS FOR PRACTICE

Although increasing trends of receipt of psychosocial interventions for hospitalised patients with brain functional impairment were observed in this study, there

was still significant variation in the use of these interventions between different hospitals. In this case, continuing effort is best focused on narrowing the variations in the use of psychosocial interventions between different hospitals (e.g., increasing access to psychiatric care, improving services delivery and planning, or encouraging more publically available psychosocial programs). However, unwarranted variation in this study highlights the need for further investigation.

RELEVANCE STATEMENT

The findings from this study provide important evidence to support future initiatives to improve targeted mental health care in patients with brain functional impairment during acute hospital care. Reduction of the unwarranted variation in the use of psychosocial interventions is urgently needed to improve outcomes in these patients with complex needs during their acute hospital care.

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ETHICAL STATEMENTS

Ethics approval was sought from the Institution Science & Medical Delegated Ethics Review Committee (#2016/030).

REFERENCES

- Australian Bureau of Statistics (ABS) (2006). *Information Paper: An Introduction to Socio- Economic Indexes for Areas (SEIFA)* (Cat. no. 2039.0). Canberra, ACT: ABS.
- Australian Government Department of Health (2017). PHN Primary Mental Health Care Flexible Funding Pool Implementation Guidance. Retrieved from: <http://www.health.gov.au/internet/main/publishing.nsf/content/2126B045A8DA90FDCA257F6500018260/File/3PHN%20Guidance%20-%20Psychological%20therapies%20for%20underserved%20groups.pdf>.
- Australian Institute of Health and Welfare (AIHW) (2014). Australian hospital statistics 2012–13 (Cat. no. 145). Canberra, ACT: AIHW.
- Australian Institute of Health and Welfare (AIHW) (2018). Hospital profile: Hospital Services. Retrieved from:

- <https://www.myhospitals.gov.au/hospital/1154Q2300/john-hunter-hospital>
- Ballard Clive, M. R. C., Brown, R., Fossey, J. *et al.* (2009) Brief psychosocial therapy for the treatment of agitation in alzheimer disease (the CALM-AD trial). *American Journal of Geriatric Psychiatry*, 17(9), 726–733.
- Bourbonnais, R., Brisson, C. & Vézina, M. (2011). Long-term effects of an intervention on psychosocial work factors among healthcare professionals in a hospital setting. *Occupational and Environmental Medicine*, 68 (7), 479–486.
- Bracher, M. (2012). *Investigating Autism: History, Culture and Embodied Difference*. London, UK: SAGE Publications.
- Charlson, M., Pompei, P., Ales, K. & MacKenzie, C. (1987). A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *Journal of Chronic Diseases*, 40 (5), 373–383.
- Chown, N. (2015). Do researchers evaluate psychosocial interventions for autism from the perspective of the three dominant cognitive autism theories? *Review Journal of Autism and Developmental Disorders*, 2 (3), 243–261.
- Corrigan, J. D. & Deuschle, J. J. (2008). The presence and impact of traumatic brain injury among clients in treatment for co-occurring mental illness and substance abuse. *Brain Injury*, 22 (3), 223–231.
- Espiritu, D., Rashid, H., Mast, B., Fitzgerald, J., Steinberg, J. & Lichtenberg, P. (2001). Depression, cognitive impairment and function in Alzheimer's disease. *International Journal of Geriatric Psychiatry*, 16 (11), 1098–1103.
- Fecteau, S., Levasseur-Moreau, J., García-Molina, A. *et al.* (2013) Risk taking in hospitalized patients with acute and severe traumatic brain injury. *PLoS One*, 8(12), e83598.
- Gallagher, D. & Herrmann, N. (2015) Agitation and aggression in alzheimer's disease: An update on pharmacological and psychosocial approaches to care. *Neurodegenerative Disease Management*, 5(1), 77–83.
- Garvin, R. & Mangat, H. S. (2017) Emergency neurological life support: Severe traumatic brain injury. *Neurocritical Care*, 27(S1), 159–169.
- Ghroubi, S., Alila, S., Feki, I. & Elleuch, M. H. (2016) Quality of life after traumatic brain injury. *Annals of Physical and Rehabilitation Medicine*, 59, e135–e135.
- Green, J., Charman, T., Pickles, A. *et al.* (2015). Parent-mediated intervention versus no intervention for infants at high risk of autism: A parallel, single-blind, randomised trial. *Lancet Psychiatry*, 2(2), 133–140.
- Gutierrez, P. M., Brenner, L. A. & Huggins, J. A. (2008) A preliminary investigation of suicidality in psychiatrically hospitalized veterans with traumatic brain injury. *Archives of Suicide Research*, 12(4), 336–343.
- Hepburn, S. L., Blakeley-Smith, A., Wolff, B. & Reaven, J. A. (2016) Telehealth delivery of cognitive-behavioral intervention to youth with autism spectrum disorder and anxiety: A pilot study. *Autism*, 20(2), 207–218.
- Howe, E. (2008) Key psychosocial interventions for Alzheimer's disease: an update. *Psychiatry (Edmont)*, 5 (2), 23–27.
- Khan, N. Z., Gallo, L. A., Arghir, A. *et al.* (2012) Autism and the grand challenges in global mental health. *Autism Research*, 5(3), 156–159.
- Kopecky, K., Broder-Fingert, S., Iannuzzi, D. & Connors, S. (2013) The needs of hospitalized patients with autism spectrum disorders: A parent survey. *Clinical Pediatrics*, 52(7), 652–660.
- Lerner, M. D., White, S. W. & McPartland, J. C. (2012) Mechanisms of change in psychosocial interventions for autism spectrum disorders. *Dialogues in Clinical Neuroscience*, 14(3), 307.
- Leskovec, J. T., Rowles, M. B. & Findling, L. R. (2008) Pharmacological treatment options for autism spectrum disorders in children and adolescents. *Harvard Review of Psychiatry*, 16(2), 97–112.
- Masi, M. V., Miller, R. B. & Olson, M. M. (2003) Differences in dropout rates among individual, couple, and family therapy clients. *Contemporary Family Therapy*, 25, 63–75.
- McConeghy, W. K., Hatton, J., Hughes, L. & Cook, M. A. (2012) A review of neuroprotection pharmacology and therapies in patients with acute traumatic brain injury. *CNS Drugs*, 26(7), 613–636.
- Mercken, M., Strooper, B. D. & Karran, E. (2011) The amyloid cascade hypothesis for alzheimer's disease: An appraisal for the development of therapeutics. *Nature Reviews Drug Discovery*, 10(9), 698–712.
- Murphy, M. A. & Ruble, L. A. (2012) A comparative study of rurality and urbanicity on access to and satisfaction with services for children with autism spectrum disorders. *Rural Special Education Quarterly*, 31(3), 3–11.
- National Centre for Classification in Health (2010). *International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD- 10-AM)*, 7th edn. Sydney, NSW: Author.
- Owensworth, T., Quinn, H., Fleming, J., Kendall, M. & Shum, D. (2010) Error self-regulation following traumatic brain injury: A single case study evaluation of metacognitive skills training and behavioural practice interventions. *Neuropsychological Rehabilitation*, 20(1), 59–80.
- Ponsford, J., Lee, N. K., Wong, D. *et al.* (2016) Efficacy of motivational interviewing and cognitive behavioral therapy for anxiety and depression symptoms following traumatic brain injury. *Psychological Medicine*, 46(5), 1079–1090.
- Snell-Johns, J., Mendez, J. L. & Smith, B. H. (2004) Evidence-based solutions for overcoming access barriers, decreasing attrition, and promoting change with underserved families. *Journal of Family Psychology*, 18(1), 19–35.
- South Western Sydney Local Health District. (2016). NSW Hospital Peer Groups 2016. Retrieved from https://www1.health.nsw.gov.au/pds/ActivePDSDocuments/IB2016_013.pdf.

- Takada, K., Sashika, H. & Kikuchi, N. (2017) Rehabilitation needs and participation restriction in patients with cognitive disorder in the chronic phase of traumatic brain injury. *Medicine*, 96(4), e5968.
- Vandenberghe, R., Rinne, J. O., Boada, M. *et al.* (2016) Bapineuzumab for mild to moderate alzheimer's disease in two global, randomized, phase 3 trials. *Alzheimer's Research & Therapy*, 8(1), 18.
- Victorian Government Department of Health. (2013). National Practice Standards for Mental Health workforce 2013. Retrieved from: <http://www.health.gov.au/internet/main/publishing.nsf/content/5D7909E82304E6D2CA257C430004E877/File/wkstd13.pdf>
- Wittenberg, B. M. (2016). *A Psychosocial Intervention for Children With Autism Spectrum Disorder in the Outpatient Surgery Unit*. Austin, TX: University of Texas at Austin.
- Zhou, M., Du, W., Salvador-Carulla, L. & Glasgow, N. (2019) Adverse drug event-related hospitalisation in persons with neurodevelopmental disorders: a state-wide retrospective cohort study. *Journal of Intellectual Disability Research* 63 (5), 429–440. <https://doi.org/10.1111/jir.12586>