BMJ Open

Factors associated with discharge from hospital to residential aged care for younger people with neuropsychiatric disorders: An exploratory case-control study using linked data in New South Wales, Australia

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2022-065982
Article Type:	Original research
Date Submitted by the Author:	27-Jun-2022
Complete List of Authors:	Cvejic, Rachael; UNSW Sydney, Department of Developmental Disability Neuropsychiatry Watkins, Tim; UNSW Sydney, Department of Developmental Disability Neuropsychiatry Walker, Adrian; UNSW Sydney, Department of Developmental Disability Neuropsychiatry Reppermund, Simone; UNSW Sydney, Department of Developmental Disability Neuropsychiatry; UNSW Sydney, Centre for Healthy Brain Ageing Srasuebkul, Preeyaporn; UNSW Sydney, Department of Developmental Disability Neuropsychiatry Draper, Brian; Prince of Wales Hospital, Eastern Suburbs Older Persons Mental Health Service Withall, Adrienne; UNSW Sydney, School of Population Health Winkler, Di; Summer Foundation; La Trobe University, Living with Disability Research Centre Honan, Ingrid; Cerebral Palsy Alliance Mackechnie, Deidre; MS Australia Trollor, Julian; University of New South Wales, Department of Developmental Disability Neuropsychiatry; UNSW Sydney, Centre for Healthy Brain Ageing
Keywords:	NEUROLOGY, PSYCHIATRY, EPIDEMIOLOGY

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Factors associated with discharge from hospital to residential aged care for younger people with neuropsychiatric disorders: An exploratory case-control study using linked data in New South Wales, Australia

Rachael C Cvejic[1*], Tim R Watkins[1*], Adrian R Walker[1], Simone Reppermund[1, 2], Preeyaporn Srasuebkul[1], Brian Draper[2, 3], Adrienne Withall[4], Di Winkler[5], Ingrid Honan[7], Deidre Mackechnie[8], Julian N Trollor[1, 2]

[*] Joint first author

[1] The Department of Developmental Disability Neuropsychiatry, Discipline of Psychiatry and Mental Health, School of Clinical Medicine, Faculty of Medicine and Health, UNSW Sydney, Australia

[2] Centre for Healthy Brain Ageing, Discipline of Psychiatry & Mental Health, School of Clinical Medicine, Faculty of Medicine and Health, UNSW Sydney, Australia

[3] Eastern Suburbs Older Persons Mental Health Service, Prince of Wales Hospital, Randwick, Australia

[4] School of Population Health, Faculty of Medicine and Health, UNSW Sydney, Australia

[5] Summer Foundation, Box Hill, Victoria, Australia

[6] Living with Disability Research Centre, La Trobe University, Melbourne, Victoria, Australia

[7] Cerebral Palsy Alliance, Allambie Heights, New South Wales, Australia

[8] MS Australia, North Sydney, New South Wales, Australia

Corresponding Author: Professor Julian Trollor

Email: J.Trollor@unsw.edu.au,

Phone: +61 (2) 9065 8076

Address: The Department of Developmental Disability Neuropsychiatry, School of Psychiatry, UNSW Sydney, NSW 2052, Australia

Word count: 2,741

Key words: Neurology; Psychiatry; Epidemiology

Abstract

Objectives: To examine the sociodemographic and diagnostic factors associated with a discharge from hospital to residential aged care (RAC) for younger people (aged 15–64 years) with neuropsychiatric disorders.

Design: An exploratory case-control study using a historic cohort of people with neuropsychiatric disorders. Cases were people transferred to RAC on hospital discharge during the study period. Controls were people not transferred to RAC on discharge during the study period.

Setting: Public and private hospital admissions in New South Wales (NSW), Australia.

Participants: People aged 15–64 years with a neuropsychiatric disorder hospitalised in NSW between July 2002 and June 2015 (n=516,469).

Outcome measures: The main outcome was transfer to RAC on discharge from hospital. We calculated odds ratios for sociodemographic and diagnostic factors to determine factors that may impact discharge to RAC.

Results: During the period of data capture, 4,406 people were discharged from hospitals to RAC. Discharge to RAC was most strongly associated with diagnoses of progressive neurological and cognitive disorders. Acute precipitants of RAC transfer included a broad range of conditions and injuries (e.g. Wernicke's encephalopathy, stroke, falls) in the context of issues such as older age, not being partnered (married

or de facto), living in areas of lower socioeconomic status, functional issues, and the need for palliative care.

Conclusions: There are multiple intersecting and interacting pathways culminating in discharge from hospital to RAC among younger people with neuropsychiatric disorders. Improved capacity for interdisciplinary home care and alternative housing and support options for people with high support needs are required.

Article Summary

Strengths and limitations

- This study utilises a large linked dataset that includes information from all hospital admissions in NSW, Australia, for people with recorded diagnoses of neuropsychiatric disorders over a period of 14 years.
- The study was completed in consultation with an advisory group comprising people with lived experience of being, or supporting, a younger person in RAC.
- The cohort included all people hospitalised with a recorded neuropsychiatric diagnosis; other related diagnoses (e.g., traumatic brain injury, stroke) were not used to derive the cohort and as such only a subpopulation of younger people discharged to RAC were included.
- We used a lookback period and excluded persons with any indication of previous placement in RAC but we could not confirm that index admissions for cases reflected the first ever transfer to RAC.
- Some information relevant to the risk of transfer to RAC was not available in the datasets used, including the reasons for placement in RAC, time since diagnoses were first made, and information about functional abilities and availability of informal care.

Introduction

Residential aged care (RAC) facilities in Australia provide accommodation and personal care (including access to nursing and health services) to older adults who are not able to continue living within their own homes. Although most people living in RAC in Australia are over 65 years of age, people aged under 65 years (hereafter "younger people") may also be placed in RAC, largely due to a lack of access to age-appropriate community-based accommodation and supports.(1) Over 3,400 younger people were living in RAC in Australia as of 31 December 2021, with over 600 new RAC placements in this age group occurring in the preceding year.(2) Younger people living in RAC typically have high clinical needs and experience activity limitations as a result of disability, e.g. due to intellectual and developmental disability, physical disability (e.g. paraplegia), acquired brain injury, and progressive neurological disorders (e.g. dementia, multiple sclerosis and Huntington disease).(3) It is known that younger people living in RAC experience a range of negative outcomes, including a lack of appropriate recreational activities and medical and rehabilitation services, loss of function, and experiences of grief, hopelessness, and neglect.(4, 3, 5, 6) Further, many RAC facilities are not equipped to adequately meet the specific and complex health and rehabilitation needs of younger people with disability.(4)

The placement of younger people into RAC in Australia has previously been targeted through the Younger People with Disability in Residential Aged Care Initiative. However, a review showed that this was unlikely to result in a sustainable reduction in younger people entering RAC.(7) The prevention of the placement of younger people into RAC has since been identified as an area for immediate action by the

Australian Royal Commission into Aged Care Quality and Safety;(6, 8) in particular, stopping the "pipeline" from hospital to RAC. Using a large, linked dataset of younger people with neuropsychiatric disorders admitted to hospital in New South Wales (NSW), Australia, this study aims to identify sociodemographic and diagnostic factors that may be associated with a transfer to RAC upon discharge from hospital. Identification of these factors will inform the development of strategies to prevent or delay the transfer of younger people from hospital to RAC.

Methods

Study design and data sources

This exploratory case-control study used data from a large linkage study of people with neuropsychiatric disorders, including mental health disorders, neurological disorders, and intellectual and developmental disabilities.(9) The primary dataset used in the current study was the NSW Admitted Patient Data Collection (APDC; 1 July 2001-30 June 2015) which contains information recorded during all admissions to NSW hospitals and psychiatric facilities. This includes admission/discharge dates and up to 51 diagnoses (coded according to the International Statistical Classification of Diseases and Related Health Problems; 10th revision, Australian modification (ICD-10-AM)) for each episode.

Study population

We defined our study population as people aged 15–64 years with a neuropsychiatric disorder who were admitted to a hospital in NSW between 1 July 2001 and 30 June 2015. Neuropsychiatric disorders were determined by any of the following: i) diagnosis of intellectual disability recorded in any dataset from the

broader linkage study previously described,(9); ii) ICD-10-AM diagnoses of mental and behavioural disorders ('F00-F99', 'S06'), disorders of the nervous system ('G00-G99'), or intellectual and developmental disability ('P04.3', 'Q86.0', 'Q87.0', 'Q87.1', 'Q87.2', 'Q87.3', 'Q87.5', 'Q87.8', 'Q89.8', 'Q90', 'Q91', 'Q93', 'Q99.2') recorded during a hospital admission; iii) an admission to a psychiatric unit, indicated where unit type on admission was one of 'Psychiatric Acute', 'Psychiatric Rehabilitation', 'Psychiatric Secure', 'Brain Injury Rehabilitation', 'Psychiatric Intensive Care', 'Post Natal Depression', 'Psychiatric Extended Care', 'Neuro-Psychiatry', 'Psychiatric Medium Secure', 'Psychiatric Emergency', or where days in a psychiatric unit were >0.

Cases were people transferred to RAC on discharge from hospital during the study (i.e., mode of hospital separation was 'Transfer to Nursing Home'). Controls were people with hospital admissions but no recorded transfers to RAC. The index admission for cases was defined as the date of the first transfer to RAC from hospital occurring in the study period. To obtain a similar distribution of control index admission dates across the study period to that of the cases, index admissions for controls were randomly selected by matching eligible control hospital discharge dates to case index dates using the SAS macro 'gmatch' greedy matching algorithm.(10)

Individuals were excluded if the mode of separation of their index admission was 'Death with Autopsy' or 'Death without Autopsy'. To minimise the chance of previous transfer to RAC, individuals were excluded if: they were transferred to RAC on discharge from hospital before 1 July 2002; the source of referral was 'Nursing

Home/RAC' at or before the index admission; the diagnosis "Place of occurrence, aged care facility" was recorded at or before the index admission. Individuals were also excluded if the index admission was a same-day admission or if diagnostic or sociodemographic data were missing.

Sociodemographic and other non-diagnosis variables

Sex, Aboriginal and/or Torres Strait Islander status, country of birth (Australia or overseas), Index of Relative Socioeconomic Disadvantage (IRSD) quintiles, remoteness of area of residence categories and date of death were obtained from multiple datasets as previously described.(9) Marital Status was sourced from the APDC at the index admission and, if missing, we used Last Observation Carried Forward if recorded in a previous admission. Age at the index admission was analysed using five-year age groups to allow for a non-linear association with the outcome. We also calculated the year of the index date, and the total admission length of stay (days) over all admissions within a lookback period of 365 days prior to the index date.

Diagnosis group variables

We extracted all ICD-10-AM diagnosis codes recorded during the index admission and collapsed these into broad but meaningful groupings. We initially grouped diagnoses based on two previous reports.(11, 12) Conditions that were deemed unlikely to affect the chance of RAC transfer (e.g., those relating to pregnancy and birth) were excluded. To avoid sparse data bias,(13) diagnosis groups with less than 20 cases were also removed. This process resulted in 224 diagnostic groupings.

Following this, the groupings were further collapsed into 57 general diagnostic categories (see Supplementary Table A).

Statistical analysis

We used logistic regression models to estimate the effect of sociodemographic and diagnostic factors on transfer to RAC. For sociodemographic factors we report both the unadjusted effects and full model results, as while the individual models do not adjust for confounding factors, adjusting for mediators in the full model would potentially bias the estimates.(14) Likewise, it is likely that some diagnosis groups share overlapping causal pathways and, hence, odds ratio estimates from our full logistic model might be affected by overadjustment bias.(17) For diagnostic factors, estimates were also produced using a separate logistic model for each diagnosis group that adjusted for sociodemographic/non-diagnosis variables only. While this approach does not adjust for confounding by other diagnostic variables, it is less likely to exhibit overadjustment bias.

Supplementary analyses utilising the lookback period

The above analyses utilise data only from the index admission and so include the acute precipitants of transfer to RAC on discharge from hospital. To determine whether inclusion of diagnoses recorded in the 365 days preceding the index admission impacted the effect estimates of variables that may be associated with transfer to RAC, we repeated the above analyses using all diagnoses received at hospital admissions occurring during the look-back period. Results of these analyses are presented in Supplementary Table B.

Analyses were conducted using SAS 9.4 (SAS Institute) and Stata 15.1 (StataCorp).

Patient and Public Involvement: Consultation with Lived Experience Advisory Group

We established an advisory group comprising nine people with lived experience of being, or supporting, a younger person living in RAC and consulted with them about the aims, methods, and findings of the research.

Ethics approval

This study was approved by the NSW Population & Health Services Research Ethics Committee (CINSW 2013/02/445, AU RED reference: HREC/13/CIPHS/7, substudy number 2019UMB0601). Ethics approval included a waiver of consent.

Results

Cohort characteristics

Details of the selection process for cases and controls are shown in Figure 1. Sociodemographic characteristics are provided in Table 1.

[Figure 1 about here]

LEGEND: Figure 1. Selection of cases and controls. RAC= residential aged care.

Table 1. Sociodemographic characteristics of cohort

Variable	Cases[a] (n=4,406)	Controls[b] (n=512,063)	*p*
Sex			< 0.001
Male	2,586 (58.7%)	271,636 (53.0%)	
Female	1,820 (41.3%)	240,427 (47.0%)	
Age (grouped)			< 0.001
15-19	18 (0.4%)	37,345 (7.3%)	
20-24	29 (0.7%)	41,765 (8.2%)	
25-29	47 (1.1%)	45,252 (8.8%)	
30-34	63 (1.4%)	52,919 (10.3%)	
35-39	100 (2.3%)	54,086 (10.6%)	
40-44	203 (4.6%)	54,187 (10.6%)	
45-49	359 (8.1%)	53,575 (10.5%)	
50-55	678 (15.4%)	55,677 (10.9%)	
55-59	1,250 (28.4%)	59,401 (11.6%)	
60-64	1,659 (37.7%)	57,856 (11.3%)	
Remoteness of area of residence			0.001
Major Cities	3,180 (72.2%)	361,626 (70.6%)	
Inner Regional	932 (21.2%)	110,864 (21.7%)	
Outer Regional	281 (6.4%)	35,747 (7.0%)	
Remote	13 (0.3%)	3,826 (0.7%)	
Index of Relative Socioeconomic Disadvantage			< 0.001
1 (Most disadvantaged)	1,068 (24.2%)	111,963 (21.9%)	
2	912 (20.7%)	99,973 (19.5%)	
3	958 (21.7%)	102,797 (20.1%)	
4	818 (18.6%)	91,313 (17.8%)	
5 (Least disadvantaged)	650 (14.8%)	106,017 (20.7%)	
Marital status			< 0.001
Married or de facto	1,295 (29.4%)	245,387 (47.9%)	
Never married	1,779 (40.4%)	201,768 (39.4%)	
Widowed	277 (6.3%)	9,155 (1.8%)	
Separated or divorced	1,055 (23.9%)	55,753 (10.9%)	
Born in Australia			0.021
Yes	3,457 (78.5%)	408,941 (79.9%)	
No	949 (21.5%)	103,122 (20.1%)	
Year of index admission, median (IQR)	2009 (2006-2012)	2009 (2006-2013)	0.007
Total length of stay (days), median (IQR)	62 (28-116)	4 (2-12)	< 0.001
Hospital type			< 0.001
Public	4,245 (96.3%)	387,607 (75.7%)	
Private	161 (3.7%)	124,456 (24.3%)	

[a]Cases were persons transferred to residential aged care during the study period; [b]Controls were persons not transferred to residential aged care during the study period

Predictors of transfer to RAC on discharge from hospital

Predictors of transfer to RAC on discharge are shown in Tables 2 (sociodemographic variables) and 3 (diagnosis variables). Accounting for all covariates, the odds of transfer to RAC increased with advancing age (ORs range from 2.18 (95% CI=1.16-4.10) for 20-24 years of age to 82.50 (95% CI=49.51-137.47) for 60-64 years). People living in regional and remote areas were less likely to be transferred to RAC than people living in major cities (inner regional OR=0.89, 95% CI=0.81-0.98, outer regional OR=0.80, 95% CI=0.69-0.93, remote OR=0.28, 95% CI=0.15, 0.53). People living in the most disadvantaged areas were slightly more likely to be discharged to RAC than those living in the least disadvantaged areas (OR=1.15, 95% CI=1.02-1.30). Individuals who were never married (OR=2.76, 95% CI=2.51-3.04), widowed (OR=2.60, 95% CI=2.22-3.05), or separated/divorced (OR=2.61, 95% CI=2.37-2.88) were more likely to be transferred to RAC on discharge than individuals who were currently partnered (married or de facto).

For diagnosis group predictors, adjusting for all variables, people with Huntington disease had the greatest likelihood of transfer to RAC on discharge (OR=29.97, 95% CI=20.88-43.01), followed by people living with dementia (OR=15.14, 95% CI=13.10-17.51), multiple sclerosis (OR=8.43, 95% CI=6.96-10.22), Wernicke's encephalopathy (OR=6.58, 95% CI=4.40-9.83), motor neurone disease (OR=5.62, 95% CI=3.93-8.03), Parkinson's disease (OR=5.55, 95% CI=4.33-7.11), a need for palliative care (OR=5.32, 95% CI=4.48-6.33), intellectual disability (OR=3.72, 95% CI=3.31-4.19), stroke (OR=3.08, 95% CI=2.75-3.46), and mobility and personal care issues (OR=2.87, 95% CI=2.57-3.22). When adjusting only for sociodemographic and other non-diagnosis variables the same diagnoses emerged as the strongest

predictors though in a slightly different order; diagnoses of Huntington disease (OR=30.23, 95% CI=22.26-41.05), dementia (OR=19.78, 95% CI=17.44-22.43), and Wernicke's encephalopathy (OR=9.03, 95% CI=6.41-12.71) conferred the greatest likelihood of transfer to RAC on discharge from hospital, followed by a need for palliative care (OR=8.47, 95% CI=7.50-9.56), multiple sclerosis (OR=8.21, 95% CI=6.94-9.71), and difficulties with mobility and personal care (OR=7.72, 95% CI=7.01-8.51). Similar results were obtained when utilising diagnostic variables available from hospital admissions occurring during the lookback period (365 days preceding the index admission; Supplementary Table B).

Table 2. Sociodemographic and other non-diagnosis predictors of transfer from hospital to RAC on discharge

Variable	Unadjusted Odds ratio (95% CI)	Full model[a] Odds ratio (95% CI)
Sex		
Male	Reference	Reference
Female	0.80 (0.75–0.84)	0.92 (0.85–0.99)
Age (grouped)		
15-19	Reference	Reference
20-24	1.44 (0.80–2.59)	2.18 (1.16–4.10)
25-29	2.15 (1.25–3.71)	3.87 (2.16–6.95)
30-34	2.47 (1.46–4.17)	5.06 (2.87–8.92)
35-39	3.84 (2.32–6.34)	7.56 (4.39–13.03)
40-44	7.77 (4.80–12.59)	13.65 (8.08–23.06)
45-49	13.90 (8.66–22.32)	22.79 (13.58–38.23)
50-55	25.26 (15.82–40.35)	39.80 (23.85–66.41)
55-59	43.66 (27.41–69.53)	66.59 (39.98–110.91)
60-64	59.49 (37.38–94.67)	82.50 (49.51–137.47)
Remoteness		
Major cities	Reference	Reference
Inner regional	0.96 (0.89–1.03)	0.89 (0.81–0.98)
Outer regional	0.89 (0.79–1.01)	0.80 (0.69–0.93)
Remote	0.39 (0.22–0.67)	0.28 (0.15–0.53)
Index of Relative Social Disadvantage		
5 Least disadvantaged	Reference	Reference
4	1.46 (1.32–1.62)	1.10 (0.97–1.24)
3	1.52 (1.38–1.68)	1.13 (1.00–1.28)
2	1.49 (1.34–1.65)	1.09 (0.96–1.23)
1 Most disadvantaged	1.56 (1.41–1.72)	1.15 (1.02–1.30)
Marital status		
Married (incl. de facto)	Reference	Reference
Never married	1.67 (1.55–1.80)	2.76 (2.51–3.04)
Widowed	5.73 (5.03–6.54)	2.60 (2.22–3.05)
Separated or divorced	3.59 (3.30–3.89)	2.61 (2.37–2.88)
Born in Australia		
Yes	Reference	Reference
No	1.09 (1.01–1.17)	0.86 (0.79–0.94)
Year of index admission	0.98 (0.97–0.99)	0.96 (0.95–0.97)
Total length of stay	1.01 (1.01–1.01)	1.01 (1.01–1.01)
Hospital type		
Public	Reference	Reference
Private	0.12 (0.10–0.14)	0.30 (0.25–0.36)

[a]Model output was dependent on the collapsed diagnosis groups included in the full model (reported in Table 3)

271 Table 3. Diagnostic predictors of transfer from hospital to RAC on discharge

Diagnosis variable	Cases[a] n=4,406	Controls[b] n=512,063	Unadjusted Odds ratio (95%CI)	Partially adjusted Odds ratio[c] (95%CI)	Full model Odds ratio[d] (95% CI)
Huntington disease	84 (1.9%)	181 (0.0%)	54.96 (42.36–71.32)	30.23 (22.28–41.05)	29.97 (20.88–43.01)
Dementia	561 (12.7%)	951 (0.2%)	78.42 (70.31–87.45)	19.78 (17.44–22.43)	15.14 (13.10–17.51)
Multiple sclerosis	189 (4.3%)	2,752 (0.5%)	8.29 (7.14–9.64)	8.21 (6.94–9.71)	8.43 (6.96–10.22)
Wernicke's encephalopathy	58 (1.3%)	177 (0.0%)	38.58 (28.64–51.97)	9.03 (6.41–12.71)	6.58 (4.40–9.83)
Motor neurone disease	52 (1.2%)	516 (0.1%)	11.84 (8.89–15.77)	6.54 (4.79–8.93)	5.62 (3.93–8.03)
Parkinson's disease	130 (3.0%)	1,084 (0.2%)	14.33 (11.92–17.23)	5.55 (4.52–6.82)	5.55 (4.33–7.11)
Need for palliative care	421 (9.6%)	2,032 (0.4%)	26.52 (23.77–29.59)	8.47 (7.50–9.56)	5.32 (4.48–6.33)
Intellectual disability	700 (15.9%)	17,257 (3.4%)	5.42 (4.99–5.88)	3.89 (3.52–4.30)	3.72 (3.31–4.19)
Stroke	929 (21.1%)	12,094 (2.4%)	11.05 (10.25–11.90)	3.72 (3.42–4.04)	3.08 (2.75–3.46)
Difficulties with mobility and personal care	797 (18.1%)	3,860 (0.8%)	29.08 (26.76–31.59)	7.72 (7.01–8.51)	2.87 (2.57–3.22)
Other genitourinary diseases	1,810 (41.1%)	26,785 (5.2%)	12.63 (11.88–13.43)	5.93 (5.53–6.36)	2.65 (2.43–2.90)
Cerebral palsy	78 (1.8%)	1,925 (0.4%)	4.78 (3.80–6.00)	5.82 (4.48–7.56)	2.52 (1.89–3.37)
Pressure injury and ulcers	811 (18.4%)	4,844 (0.9%)	23.62 (21.78–25.62)	4.74 (4.30–5.22)	2.35 (2.09–2.64)
Primary malignant cancers	635 (14.4%)	14,552 (2.8%)	5.76 (5.28–6.27)	2.47 (2.25–2.71)	1.88 (1.59–2.21)
Epilepsy	377 (8.6%)	12,843 (2.5%)	3.64 (3.27–4.05)	3.08 (2.73–3.47)	1.78 (1.54–2.05)
Neurological symptoms and signs	1,371 (31.1%)	26,414 (5.2%)	8.31 (7.78–8.86)	3.81 (3.54–4.10)	1.77 (1.61–1.93)
Falls	785 (17.8%)	18,284 (3.6%)	5.85 (5.41–6.33)	2.47 (2.26–2.70)	1.76 (1.55–2.00)
Chronic liver disease	433 (9.8%)	12,884 (2.5%)	4.22 (3.82–4.67)	1.95 (1.75–2.18)	1.67 (1.46–1.91)
Chronic respiratory diseases	919 (20.9%)	19,644 (3.8%)	6.61 (6.13–7.11)	1.95 (1.79–2.11)	1.48 (1.35–1.64)
Gastrointestinal symptoms and signs	978 (22.2%)	25,828 (5.0%)	5.37 (5.00–5.77)	3.07 (2.83–3.32)	1.43 (1.29–1.58)
Other factors influencing health status and contact with health services	3,140 (71.3%)	230,981 (45.1%)	3.02 (2.83–3.22)	1.62 (1.51–1.74)	1.35 (1.25–1.47)
Secondary mental disorders	150 (3.4%)	1,674 (0.3%)	10.75 (9.07–12.73)	3.02 (2.46–3.70)	1.34 (1.06–1.70)
Delirium	289 (6.6%)	3,439 (0.7%)	10.38 (9.17–11.75)	3.29 (2.86–3.79)	1.32 (1.12–1.57)
Other neurological conditions	1,806 (41.0%)	125,113 (24.4%)	2.15 (2.02–2.28)	2.21 (2.06–2.36)	1.31 (1.20–1.43)
Diabetes	886 (20.1%)	31,542 (6.2%)	3.83 (3.56–4.13)	1.38 (1.27–1.50)	1.30 (1.18–1.43)
Other endocrine, nutritional and metabolic diseases	1,941 (44.1%)	63,638 (12.4%)	5.55 (5.23–5.89)	2.03 (1.90–2.17)	1.26 (1.15–1.37)
Infections	1,968 (44.7%)	60,793 (11.9%)	5.99 (5.64–6.36)	2.61 (2.44–2.79)	1.21 (1.11–1.32)

Behavioural and emotional symptoms and signs	355 (8.1%)	17,421 (3.4%)	2.49 (2.23–2.78)	1.81 (1.59–2.05)	1.17 (1.00–1.36)
Traumatic brain injury	153 (3.5%)	9,652 (1.9%)	1.87 (1.59–2.20)	1.47 (1.22–1.76)	1.14 (0.92–1.42)
Other symptoms and signs	1,616 (36.7%)	53,259 (10.4%)	4.99 (4.69–5.31)	2.60 (2.43–2.79)	1.14 (1.04–1.24)
Problems related to housing, economic and social situation	653 (14.8%)	45,332 (8.9%)	1.79 (1.65–1.95)	1.27 (1.15–1.39)	1.13 (1.01–1.26)
Dental caries	54 (1.2%)	1,597 (0.3%)	3.97 (3.02–5.21)	1.45 (1.04–2.02)	1.10 (0.75–1.60)
Skin disease	678 (15.4%)	19,168 (3.7%)	4.68 (4.30–5.08)	1.84 (1.62–2.02)	1.09 (0.97–1.22)
Alcohol, substance and other mental disorders	1,158 (26.3%)	132,886 (26.0%)	1.02 (0.95–1.09)	1.02 (0.95–1.10)	1.05 (0.96–1.15)
Secondary malignant cancers	324 (7.4%)	5,743 (1.1%)	7.00 (6.23–7.86)	2.90 (2.57–3.28)	1.01 (0.83–1.23)
Diseases of eyes and ears	527 (12.0%)	13,616 (2.7%)	4.97 (4.53–5.46)	1.90 (1.72–2.12)	1.00 (0.88–1.13)
Acute and chronic renal disease	565 (12.8%)	14,548 (2.8%)	5.03 (4.60–5.50)	1.38 (1.25–1.53)	0.99 (0.88–1.12)
Other injuries	1,691 (38.4%)	104,213 (20.4%)	2.44 (2.29–2.59)	1.53 (1.43–1.63)	0.97 (0.89–1.05)
Diseases of the digestive system	1,192 (27.1%)	53,957 (10.5%)	3.15 (2.94–3.37)	1.51 (1.40–1.62)	0.95 (0.87–1.04)
Fractures	392 (8.9%)	22,140 (4.3%)	2.16 (1.95–2.40)	1.26 (1.13–1.42)	0.91 (0.78–1.07)
Other circulatory system disorders	1,838 (41.7%)	69,117 (13.5%)	4.59 (4.32–4.87)	1.44 (1.34–1.54)	0.90 (0.82–0.98)
Musculoskeletal	1,465 (33.3%)	82,920 (16.2%)	2.58 (2.42–2.75)	1.52 (1.41–1.62)	0.88 (0.80–0.97)
Other common mental disorders	767 (17.4%)	116,898 (22.8%)	0.71 (0.66–0.77)	0.75 (0.69–0.82)	0.86 (0.78–0.95)
Other cancers	116 (2.6%)	8,165 (1.6%)	1.67 (1.39–2.01)	1.01 (0.83–1.25)	0.77 (0.61–0.97)
Circulatory and respiratory symptoms and signs	303 (6.9%)	21,903 (4.3%)	1.65 (1.47–1.86)	0.91 (0.80–1.03)	0.74 (0.64–0.86)
Asthma	58 (1.3%)	7,585 (1.5%)	0.89 (0.68–1.15)	0.67 (0.51–0.88)	0.72 (0.53–0.97)
Blood disorders	554 (12.6%)	14,237 (2.8%)	5.03 (4.59–5.51)	1.55 (1.40–1.72)	0.69 (0.61–0.79)
Schizophrenia	372 (8.4%)	31,106 (6.1%)	1.43 (1.28–1.59)	0.32 (0.28–0.37)	0.65 (0.56–0.76)
Other oral disorders	98 (2.2%)	3,420 (0.7%)	3.38 (2.76–4.14)	1.26 (0.99–1.61)	0.65 (0.50–0.86)
Intentional self-harm	51 (1.2%)	22,161 (4.3%)	0.26 (0.20–0.34)	0.36 (0.26–0.48)	0.57 (0.41–0.79)
Coronary heart disease	196 (4.4%)	13,550 (2.6%)	1.71 (1.48–1.98)	0.59 (0.51–0.69)	0.55 (0.46–0.65)
Rehabilitation, convalescence and respite	1,089 (24.7%)	18,829 (3.7%)	8.60 (8.02–9.22)	1.85 (1.70–2.02)	0.51 (0.46–0.57)
Upper respiratory diseases	39 (0.9%)	9,763 (1.9%)	0.46 (0.34–0.63)	0.65 (0.46–0.92)	0.46 (0.31–0.68)
Spinal cord injury	21 (0.5%)	638 (0.1%)	3.84 (2.48–5.94)	0.35 (0.21–0.59)	0.21 (0.12–0.36)

[a]Cases were persons transferred to residential aged care during the study period; [b]Controls were persons not transferred to residential aged care during the study period; [c] Partially adjusted odds ratios were calculated using a model adjusting only for sociodemographic/non-diagnosis variables shown in Table 2. [d]Adjusted odds ratios were calculated using a model adjusting for all diagnosis and sociodemographic/non-diagnosis variables (sociodemographic/non-diagnosis variables are shown in Table 2).

Discussion

This study investigated multiple factors that may lead to transfer from hospital to RAC for younger people with neuropsychiatric disorders in NSW, Australia. Within this cohort, people at greatest risk of transfer from hospital to RAC were those with progressive cognitive and neurological disorders. People with neurodevelopmental disorders were also at increased risk. Acute precipitants of transfer from hospital to RAC included a range of medical conditions in the context of issues such as older age, not being partnered, living in areas of lower socioeconomic status, functional issues related to mobility and personal care, and the need for palliative care. These findings highlight opportunities for interventions that might prevent or delay placement of younger people in RAC, including reducing preventable causes of disability, the development of hospital discharge protocols, rapid intensive and responsive support in the home, alternative high support housing options, and alternative palliative care pathways.

Our findings indicate that specific conditions and acute health events are major factors associated with greater odds of transfer from hospital to RAC for younger people with neuropsychiatric disorders. We found an increased risk of discharge to RAC specifically for people with progressive cognitive and neurological disorders (particularly Huntington disease and young onset dementia) and people with neurodevelopmental disorders (intellectual disability and cerebral palsy). Acute medical factors associated with increased risk of RAC transfer included Wernicke's encephalopathy, stroke, and cancer. Indicators of increasing support needs included difficulties with mobility and personal care, injuries (e.g. falls, pressure injuries and ulcers), and a need for palliative care. Importantly, some of these primary drivers of

transfer from hospital to RAC are preventable, or amenable to intervention. Prevention strategies include minimising fall risk amongst people with progressive cognitive and neurological disorders (e.g., Parkinson's disease) through individualised exercise, physical therapy, and falls prevention programs.(15) The development and evaluation of individualised falls prevention and balance programs for people with intellectual disability is needed to improve functional outcomes and reduce fall risk in this prematurely frail group.(16, 17) Additionally, long-term neurocognitive disability due to Wernicke's encephalopathy (Korsakoff syndrome) should be prevented with rapid treatment with thiamine, and addressing issues such as alcohol abuse and malnutrition.(18) An increased emphasis on rehabilitation following acute health events may also lead to improved outcomes, including addressing barriers to post-stroke rehabilitation among people with cognitive disabilities. People with cognitive disabilities typically experience poorer outcomes post-stroke including institutionalisation (19) and are often considered unlikely to benefit from rehabilitation, however demonstrate functional improvements when appropriate rehabilitation is provided.(20)

In November 2019, the Prime Minister of Australia declared that no younger people should be living in RAC by 2025.(21) A number of specific actions required to meet this commitment were outlined by the Royal Commission into Aged Care Quality and Safety (Recommendation 74; (8)), which have since been accepted but not necessarily funded by the Australian Government.(22)) Our findings highlight the need to prioritise the funding and development of health and disability support pathways as alternatives to RAC, including hospital discharge protocols to prevent younger people being discharged into RAC and, alternative housing and support

options for younger people at risk of entering RAC (8). Potential hospital discharge protocols could include a trial and evaluation of a short-term specialised transition disability care model (e.g. 12 weeks; similar to the Australian Transition Care Programme for eligible older people leaving hospital)(23) to be implemented prior to consideration of RAC, as well as alternative palliative care pathways for younger people with life-limiting conditions. Alternative housing and support options could include the establishment of high-support needs community living options through expansion of intensive disability supports and home in-reach programs from health and allied health professionals, and extending trials of “Health care homes” to target those at risk.(24)

Further actions relate to Australia’s National Disability Insurance Scheme (NDIS), which provides individualised funding packages for disability supports and services to eligible individuals with permanent and significant disability (e.g. intellectual, cognitive, neurological, sensory, physical or psychosocial disability).(25) Potential actions include improving capacity for the NDIS to enable health and disability systems to provide interdisciplinary care, echoing the recommendations of the Royal Australian and New Zealand College of Psychiatrists to the Joint Standing Committee of the NDIS.(26) This could include the development of a system for rapid crisis response in the case of a new or deteriorating primary condition, a medical comorbidity that affects functioning, or when a person requires palliative care. This would entail ensuring a joint response from health and disability services with rapid response to assessment of new and emerging support needs, timely provision of funding to meet those needs, and finally, establishing a pipeline of available alternative high support housing options.

Strengths of our study include the use of a large dataset including all hospital admissions in NSW over a period of 14 years. Furthermore, our study was done in consultation with a Lived Experience Advisory Group who provided feedback on our interpretation of the results, ensuring that our research was relevant to the needs and experiences of younger people living in RAC. Limitations include the restricted cohort, which only included people hospitalised in NSW, Australia, with a recorded neuropsychiatric diagnosis. Diagnoses used for cohort formation in the broader data linkage on which this study is based did not include other related diagnoses (e.g., traumatic brain injury and stroke). As such, the findings must be interpreted in the context of younger people with neuropsychiatric disorders (who represent a substantial proportion of younger people living in RAC in Australia),(3) but not the entire population of younger people at risk of transfer to RAC. Further, we could not confirm that index admissions for cases reflected the first ever transfer to RAC, though we attempted to do this by using a lookback period and excluding persons with any indication of previous placement in RAC. Finally, other information relevant to the risk of transfer to RAC was not available in the datasets used, including reason for placement in RAC (e.g., respite, residential, or palliative care), time since diagnosis, detailed information about functional abilities, and information about informal care.

Our study has identified acute precipitants of transfer to RAC on discharge from hospital for younger people with neuropsychiatric disorders in NSW, Australia. Significant investment in health and disability support pathways as alternatives to RAC, as well as cross-sector support to rapidly respond to escalating needs, may prevent the movement of younger people from hospital to RAC.

Acknowledgements: We thank the Lived Experience Advisory Group (including Imelda Gilmore, Chanelle McKenna, Lisa Corcoran, Denis Cavanagh, Andrew Wallner, Paulene Bates, Helen Burt, and others) for their continued input into this study. We also thank Andrew Giles (National Policy Manager, MS Australia) for his ongoing contributions to this project.

Funding statement: This project was funded by the Summer Foundation (award number: N/A; Title: Understanding the health and support needs of younger people with disabilities discharged from hospital to residential aged care) and was supported by a National Health and Medical Research Council Australia Partnerships for Better Health grant (Award number: APP1056128; Title: Improving the Mental Health Outcomes of People with an Intellectual Disability).

Competing interests: Dr Di Winkler is Chief Executive Officer of the Summer Foundation. No other disclosures.

Author contributions: RCC led the drafting and finalisation of this manuscript, and contributed to the overall project direction and interpretation of results; TRW led the statistical analyses, and contributed to the overall project direction, interpretation of results, and drafting and finalisation of this manuscript; ARW led consultations with the Lived Experience Advisory Group, contributed to the overall project direction, interpretation of results, and drafting and finalisation of this manuscript; PS contributed to the statistical analyses, and contributed to the overall project direction, interpretation of results, and drafting and finalisation of this manuscript; SR, BD, AW,

DW, IH, DM, and JNT all contributed to the overall project direction, interpretation of results, and drafting and finalisation of this manuscript.

Data sharing statement: Datasets used in this project cannot be shared publicly due to the data usage agreement between the Department of Developmental Disability Neuropsychiatry, The University of New South Wales Sydney, and the data custodians who provide access to this data.

Ethics approval: This study was approved by the NSW Population & Health Services Research Ethics Committee (CINSW 2013/02/445, AU RED reference: HREC/13/CIPHS/7, substudy number 2019UMB0601). Ethics approval included a waiver of consent.

References

1. Australian Institute of Health and Welfare. GEN Aged Care Data: People using aged care; 2022 [cited 18th May 2022]. Available from: URL: https://www.gen-agedcaredata.gov.au/Topics/People-using-aged-care#Aged%20care%20use%20and%20age.
2. Australian Institute of Health and Welfare. Younger People in Residential Aged Care- GEN Aged Care Data. Available from: URL: https://www.gen-agedcaredata.gov.au/Resources/Younger-people-in-residential-aged-care.
3. Winkler DF, Farnworth L, Sloan S. People under 60 living in aged care facilities in Victoria. Australian Health Review 2006; 30(1):100–8.
4. Cameron C, Pirozzo S, Tooth L. Long-term care of people below age 65 with severe acquired brain injury: appropriateness of aged care facilities. Health and Health Care 2001; 25(3):261–4.
5. McMillan TM, Laurie M. Young adults with acquired brain injury in nursing homes in Glasgow. Clin Rehabil 2004; 18(2):132–8.
6. Tracey R, Briggs L. Royal Commission into Aged Care Quality and Safety: Interim report. Royal Commission into Aged Care Quality and Safety; 2019. Available from: URL: https://agedcare.royalcommission.gov.au/publications/Pages/interim-report.aspx.
7. Winkler DF, Farnworth LJ, Sloan SM, Brown T. Young people in aged care: progress of the current national program. Aust Health Rev 2011; 35(3):320–6.
8. Royal Commission into Aged Care Quality and Safety. Final Report: Care, Dignity and Respect. Commonwealth of Australia; 2021. Available from: URL: https://agedcare.royalcommission.gov.au/publications/final-report.

9. Reppermund S, Heintze T, Srasuebkul P, Reeve R, Dean K, Smith M et al. Health and wellbeing of people with intellectual disability in New South Wales, Australia: a data linkage cohort. BMJ Open 2019; 9(9):e031624.
10. Gmatch: SAS macro. http://bioinformaticstools.mayo.edu/research/gmatch/; 2007.
11. Australian Institute of Health and Welfare. Pathways of younger people entering permanent residential aged care. Canberra: AIHW; 2019 Cat. no. AGE 89. Available from: URL: https://www.gen-agedcaredata.gov.au/Resources/Reports-and-publications/2019/July/Pathways-of-younger-people-entering-permanent-resi.
12. Australian Institute of Health and Welfare. Australian Burden of Disease Study: Methods and supplementary material 2015; 2019. Available from: URL: https://www.aihw.gov.au/getmedia/a99468c5-4048-4ee9-972e-d76b9fb65a88/aihw-bod-23.pdf.
13. Greenland S, Mansournia MA, Altman DG. Sparse data bias: A problem hiding in plain sight. BMJ 2016; 352:i1981.
14. Westreich DJ, Greenland S. The Table 2 Fallacy: Presenting and Interpreting Confounder and Modifier Coefficients. American Journal of Epidemiology 2013; 177(4):292–8.
15. Mak MK, Wong-Yu IS, Shen X, Chung CL. Long-term effects of exercise and physical therapy in people with Parkinson disease. Nat Rev Neurol 2017; 13(11):689–703.
16. Hale LA, Mirfin-Veitch BF, Treharne GJ. Prevention of falls for adults with intellectual disability (PROFAID): a feasibility study. Disabil Rehabil 2016; 38(1):36–44.

17. McKenzie K, Ouellette-Kuntz H, Martin L. Frailty as a Predictor of Institutionalization Among Adults With Intellectual and Developmental Disabilities. Intellectual and Developmental Disabilities 2016; 54(2):123–35.
18. Latt N, Dore G. Thiamine in the treatment of Wernicke encephalopathy in patients with alcohol use disorders. Intern Med J 2014; 44(9):911–5.
19. Saposnik G, Cote R, Rochon PA, Mamdani M, Liu Y, Raptis S et al. Care and outcomes in patients with ischemic stroke with and without preexisting dementia. Neurology 2011; 77(18):1664.
20. Mizrahi E-H, Arad M, Adunsky A. Pre-stroke dementia does not affect the post-acute care functional outcome of old patients with ischemic stroke. Geriatr Gerontol Int 2016; 16(8):928–33.
21. Prime Minister of Australia. Response to Aged Care Royal Commission Interim Report: Media Release; 2019. Available from: URL: https://www.pm.gov.au/media/response-aged-care-royal-commission-interim-report.
22. Australian Government Department of Health. Australian Government response to the final report of the Royal Commission into Aged Care Quality and Safety; 2021. Available from: URL: https://www.health.gov.au/sites/default/files/documents/2021/05/australian-government-response-to-the-final-report-of-the-royal-commission-into-aged-care-quality-and-safety.pdf.
23. Australian Government Department of Health. Transition Care Programme; 2022 [cited 18th May 2022]. Available from: URL: https://www.health.gov.au/initiatives-and-programs/transition-care-programme.

24. Australian Government Department of Health. Health Care Homes; 2021 [cited 18th May 2022]. Available from: URL: https://www1.health.gov.au/internet/main/publishing.nsf/Content/health-care-homes.

25. National Disability Insurance Agency. What is the NDIS?; 2021 [cited 18th May 2022]. Available from: URL: https://www.ndis.gov.au/understanding/what-ndis.

26. The Royal Australian & New Zealand College of Psychiatrists. General issues around the implementation and performance of the NDIS Submission 21; 2020. Available from: URL: https://www.aph.gov.au/Parliamentary_Business/Committees/Joint/National_Disability_Insurance_Scheme/GeneralIssues/Submissions.

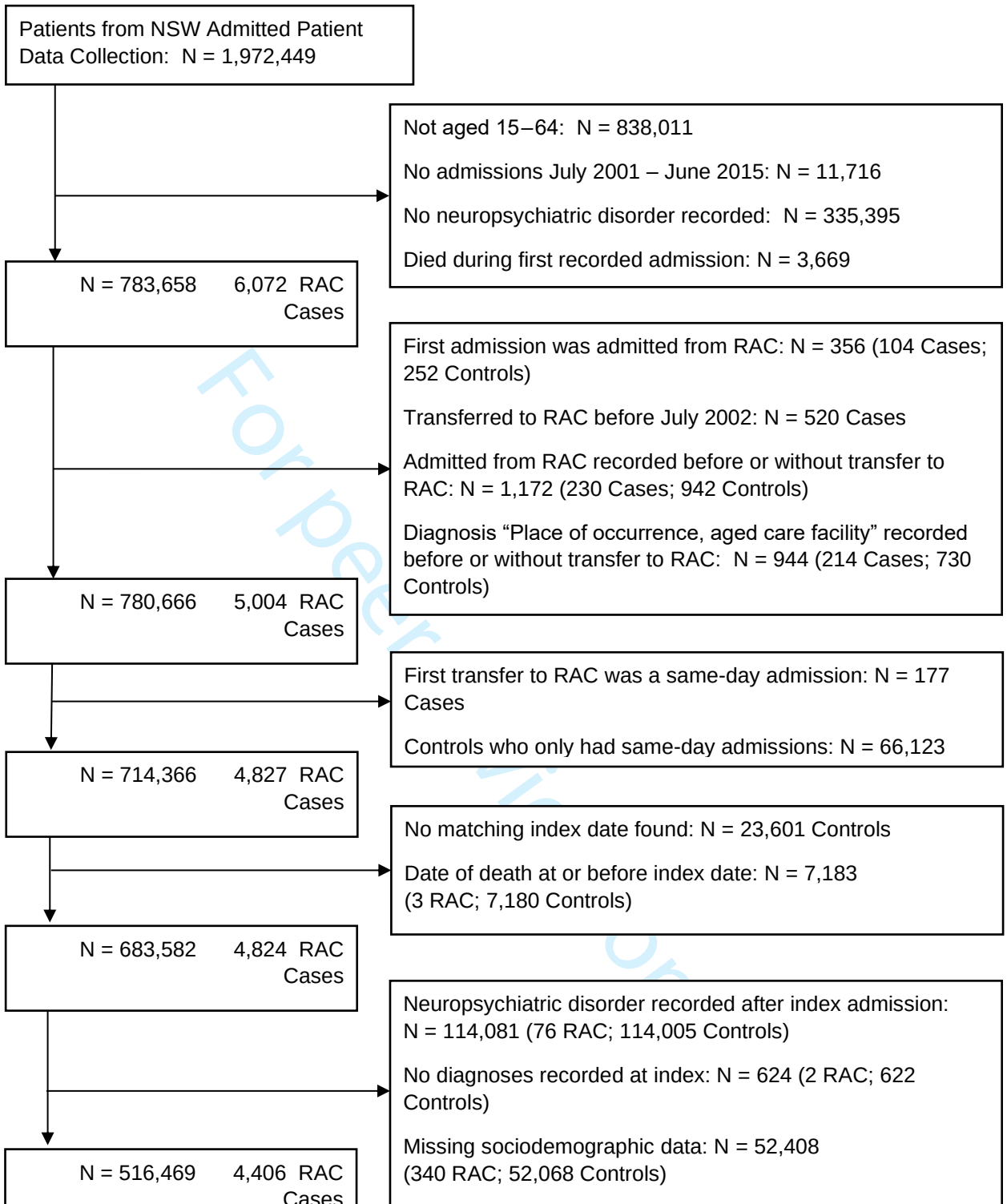

Figure 1. Selection of cases and controls. RAC= residential aged care.

Supplementary Tables

Supplementary Table A. Diagnostic categories

Collapsed diagnosis group	ICD-10 codes
Infections	A, B (not B18), G00-G07, J0-J2, J85, J86, Y95, Z22
Primary malignant cancers	C0-C6, C70-C76, C8-C9
Secondary malignant cancers	C77-C79
Other cancers	D0-D4
Blood disorders	D55-D59, D6-D9
Other endocrine, nutritional and metabolic diseases	D50-D53, E0, E12 (not E12.2), E15, E16, E2-E5 (not E51.2), E60, E61, E63-E68, E7, E8, E9
Diabetes	E10 (not E10.2), E11 (not E11.2), E13 (not E13.2), E14 (not E14.2), O24
Wernicke's encephalopathy	E51.2
Dementia	F00, F01, F02, F03, G30, G31.0, G31.3
Delirium	F05
Secondary mental disorders	F06, F07, F09
Alcohol, substance and other mental disorders	F04, F1, F38, F44, F45, F48, F5 (not F50), F6, F8 (not F84), F9
Schizophrenia	F2
Other common mental disorders	F30-F33, F34 (not F34.0), F39, F40-F43, F50
Autism spectrum disorders	F84
Huntington's disease	G10
Motor neurone disease	G12.2
Parkinson disease	G20
Multiple sclerosis	G35
Epilepsy	G40, G41
Other neurological conditions	G08, G09, G11, G12 (not G12.2), G13, G14, G2 (not G20), G3 (not G30, G31.0, G31.3, G35), G43, G44, G47, G5-G7, G81-G83, G9
Cerebral palsy	G80
Diseases of eyes and ears	H (not H0.00)
Coronary heart disease	I20-I25
Stroke	I6
Other circulatory system disorders	G45, G46, I0, I10, I11, I13, I15, I26-I28, I3, I4, I50-I52, I7, I8 (not I85), I9
Asthma	J45, J46
Chronic respiratory diseases	J40-J44, J47, J6, J7, J80-J84, J9
Upper respiratory diseases	J3 (not J34.0)
Dental caries	K02, K04
Other oral disorders	K00, K01, K03, K05-K09, K1
Chronic liver disease	B18, I85, K70-K76
Diseases of the digestive system	K2-K5, K6 (not K62.2, K62.3) K77, K8, K9
Skin disease	A46, B08, B86, H00.0, H60, J34.0, L0-L7, L8 (not L89), L90-L95, L98 (not L98.4), L99
Pressure injury and ulcers	L89, L97, L98.4
Musculoskeletal	M
Acute and chronic renal disease	E10.2, E11.2, E12.2, E13.2, E14.2, I12, N0 (not N00, N01), N1, N20-N28, N35, N36, N37, N39.1, N39.2, Q61

Supplementary Tables

Other genitourinary diseases	D25, K62.2, K62.3, N30-N32, N34, "N39", N39.0, N39.3, N39.4, N4, N50, N6, N7, N8, N9, O94, R15, R32
Other symptoms and signs	R00, R02, R20-R23, R30, R31, R33-R39, R47-R49, R50-R55, R57-R65
Neurological symptoms and signs	R25-R29, R40-R44, R56
Gastrointestinal symptoms and signs	R10-R14, R16-R19
Circulatory and respiratory symptoms and signs	R01, R03-R09
Behavioural and emotional symptoms and signs	R45, R46
Traumatic brain injury	"S02", S02.0, S02.1, S02.7, S02.9, S06
Spinal cord injury	"S14", S14.0, S14.1, S14.7, 'S24', S24.0, S24.1, S24.7, "S34", S34.0, S34.1, S34.7, T06.0, T06.1, T09.3
Fractures	S02.2-S02.6, S02.8, S12, S22, S32, S42, S49, S52, S59.7, S62, S69, S72, S82, S92, T02, T08, T10, T12, T14.2
Other injuries	S00, S01, S03-S05, S07, S08, S09, S10, S11, S13, S14.2-S14.6, S15, S16, S17, S18, S19, S20, S21, S23, S24.2-S24.6, S25, S26, S27, S28, S29, S30, S31, S33, S34.2-S34.6, S34.8, S35-S41, S43-S48, S50, S51, S53-S58, "S59", S59.7, S59.8, S59.9, S60, S61, S63-S68, S69.8, S69.9, S70, S71, S73-S78, S80, S81, S83–S91, S93-S99, T00, T01, T03-T05, T06.2-T06.8, T07, "T09", T09.0-T09.2, T09.4-T09.9, T11, T13, "T14", T14.0, T14.1, T14.3-T14.9, T15-T19, T2, T3, T4, T5, T6, T70-T74, T75 (not T75.1), T79, T80, T81, T88, T89, V (not V90, V92), W2-W6, W70, W73-W79, W8, W9, X0-X5, X85-X89, X9, Y0, Y35, Y36, Y4-Y7, Y80-Y86, Y87 (not 87.0), Y88, Y89
Falls	W0, W1
Intentional self-harm	X6, X7, X80-X84, Y87.0
Rehabilitation, convalescence and respite	Z50, Z54, Z75.5
Housing and living situation	Z59-Z65
Palliative care	Z51.5
Mobility and personal care	Z74, Z75.0, "Z99", Z99.3, Z99.8, Z99.9
Other Z codes	Y93, Y96, Y98, Z00-Z07, Z11-Z13, Z20, Z21, Z28, Z29, Z4, "Z51", Z51.0-Z51.4, Z51.6, Z51.81, Z51.88, Z51.9, Z52, Z53, Z55-Z59, Z71-Z73, "Z75", Z75.1-Z75.4, Z75.8, Z75.9, Z76, Z8, Z90, Z91 (not Z91.7), Z92-Z98, Z99.0-Z99.2

Supplementary Tables

Supplementary Table B. Diagnostic predictors of transfer from hospital to RAC on discharge using diagnoses recorded during hospital admissions in the 365 days prior to the index admission

Diagnosis variable	**Cases**[a] n=4,406	**Controls**[b] n=512,063	**Unadjusted** Odds ratio (95%CI)	**Partially adjusted** Odds ratio[d] (95%CI)	**Full model** Odds ratio[c] (95% CI)
Huntington disease	87 (2.0%)	187 (0.0%)	55.14 (42.68–71.23)	30.84 (22.82–41.67)	33.41 (23.56–47.37)
Dementia	621 (14.1%)	1,131 (0.2%)	74.12 (66.87–82.16)	18.26 (16.24–20.56)	13.39 (11.66–15.37)
Multiple sclerosis	199 (4.5%)	3,067 (0.6%)	7.85 (6.78–9.09)	7.67 (6.52–9.04)	6.71 (5.54–8.12)
Wernicke's encephalopathy	70 (1.6%)	239 (0.0%)	34.57 (26.44–45.20)	7.81 (5.73–10.65)	5.91 (4.14–8.42)
Need for palliative care	471 (10.7%)	2,567 (0.5%)	23.76 (21.43–26.34)	7.53 (6.72–8.44)	4.99 (4.24–5.87)
Motor neurone disease	58 (1.3%)	562 (0.1%)	12.14 (9.25–15.94)	6.53 (4.86–8.79)	4.74 (3.34–6.71)
Parkinson’s disease	149 (3.4%)	1,255 (0.2%)	14.25 (11.99–16.93)	5.33 (4.39–6.46)	4.57 (3.61–5.77)
Intellectual disability	700 (15.9%)	17,257 (3.4%)	5.42 (4.99–5.88)	3.89 (3.52–4.30)	3.51 (3.12–3.95)
Stroke	1,063 (24.1%)	14,373 (2.8%)	11.01 (10.26–11.82)	3.65 (3.38–3.96)	2.86 (2.57–3.18)
Problems with mobility and personal care	1,063 (24.1%)	5,308 (1.0%)	30.36 (28.19–32.69)	7.99 (7.33–8.71)	2.73 (2.47–3.01)
Other genitourinary diseases	2,195 (49.8%)	41,614 (8.1%)	11.22 (10.57–11.92)	5.48 (5.13–5.87)	2.35 (2.17–2.55)
Cerebral palsy	90 (2.0%)	2,182 (0.4%)	4.87 (3.94–6.03)	5.89 (4.62–7.52)	2.32 (1.77–3.05)
Pressure injury and ulcers	1,007 (22.9%)	6,728 (1.3%)	22.25 (20.66–23.97)	4.32 (3.96–4.72)	2.17 (1.96–2.41)
Falls	1,165 (26.4%)	25,109 (4.9%)	6.97 (6.51–7.46)	2.77 (2.57–2.99)	1.70 (1.52–1.89)
Epilepsy	508 (11.5%)	15,652 (3.1%)	4.13 (3.76–4.54)	3.31 (2.98–3.68)	1.64 (1.45–1.86)
Neurological symptoms and signs	1,837 (41.7%)	36,962 (7.2%)	9.19 (8.65–9.77)	4.06 (3.80–4.34)	1.62 (1.49–1.76)

Supplementary Tables

Primary malignant cancers	711 (16.1%)	18,282 (3.6%)	5.20 (4.79–5.64)	2.16 (1.98–2.36)	1.57 (1.35–1.82)
Secondary mental disorders	228 (5.2%)	2,285 (0.4%)	12.17 (10.59–14.00)	3.31 (2.79–3.92)	1.45 (1.20–1.76)
Other factors influencing health status and contact with health services	3,608 (81.9%)	270,761 (52.9%)	4.03 (3.73–4.35)	1.91 (1.76–2.07)	1.40 (1.28–1.54)
Chronic liver disease	539 (12.2%)	16,403 (3.2%)	4.21 (3.84–4.62)	1.84 (1.67–2.04)	1.38 (1.22–1.56)
Infections	2,550 (57.9%)	83,614 (16.3%)	7.04 (6.63–7.48)	2.95 (2.76–3.15)	1.37 (1.26–1.50)
Delirium	417 (9.5%)	4,707 (0.9%)	11.27 (10.15–12.51)	3.14 (2.79–3.54)	1.32 (1.15–1.53)
Gastrointestinal symptoms and signs	1,368 (31.0%)	44,335 (8.7%)	4.75 (4.45–5.07)	2.73 (2.54–2.93)	1.32 (1.21–1.44)
Chronic respiratory diseases	1,179 (26.8%)	26,339 (5.1%)	6.74 (6.30–7.21)	1.87 (1.74–2.02)	1.31 (1.19–1.43)
Other neurological conditions	2,203 (50.0%)	148,120 (28.9%)	2.46 (2.32–2.61)	2.21 (2.07–2.36)	1.30 (1.20–1.42)
Other endocrine, nutritional and metabolic diseases	2,463 (55.9%)	84,603 (16.5%)	6.40 (6.03–6.80)	2.19 (2.06–2.34)	1.24 (1.14–1.35)
Problems related to housing, economic and social situation	995 (22.6%)	57,548 (11.2%)	2.30 (2.15–2.47)	1.47 (1.36–1.59)	1.23 (1.12–1.35)
Behavioural and emotional symptoms and signs	502 (11.4%)	23,666 (4.6%)	2.65 (2.42–2.91)	1.83 (1.64–2.04)	1.22 (1.07–1.39)
Dental caries	92 (2.1%)	3,123 (0.6%)	3.48 (2.82–4.29)	1.60 (1.25–2.06)	1.20 (0.91–1.59)
Diabetes	983 (22.3%)	35,856 (7.0%)	3.81 (3.55–4.10)	1.37 (1.26–1.48)	1.20 (1.09–1.31)
Other symptoms and signs	2,153 (48.9%)	73,456 (14.3%)	5.71 (5.38–6.06)	2.71 (2.53–2.89)	1.13 (1.04–1.23)
Traumatic brain injury	215 (4.9%)	12,094 (2.4%)	2.12 (1.85–2.44)	1.57 (1.34–1.84)	1.13 (0.94–1.36)
Alcohol, substance and other mental disorders	1,457 (33.1%)	153,056 (29.9%)	1.16 (1.09–1.23)	1.06 (0.99–1.14)	1.07 (0.98–1.17)
Skin disease	981 (22.3%)	28,613 (5.6%)	4.84 (4.50–5.20)	1.83 (1.68–1.99)	1.07 (0.97–1.17)
Diseases of eyes and ears	761 (17.3%)	20,568 (4.0%)	4.99 (4.61–5.40)	1.85 (1.69–2.02)	1.06 (0.96–1.18)

Supplementary Tables

Other injuries	2,332 (52.9%)	134,307 (26.2%)	3.16 (2.98–3.36)	1.80 (1.69–1.92)	1.02 (0.93–1.10)
Diseases of the digestive system	1,778 (40.4%)	83,648 (16.3%)	3.47 (3.26–3.68)	1.59 (1.49–1.70)	0.99 (0.92–1.07)
Secondary malignant cancers	350 (7.9%)	6,874 (1.3%)	6.34 (5.67–7.09)	2.61 (2.32–2.94)	0.98 (0.81–1.19)
Fractures	612 (13.9%)	28,682 (5.6%)	2.72 (2.49–2.96)	1.48 (1.35–1.63)	0.97 (0.85–1.10)
Other circulatory system disorders	2,323 (52.7%)	88,989 (17.4%)	5.30 (5.00–5.63)	1.57 (1.47–1.68)	0.95 (0.87–1.03)
Circulatory and respiratory symptoms and signs	610 (13.8%)	33,924 (6.6%)	2.26 (2.08–2.47)	1.16 (1.06–1.27)	0.92 (0.83–1.03)
Other common mental disorders	1,099 (24.9%)	136,978 (26.8%)	0.91 (0.85–0.97)	0.85 (0.79–0.92)	0.92 (0.84–1.00)
Schizophrenia	464 (10.5%)	34,839 (6.8%)	1.61 (1.46–1.78)	0.41 (0.36–0.46)	0.90 (0.79–1.03)
Other oral disorders	166 (3.8%)	6,828 (1.3%)	2.90 (2.48–3.39)	1.40 (1.17–1.69)	0.87 (0.71–1.06)
Rehabilitation, convalescence and respite	1,484 (33.7%)	22,958 (4.5%)	10.82 (10.15–11.53)	2.38 (2.20–2.58)	0.85 (0.77–0.94)
Acute and chronic renal disease	744 (16.9%)	20,147 (3.9%)	4.96 (4.58–5.37)	1.39 (1.27–1.52)	0.85 (0.76–0.95)
Musculoskeletal	1,861 (42.2%)	105,794 (20.7%)	2.81 (2.64–2.98)	1.48 (1.38–1.58)	0.85 (0.77–0.92)
Asthma	107 (2.4%)	10,767 (2.1%)	1.16 (0.96–1.41)	0.81 (0.66–1.00)	0.84 (0.67–1.05)
Other cancers	203 (4.6%)	15,683 (3.1%)	1.53 (1.33–1.76)	0.92 (0.79–1.07)	0.75 (0.63–0.89)
Blood disorders	827 (18.8%)	20,929 (4.1%)	5.42 (5.02–5.86)	1.58 (1.44–1.72)	0.73 (0.65–0.81)
Coronary heart disease	326 (7.4%)	18,079 (3.5%)	2.18 (1.95–2.45)	0.69 (0.61–0.77)	0.62 (0.54–0.71)
Intentional self-harm	93 (2.1%)	29,150 (5.7%)	0.36 (0.29–0.44)	0.45 (0.36–0.56)	0.59 (0.46–0.75)
Upper respiratory diseases	65 (1.5%)	12,798 (2.5%)	0.58 (0.46–0.75)	0.73 (0.56–0.95)	0.56 (0.42–0.76)
Spinal cord injury	25 (0.6%)	775 (0.2%)	3.76 (2.53–5.61)	0.32 (0.20–0.51)	0.29 (0.18–0.47)

Reporting checklist for cohort study.

Based on the STROBE cohort guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cohortreporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	6
Objectives	#3	State specific objectives, including any prespecified hypotheses	7
Methods			
Study design	#4	Present key elements of study design early in the paper	7
Setting	#5	Describe the setting, locations, and relevant dates, including periods	7

		of recruitment, exposure, follow-up, and data collection	
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up.	7
Eligibility criteria	#6b	For matched studies, give matching criteria and number of exposed and unexposed	8
Variables	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	9
Bias	#9	Describe any efforts to address potential sources of bias	10
Study size	#10	Explain how the study size was arrived at	7
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	10
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	
10			
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	10
Statistical methods	#12c	Explain how missing data were addressed	9
Statistical methods	#12d	If applicable, explain how loss to follow-up was addressed	N/A
Statistical methods	#12e	Describe any sensitivity analyses	
10			
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible,	11

		included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	
Participants	#13b	Give reasons for non-participation at each stage	11
Participants	#13c	Consider use of a flow diagram	11
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	12
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	N/A
Descriptive data	#14c	Summarise follow-up time (eg, average and total amount)	7
Outcome data	#15	Report numbers of outcome events or summary measures over time. Give information separately for exposed and unexposed groups if applicable.	12
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	15
Main results	#16b	Report category boundaries when continuous variables were categorized	N/A
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	#17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	14

Discussion

Key results	#18	Summarise key results with reference to study objectives	21
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	24
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	24
Generalisability	#21	Discuss the generalisability (external validity) of the study results	24
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

This checklist was completed on 22. June 2022 using https://www.goodreports.org/, a tool made by the EQUATOR Network in collaboration with Penelope.ai

BMJ Open

Factors associated with discharge from hospital to residential aged care for younger people with neuropsychiatric disorders: An exploratory case-control study in New South Wales, Australia

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2022-065982.R1
Article Type:	Original research
Date Submitted by the Author:	27-Sep-2022
Complete List of Authors:	Cvejic, Rachael; UNSW Sydney, Department of Developmental Disability Neuropsychiatry Watkins, Tim; UNSW Sydney, Department of Developmental Disability Neuropsychiatry Walker, Adrian; UNSW Sydney, Department of Developmental Disability Neuropsychiatry Reppermund, Simone; UNSW Sydney, Department of Developmental Disability Neuropsychiatry; UNSW Sydney, Centre for Healthy Brain Ageing Srasuebkul, Preeyaporn; UNSW Sydney, Department of Developmental Disability Neuropsychiatry Draper, Brian; Prince of Wales Hospital, Eastern Suburbs Older Persons Mental Health Service Withall, Adrienne; UNSW Sydney, School of Population Health Winkler, Di; Summer Foundation; La Trobe University, Living with Disability Research Centre Honan, Ingrid; Cerebral Palsy Alliance Mackechnie, Deidre; MS Australia Trollor, Julian; University of New South Wales, Department of Developmental Disability Neuropsychiatry; UNSW Sydney, Centre for Healthy Brain Ageing
Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Rehabilitation medicine
Keywords:	NEUROLOGY, PSYCHIATRY, EPIDEMIOLOGY

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Factors associated with discharge from hospital to residential aged care for younger people with neuropsychiatric disorders: An exploratory case-control study in New South Wales, Australia

Rachael C Cvejic[1*], Tim R Watkins[1*], Adrian R Walker[1], Simone Reppermund[1, 2], Preeyaporn Srasuebkul[1], Brian Draper[2, 3], Adrienne Withall[4], Di Winkler[5, 6], Ingrid Honan[7], Deidre Mackechnie[8], Julian N Trollor[1, 2]

[*] Joint first author

[1] The Department of Developmental Disability Neuropsychiatry, Discipline of Psychiatry and Mental Health, School of Clinical Medicine, Faculty of Medicine and Health, UNSW Sydney, Australia

[2] Centre for Healthy Brain Ageing, Discipline of Psychiatry & Mental Health, School of Clinical Medicine, Faculty of Medicine and Health, UNSW Sydney, Australia

[3] Eastern Suburbs Older Persons Mental Health Service, Prince of Wales Hospital, Randwick, Australia

[4] School of Population Health, Faculty of Medicine and Health, UNSW Sydney, Australia

[5] Summer Foundation, Box Hill, Victoria, Australia

[6] Living with Disability Research Centre, La Trobe University, Melbourne, Victoria, Australia

[7] Cerebral Palsy Alliance, Allambie Heights, New South Wales, Australia

[8] MS Australia, North Sydney, New South Wales, Australia

Corresponding Author: Professor Julian Trollor

Email: J.Trollor@unsw.edu.au,

Phone: +61 (2) 9065 8076

Address: The Department of Developmental Disability Neuropsychiatry, School of Psychiatry, UNSW Sydney, NSW 2052, Australia

Word count: 3,120

Key words: Neurology; Psychiatry; Epidemiology

Abstract

Objectives: To examine the sociodemographic and diagnostic factors associated with a discharge from hospital to residential aged care (RAC) for younger people (aged 15–64 years) with neuropsychiatric disorders.

Design: An exploratory case-control study using a historic cohort of people with neuropsychiatric disorders. Cases were people transferred to RAC on hospital discharge during the study period. Controls were people not transferred to RAC on discharge during the study period.

Setting: Public and private hospital admissions in New South Wales (NSW), Australia.

Participants: People aged 15–64 years with a neuropsychiatric disorder hospitalised in NSW between July 2002 and June 2015 (n=516,469).

Outcome measures: The main outcome was transfer to RAC on discharge from hospital. We calculated odds ratios for sociodemographic and diagnostic factors to determine factors that may impact discharge to RAC.

Results: During the period of data capture, 4,406 people were discharged from hospitals to RAC. Discharge to RAC was most strongly associated with diagnoses of progressive neurological and cognitive disorders. Acute precipitants of RAC transfer included a broad range of conditions and injuries (e.g. Wernicke's encephalopathy, stroke, falls) in the context of issues such as older age, not being partnered (married

or de facto), living in areas of lower socioeconomic status, functional issues, and the need for palliative care.

Conclusions: There are multiple intersecting and interacting pathways culminating in discharge from hospital to RAC among younger people with neuropsychiatric disorders. Improved capacity for interdisciplinary home care and alternative housing and support options for people with high support needs are required.

Article Summary

Strengths and limitations

- This study utilises a large, linked dataset that includes information from all hospital admissions in NSW, Australia, for people with recorded diagnoses of neuropsychiatric disorders over a period of 14 years.
- The study was completed in consultation with an advisory group comprising people with lived experience of being, or supporting, a younger person in RAC.
- The cohort included all people hospitalised with a recorded neuropsychiatric diagnosis; other related diagnoses (e.g., traumatic brain injury, stroke) were not used to derive the cohort and as such only a subpopulation of younger people discharged to RAC were included.
- We used a lookback period and excluded persons with any indication of previous placement in RAC but we could not confirm that index admissions for cases reflected the first ever transfer to RAC.
- Some information relevant to the risk of transfer to RAC was not available in the datasets used, including the reasons for placement in RAC, time since diagnoses were first made, and information about functional abilities and availability of informal care.

Introduction

Residential aged care (RAC) facilities in Australia provide accommodation and personal care (including access to nursing and health services) to older adults who are not able to continue living within their own homes. Although most people living in RAC in Australia are over 65 years of age, people aged under 65 years (hereafter "younger people") may also be placed in RAC, largely due to a lack of access to age-appropriate community-based accommodation and supports.(1) Over 3,400 younger people were living in RAC in Australia as of 31 December 2021, with over 600 new RAC placements in this age group occurring in the preceding year.(2) Younger people living in RAC typically have high clinical needs and experience activity limitations as a result of disability, e.g. due to intellectual and developmental disability, physical disability (e.g. paraplegia), acquired brain injury, and progressive neurological disorders (e.g. dementia, multiple sclerosis and Huntington disease).(3) It is known that younger people living in RAC experience a range of negative outcomes, including a lack of appropriate recreational activities and medical and rehabilitation services, loss of function, and experiences of grief, hopelessness, and neglect.(3–9) Further, many RAC facilities are not equipped to adequately meet the specific and complex health and rehabilitation needs of younger people with disability.(4, 10)

The placement of younger people into RAC in Australia has previously been targeted through the Younger People with Disability in Residential Aged Care Initiative. However, a review showed that this was unlikely to result in a sustainable reduction in younger people entering RAC.(11) The prevention of the placement of younger people into RAC has since been identified as an area for immediate action by the

Australian Royal Commission into Aged Care Quality and Safety;(6, 12) in particular, stopping the "pipeline" from hospital to RAC. Using a large, linked dataset of younger people with neuropsychiatric disorders admitted to hospital in New South Wales (NSW), Australia, this study aims to identify sociodemographic and diagnostic factors that may be associated with a transfer to RAC upon discharge from hospital. Identification of these factors will inform the development of strategies to prevent or delay the transfer of younger people from hospital to RAC.

Methods

Study design and data sources

This exploratory case-control study used data from a large linkage study of people with neuropsychiatric disorders, including mental health disorders, neurological disorders, and intellectual and developmental disabilities.(13) The primary dataset used in the current study was the NSW Admitted Patient Data Collection (1 July 2001-30 June 2015), which contains information recorded during all admissions to NSW hospitals and psychiatric facilities. This includes admission/discharge dates and up to 51 diagnoses (coded according to the International Statistical Classification of Diseases and Related Health Problems; 10th revision, Australian modification (ICD-10-AM)) for each episode.

Study population

We defined our study population as people aged 15–64 years with a neuropsychiatric disorder who were admitted to a hospital in NSW between 1 July 2001 and 30 June 2015. Neuropsychiatric disorders were determined by any of the following: i) diagnosis of intellectual disability recorded in any dataset from the

broader linkage study previously described,(13); ii) ICD-10-AM diagnoses of mental and behavioural disorders ('F00-F99', 'S06'), disorders of the nervous system ('G00-G99'), or intellectual and developmental disability ('P04.3', 'Q86.0', 'Q87.0', 'Q87.1', 'Q87.2', 'Q87.3', 'Q87.5', 'Q87.8', 'Q89.8', 'Q90', 'Q91', 'Q93', 'Q99.2') recorded during a hospital admission; iii) an admission to a psychiatric unit, indicated where unit type on admission was one of 'Psychiatric Acute', 'Psychiatric Rehabilitation', 'Psychiatric Secure', 'Brain Injury Rehabilitation', 'Psychiatric Intensive Care', 'Post Natal Depression', 'Psychiatric Extended Care', 'Neuro-Psychiatry', 'Psychiatric Medium Secure', 'Psychiatric Emergency', or where days in a psychiatric unit were >0.

Cases were people transferred to RAC on discharge from hospital during the study (i.e., mode of hospital separation was 'Transfer to Nursing Home'). Controls were people with hospital admissions but no recorded transfers to RAC. The index admission for cases was defined as the date of the first transfer to RAC from hospital occurring in the study period. To obtain a similar distribution of control index admission dates across the study period to that of the cases, index admissions for controls were randomly selected by matching eligible control hospital discharge dates to case index dates using the SAS macro 'gmatch' greedy matching algorithm.(14)

Individuals were excluded if they died at their index hospital admission (i.e., mode of separation of their index admission was 'Death with Autopsy' or 'Death without Autopsy'). To minimise the chance of previous transfer to RAC, individuals were excluded if: they were transferred to RAC on discharge from hospital before 1 July

2002; the source of referral was 'Nursing Home/RAC' at or before the index admission; the diagnosis "Place of occurrence, aged care facility" was recorded at or before the index admission. Individuals were also excluded if the index admission was a same-day admission or if diagnostic or sociodemographic data were missing.

Sociodemographic and other non-diagnosis variables

Sex, Aboriginal and/or Torres Strait Islander status, country of birth (Australia or overseas), Index of Relative Socioeconomic Disadvantage (IRSD) quintiles, remoteness of area of residence categories and date of death were obtained from multiple datasets as previously described.(13) Marital Status was sourced from the Admitted Patient Data Collection at the index admission and, if missing, we used Last Observation Carried Forward if recorded in a previous admission. Age at the index admission was analysed using five-year age groups to allow for a non-linear association with the outcome. We also calculated the year of the index date, and the total admission length of stay (days) over all admissions within a lookback period of 365 days prior to the index date.

Diagnosis group variables

We extracted all ICD-10-AM diagnosis codes recorded during the index admission and collapsed these into broad but meaningful groupings. We initially grouped diagnoses based on two previous reports.(15, 16) Conditions that were deemed unlikely to affect the chance of RAC transfer (e.g., those relating to pregnancy and birth) were excluded. To avoid sparse data bias,(17) diagnosis groups with less than 20 cases were also removed. This process resulted in 224 diagnostic groupings.

Following this, the groupings were further collapsed into 57 general diagnostic categories (see Supplementary Table A).

Statistical analysis

We used logistic regression models to estimate the effect of sociodemographic and diagnostic factors on transfer to RAC. For sociodemographic factors we report both the unadjusted effects and full model results, as while the individual models do not adjust for confounding factors, adjusting for mediators in the full model would potentially bias the estimates.(18) Likewise, it is likely that some diagnosis groups share overlapping causal pathways and, hence, odds ratio estimates from our full logistic model might be affected by overadjustment bias.(17) For diagnostic factors, estimates were also produced using a separate logistic model for each diagnosis group that adjusted for sociodemographic/non-diagnosis variables only. While this approach does not adjust for confounding by other diagnostic variables, it is less likely to exhibit overadjustment bias.

Supplementary analyses utilising the lookback period

The above analyses utilise data solely from the index admission and so only include diagnostic factors recorded at the time of discharge to RAC (i.e., the acute precipitants of transfer to RAC on discharge from hospital). To determine whether inclusion of diagnoses recorded in the 365 days preceding the index admission impacted the effect estimates of variables that may be associated with transfer to RAC, we repeated the above analyses using all diagnoses received at hospital admissions occurring during the look-back period. Results of these analyses are presented in Supplementary Table B.

Analyses were conducted using SAS 9.4 (SAS Institute) and Stata 15.1 (StataCorp).

Patient and Public Involvement: Consultation with Lived Experience Advisory Group

We established an advisory group comprising nine people with lived experience of being, or supporting, a younger person living in RAC and consulted with them about the aims, methods, and findings of the research.

Ethics approval

This study was approved by the NSW Population & Health Services Research Ethics Committee (CINSW 2013/02/445, AU RED reference: HREC/13/CIPHS/7, substudy number 2019UMB0601). Ethics approval included a waiver of consent.

Results

Cohort characteristics

Details of the selection process for cases and controls are shown in Figure 1. Sociodemographic characteristics are provided in Table 1.

[Figure 1 about here]

LEGEND: Figure 1. Selection of cases and controls.

Table 1. Sociodemographic characteristics of cohort

Variable	Cases (n=4,406)	Controls (n=512,063)	*p* (X^2)
Sex			< 0.001
Male	2,586 (58.7%)	271,636 (53.0%)	
Female	1,820 (41.3%)	240,427 (47.0%)	
Age (grouped)			< 0.001
15-19	18 (0.4%)	37,345 (7.3%)	
20-24	29 (0.7%)	41,765 (8.2%)	
25-29	47 (1.1%)	45,252 (8.8%)	
30-34	63 (1.4%)	52,919 (10.3%)	
35-39	100 (2.3%)	54,086 (10.6%)	
40-44	203 (4.6%)	54,187 (10.6%)	
45-49	359 (8.1%)	53,575 (10.5%)	
50-55	678 (15.4%)	55,677 (10.9%)	
55-59	1,250 (28.4%)	59,401 (11.6%)	
60-64	1,659 (37.7%)	57,856 (11.3%)	
Remoteness of area of residence			0.001
Major Cities	3,180 (72.2%)	361,626 (70.6%)	
Inner Regional	932 (21.2%)	110,864 (21.7%)	
Outer Regional	281 (6.4%)	35,747 (7.0%)	
Remote	13 (0.3%)	3,826 (0.7%)	
Index of Relative Socioeconomic Disadvantage			< 0.001
1 (Most disadvantaged)	1,068 (24.2%)	111,963 (21.9%)	
2	912 (20.7%)	99,973 (19.5%)	
3	958 (21.7%)	102,797 (20.1%)	
4	818 (18.6%)	91,313 (17.8%)	
5 (Least disadvantaged)	650 (14.8%)	106,017 (20.7%)	
Marital status			< 0.001
Married or de facto	1,295 (29.4%)	245,387 (47.9%)	
Never married	1,779 (40.4%)	201,768 (39.4%)	
Widowed	277 (6.3%)	9,155 (1.8%)	
Separated or divorced	1,055 (23.9%)	55,753 (10.9%)	
Born in Australia			0.021
Yes	3,457 (78.5%)	408,941 (79.9%)	
No	949 (21.5%)	103,122 (20.1%)	
Year of index admission, median (IQR)	2009 (2006-2012)	2009 (2006-2013)	0.007
Total length of stay (days), median (IQR)	62 (28-116)	4 (2-12)	< 0.001
Hospital type			< 0.001
Public	4,245 (96.3%)	387,607 (75.7%)	
Private	161 (3.7%)	124,456 (24.3%)	

[a]De facto= in a relationship and living together but not legally married

Predictors of transfer to RAC on discharge from hospital

Predictors of transfer to RAC on discharge are shown in Tables 2 (sociodemographic variables) and 3 (diagnosis variables). Accounting for all covariates, the odds of transfer to RAC increased with advancing age; ORs range from 2.18 (95% CI=1.16-4.10) for people aged 20-24 years to 82.50 (95% CI=49.51-137.47) for people aged 60-64 years. People living in regional and remote areas were less likely to be transferred to RAC than people living in major cities (inner regional OR=0.89, 95% CI=0.81-0.98, outer regional OR=0.80, 95% CI=0.69-0.93, remote OR=0.28, 95% CI=0.15, 0.53). People living in the most disadvantaged areas were slightly more likely to be discharged to RAC than those living in the least disadvantaged areas (OR=1.15, 95% CI=1.02-1.30). Individuals who were never married (OR=2.76, 95% CI=2.51-3.04), widowed (OR=2.60, 95% CI=2.22-3.05), or separated/divorced (OR=2.61, 95% CI=2.37-2.88) were more likely to be transferred to RAC on discharge than individuals who were currently partnered (married or de facto).

For diagnosis group predictors, adjusting for all variables, people with Huntington disease had the greatest likelihood of transfer to RAC on discharge (OR=29.97, 95% CI=20.88-43.01), followed by people living with dementia (OR=15.14, 95% CI=13.10-17.51), multiple sclerosis (OR=8.43, 95% CI=6.96-10.22), Wernicke's encephalopathy (OR=6.58, 95% CI=4.40-9.83), motor neurone disease (OR=5.62, 95% CI=3.93-8.03), Parkinson's disease (OR=5.55, 95% CI=4.33-7.11), a need for palliative care (OR=5.32, 95% CI=4.48-6.33), intellectual disability (OR=3.72, 95% CI=3.31-4.19), stroke (OR=3.08, 95% CI=2.75-3.46), and mobility and personal care issues (OR=2.87, 95% CI=2.57-3.22). When adjusting only for sociodemographic and other non-diagnosis variables the same diagnoses emerged as the strongest

predictors though in a slightly different order; diagnoses of Huntington disease (OR=30.23, 95% CI=22.26-41.05), dementia (OR=19.78, 95% CI=17.44-22.43), and Wernicke's encephalopathy (OR=9.03, 95% CI=6.41-12.71) conferred the greatest likelihood of transfer to RAC on discharge from hospital, followed by a need for palliative care (OR=8.47, 95% CI=7.50-9.56), multiple sclerosis (OR=8.21, 95% CI=6.94-9.71), and difficulties with mobility and personal care (OR=7.72, 95% CI=7.01-8.51). Similar results were obtained when utilising diagnostic variables available from hospital admissions occurring during the lookback period (365 days preceding the index admission; Supplementary Table B).

Table 2. Sociodemographic and other non-diagnosis predictors of transfer from hospital to RAC on discharge

Variable	Unadjusted Odds ratio (95% CI)	Full model[a] Odds ratio (95% CI)
Sex		
Male	Reference	Reference
Female	0.80 (0.75–0.84)	0.92 (0.85–0.99)
Age (grouped)		
15-19	Reference	Reference
20-24	1.44 (0.80–2.59)	2.18 (1.16–4.10)
25-29	2.15 (1.25–3.71)	3.87 (2.16–6.95)
30-34	2.47 (1.46–4.17)	5.06 (2.87–8.92)
35-39	3.84 (2.32–6.34)	7.56 (4.39–13.03)
40-44	7.77 (4.80–12.59)	13.65 (8.08–23.06)
45-49	13.90 (8.66–22.32)	22.79 (13.58–38.23)
50-55	25.26 (15.82–40.35)	39.80 (23.85–66.41)
55-59	43.66 (27.41–69.53)	66.59 (39.98–110.91)
60-64	59.49 (37.38–94.67)	82.50 (49.51–137.47)
Remoteness		
Major cities	Reference	Reference
Inner regional	0.96 (0.89–1.03)	0.89 (0.81–0.98)
Outer regional	0.89 (0.79–1.01)	0.80 (0.69–0.93)
Remote	0.39 (0.22–0.67)	0.28 (0.15–0.53)
Index of Relative Social Disadvantage		
5 Least disadvantaged	Reference	Reference
4	1.46 (1.32–1.62)	1.10 (0.97–1.24)
3	1.52 (1.38–1.68)	1.13 (1.00–1.28)
2	1.49 (1.34–1.65)	1.09 (0.96–1.23)
1 Most disadvantaged	1.56 (1.41–1.72)	1.15 (1.02–1.30)
Marital status		
Married or de facto	Reference	Reference
Never married	1.67 (1.55–1.80)	2.76 (2.51–3.04)
Widowed	5.73 (5.03–6.54)	2.60 (2.22–3.05)
Separated or divorced	3.59 (3.30–3.89)	2.61 (2.37–2.88)
Born in Australia		
Yes	Reference	Reference
No	1.09 (1.01–1.17)	0.86 (0.79–0.94)
Year of index admission	0.98 (0.97–0.99)	0.96 (0.95–0.97)
Total length of stay	1.01 (1.01–1.01)	1.01 (1.01–1.01)
Hospital type		
Public	Reference	Reference
Private	0.12 (0.10–0.14)	0.30 (0.25–0.36)

[a]Model output was dependent on the collapsed diagnosis groups included in the full model (reported in Table 3)

272 Table 3. Diagnostic predictors of transfer from hospital to RAC on discharge

Diagnosis variable	Cases n=4,406	Controls n=512,063	Unadjusted Odds ratio (95%CI)	Partially adjusted Odds ratio[a] (95%CI)	Full model Odds ratio[b] (95% CI)
Huntington disease	84 (1.9%)	181 (0.0%)	54.96 (42.36–71.32)	30.23 (22.28–41.05)	29.97 (20.88–43.01)
Dementia	561 (12.7%)	951 (0.2%)	78.42 (70.31–87.45)	19.78 (17.44–22.43)	15.14 (13.10–17.51)
Multiple sclerosis	189 (4.3%)	2,752 (0.5%)	8.29 (7.14–9.64)	8.21 (6.94–9.71)	8.43 (6.96–10.22)
Wernicke's encephalopathy	58 (1.3%)	177 (0.0%)	38.58 (28.64–51.97)	9.03 (6.41–12.71)	6.58 (4.40–9.83)
Motor neurone disease	52 (1.2%)	516 (0.1%)	11.84 (8.89–15.77)	6.54 (4.79–8.93)	5.62 (3.93–8.03)
Parkinson's disease	130 (3.0%)	1,084 (0.2%)	14.33 (11.92–17.23)	5.55 (4.52–6.82)	5.55 (4.33–7.11)
Need for palliative care	421 (9.6%)	2,032 (0.4%)	26.52 (23.77–29.59)	8.47 (7.50–9.56)	5.32 (4.48–6.33)
Intellectual disability	700 (15.9%)	17,257 (3.4%)	5.42 (4.99–5.88)	3.89 (3.52–4.30)	3.72 (3.31–4.19)
Stroke	929 (21.1%)	12,094 (2.4%)	11.05 (10.25–11.90)	3.72 (3.42–4.04)	3.08 (2.75–3.46)
Difficulties with mobility and personal care	797 (18.1%)	3,860 (0.8%)	29.08 (26.76–31.59)	7.72 (7.01–8.51)	2.87 (2.57–3.22)
Other genitourinary diseases	1,810 (41.1%)	26,785 (5.2%)	12.63 (11.88–13.43)	5.93 (5.53–6.36)	2.65 (2.43–2.90)
Cerebral palsy	78 (1.8%)	1,925 (0.4%)	4.78 (3.80–6.00)	5.82 (4.48–7.56)	2.52 (1.89–3.37)
Pressure injury and ulcers	811 (18.4%)	4,844 (0.9%)	23.62 (21.78–25.62)	4.74 (4.36–5.22)	2.35 (2.09–2.64)
Primary malignant cancers	635 (14.4%)	14,552 (2.8%)	5.76 (5.28–6.27)	2.47 (2.25–2.71)	1.88 (1.59–2.21)
Epilepsy	377 (8.6%)	12,843 (2.5%)	3.64 (3.27–4.05)	3.08 (2.73–3.47)	1.78 (1.54–2.05)
Neurological symptoms and signs	1,371 (31.1%)	26,414 (5.2%)	8.31 (7.78–8.86)	3.81 (3.54–4.10)	1.77 (1.61–1.93)
Falls	785 (17.8%)	18,284 (3.6%)	5.85 (5.41–6.33)	2.47 (2.26–2.70)	1.76 (1.55–2.00)
Chronic liver disease	433 (9.8%)	12,884 (2.5%)	4.22 (3.82–4.67)	1.95 (1.75–2.18)	1.67 (1.46–1.91)
Chronic respiratory diseases	919 (20.9%)	19,644 (3.8%)	6.61 (6.13–7.11)	1.95 (1.79–2.11)	1.48 (1.35–1.64)
Gastrointestinal symptoms and signs	978 (22.2%)	25,828 (5.0%)	5.37 (5.00–5.77)	3.07 (2.83–3.32)	1.43 (1.29–1.58)
Other factors influencing health status and contact with health services	3,140 (71.3%)	230,981 (45.1%)	3.02 (2.83–3.22)	1.62 (1.51–1.74)	1.35 (1.25–1.47)
Secondary mental disorders	150 (3.4%)	1,674 (0.3%)	10.75 (9.07–12.73)	3.02 (2.46–3.70)	1.34 (1.06–1.70)
Delirium	289 (6.6%)	3,439 (0.7%)	10.38 (9.17–11.75)	3.29 (2.86–3.79)	1.32 (1.12–1.57)
Other neurological conditions	1,806 (41.0%)	125,113 (24.4%)	2.15 (2.02–2.28)	2.21 (2.06–2.36)	1.31 (1.20–1.43)
Diabetes	886 (20.1%)	31,542 (6.2%)	3.83 (3.56–4.13)	1.38 (1.27–1.50)	1.30 (1.18–1.43)
Other endocrine, nutritional and metabolic diseases	1,941 (44.1%)	63,638 (12.4%)	5.55 (5.23–5.89)	2.03 (1.90–2.17)	1.26 (1.15–1.37)
Infections	1,968 (44.7%)	60,793 (11.9%)	5.99 (5.64–6.36)	2.61 (2.44–2.79)	1.21 (1.11–1.32)

Behavioural and emotional symptoms and signs	355 (8.1%)	17,421 (3.4%)	2.49 (2.23–2.78)	1.81 (1.59–2.05)	1.17 (1.00–1.36)
Traumatic brain injury	153 (3.5%)	9,652 (1.9%)	1.87 (1.59–2.20)	1.47 (1.22–1.76)	1.14 (0.92–1.42)
Other symptoms and signs	1,616 (36.7%)	53,259 (10.4%)	4.99 (4.69–5.31)	2.60 (2.43–2.79)	1.14 (1.04–1.24)
Problems related to housing, economic and social situation	653 (14.8%)	45,332 (8.9%)	1.79 (1.65–1.95)	1.27 (1.15–1.39)	1.13 (1.01–1.26)
Dental caries	54 (1.2%)	1,597 (0.3%)	3.97 (3.02–5.21)	1.45 (1.04–2.02)	1.10 (0.75–1.60)
Skin disease	678 (15.4%)	19,168 (3.7%)	4.68 (4.30–5.08)	1.84 (1.62–2.02)	1.09 (0.97–1.22)
Alcohol, substance and other mental disorders	1,158 (26.3%)	132,886 (26.0%)	1.02 (0.95–1.09)	1.02 (0.95–1.10)	1.05 (0.96–1.15)
Secondary malignant cancers	324 (7.4%)	5,743 (1.1%)	7.00 (6.23–7.86)	2.90 (2.57–3.28)	1.01 (0.83–1.23)
Diseases of eyes and ears	527 (12.0%)	13,616 (2.7%)	4.97 (4.53–5.46)	1.90 (1.72–2.12)	1.00 (0.88–1.13)
Acute and chronic renal disease	565 (12.8%)	14,548 (2.8%)	5.03 (4.60–5.50)	1.38 (1.25–1.53)	0.99 (0.88–1.12)
Other injuries	1,691 (38.4%)	104,213 (20.4%)	2.44 (2.29–2.59)	1.53 (1.43–1.63)	0.97 (0.89–1.05)
Diseases of the digestive system	1,192 (27.1%)	53,957 (10.5%)	3.15 (2.94–3.37)	1.51 (1.40–1.62)	0.95 (0.87–1.04)
Fractures	392 (8.9%)	22,140 (4.3%)	2.16 (1.95–2.40)	1.26 (1.13–1.42)	0.91 (0.78–1.07)
Other circulatory system disorders	1,838 (41.7%)	69,117 (13.5%)	4.59 (4.32–4.87)	1.44 (1.34–1.54)	0.90 (0.82–0.98)
Musculoskeletal	1,465 (33.3%)	82,920 (16.2%)	2.58 (2.42–2.75)	1.52 (1.41–1.62)	0.88 (0.80–0.97)
Other common mental disorders	767 (17.4%)	116,898 (22.8%)	0.71 (0.66–0.77)	0.75 (0.69–0.82)	0.86 (0.78–0.95)
Other cancers	116 (2.6%)	8,165 (1.6%)	1.67 (1.39–2.01)	1.01 (0.83–1.25)	0.77 (0.61–0.97)
Circulatory and respiratory symptoms and signs	303 (6.9%)	21,903 (4.3%)	1.65 (1.47–1.86)	0.91 (0.80–1.03)	0.74 (0.64–0.86)
Asthma	58 (1.3%)	7,585 (1.5%)	0.89 (0.68–1.15)	0.67 (0.51–0.88)	0.72 (0.53–0.97)
Blood disorders	554 (12.6%)	14,237 (2.8%)	5.03 (4.59–5.51)	1.55 (1.40–1.72)	0.69 (0.61–0.79)
Schizophrenia	372 (8.4%)	31,106 (6.1%)	1.43 (1.28–1.59)	0.32 (0.28–0.37)	0.65 (0.56–0.76)
Other oral disorders	98 (2.2%)	3,420 (0.7%)	3.38 (2.76–4.14)	1.26 (0.99–1.61)	0.65 (0.50–0.86)
Intentional self-harm	51 (1.2%)	22,161 (4.3%)	0.26 (0.20–0.34)	0.36 (0.26–0.48)	0.57 (0.41–0.79)
Coronary heart disease	196 (4.4%)	13,550 (2.6%)	1.71 (1.48–1.98)	0.59 (0.51–0.69)	0.55 (0.46–0.65)
Rehabilitation, convalescence and respite	1,089 (24.7%)	18,829 (3.7%)	8.60 (8.02–9.22)	1.85 (1.70–2.02)	0.51 (0.46–0.57)
Upper respiratory diseases	39 (0.9%)	9,763 (1.9%)	0.46 (0.34–0.63)	0.65 (0.46–0.92)	0.46 (0.31–0.68)
Spinal cord injury	21 (0.5%)	638 (0.1%)	3.84 (2.48–5.94)	0.35 (0.21–0.59)	0.21 (0.12–0.36)

[a] Partially adjusted odds ratios were calculated using a model adjusting only for sociodemographic/non-diagnosis variables shown in Table 2.
[b]Adjusted odds ratios were calculated using a model adjusting for all diagnosis and sociodemographic/non-diagnosis variables (sociodemographic/non-diagnosis variables are shown in Table 2).

Discussion

This study investigated multiple factors that may lead to transfer from hospital to RAC for younger people with neuropsychiatric disorders in NSW, Australia. Within this cohort, people at greatest risk of transfer from hospital to RAC were those with progressive cognitive and neurological disorders. People with neurodevelopmental disorders (e.g., intellectual disability and cerebral palsy) were also at increased risk. Contributing factors recorded at the time of transfer from hospital to RAC included a range of medical conditions (e.g., Wernicke's encephalopathy, stroke, and cancer) in the context of issues such as older age, not being partnered, living in areas of lower socioeconomic status, functional issues related to mobility and personal care, and the need for palliative care. These findings highlight opportunities for interventions that might prevent or delay placement of younger people in RAC, including reducing preventable causes of disability, the development of hospital discharge protocols, rapid intensive and responsive support in the home, alternative high support housing options, and alternative palliative care pathways.

Our findings indicate that specific conditions and acute health events are major factors associated with greater odds of transfer from hospital to RAC for younger people with neuropsychiatric disorders. We found a substantial risk of discharge to RAC specifically amongst people with Huntington disease and people living with young onset dementia. This likely reflects the significant motor impairments associated with Huntington disease, and impact of cognitive decline and neuropsychiatric symptoms among people with young onset dementia, all of which have been previously shown to predict placement in RAC.(19–22) Indicators of increasing support needs that were associated with discharge to RAC in our study

included difficulties with mobility and personal care, injuries (e.g. falls, pressure injuries and ulcers), and a need for palliative care. Our findings indicate that increasing support needs may be exacerbated by personal circumstances, such as older age, not being partnered (married or de facto), and living in areas of lower socioeconomic status. Collectively, these findings are in line with those reported by previous studies examining sociodemographic and clinical risk factors for institutionalisation of people of all ages, including advancing age,(23–25) being unmarried or living alone,(21, 25-28) experiencing problems with living conditions,(28) greater functional dependency and difficulties with activities of daily living.(20, 24, 25, 27, 28)

The cohort discharged from hospital to RAC in this study represents a group of individuals with chronic neuropsychiatric disorders and unmet therapeutic and rehabilitative needs. While different neuropsychiatric disorders can be similarly characterised by severe alterations (e.g., cognitive, behavioural and motor) that impact autonomy, it is important to note that some of the primary drivers of transfer from hospital to RAC identified in this study are preventable, or amenable to intervention. In particular, provision of personalised and specific therapeutic and rehabilitation programs may mitigate the need for placement in RAC facilities, which are typically not equipped to meet the complex support needs of younger people with chronic and disabling conditions.(4, 10) Potential prevention strategies include minimising fall risk amongst people with progressive cognitive and neurological disorders (e.g., Parkinson's disease) through individualised exercise, physical therapy, and falls prevention programs.(29) The development and evaluation of individualised falls prevention and balance programs for people with intellectual

disability is needed to improve functional outcomes and reduce fall risk in this prematurely frail group.(30, 31) Additionally, long-term neurocognitive disability due to Wernicke's encephalopathy (Korsakoff syndrome) should be prevented with rapid treatment with thiamine, and addressing issues such as alcohol abuse and malnutrition.(32) An increased emphasis on rehabilitation following acute health events may also lead to improved outcomes, including addressing barriers to post-stroke rehabilitation among people with cognitive disabilities. People with cognitive disabilities typically experience poorer outcomes post-stroke including institutionalisation (33) and are often considered unlikely to benefit from rehabilitation, however demonstrate functional improvements when appropriate rehabilitation is provided.(34)

In November 2019, the then Prime Minister of Australia declared that no younger people should be living in RAC by 2025.(35) A number of specific actions required to meet this commitment were outlined by the Royal Commission into Aged Care Quality and Safety (Recommendation 74),(12) which have since been accepted but not necessarily funded by the Australian Government.(36) Our findings highlight the need to prioritise the funding and development of health and disability support pathways as alternatives to RAC, including hospital discharge protocols to prevent younger people being discharged into RAC and, alternative housing and support options for younger people at risk of entering RAC.(12, 37) Potential hospital discharge protocols could include a trial and evaluation of a short-term specialised transition disability care model (e.g. 12 weeks; similar to the Australian Transition Care Programme for eligible older people leaving hospital) (38) to be implemented prior to consideration of RAC, as well as alternative palliative care pathways for

younger people with life-limiting conditions. Alternative housing and support options could include the establishment of high-support needs community living options through expansion of intensive disability supports and home in-reach programs from health and allied health professionals, and extending trials of "Health care homes" to target those at risk.(39)

Further actions relate to Australia's National Disability Insurance Scheme (NDIS), which provides individualised funding packages for disability supports and services to eligible individuals with permanent and significant disability (e.g. intellectual, cognitive, neurological, sensory, physical or psychosocial disability).(40) Potential actions include improving capacity for the NDIS to enable health and disability systems to provide interdisciplinary care, echoing the recommendations of the Royal Australian and New Zealand College of Psychiatrists to the Joint Standing Committee of the NDIS.(41) This could include the development of a system for rapid crisis response in the case of a new or deteriorating primary condition, a medical comorbidity that affects functioning, or when a person requires palliative care. This would entail ensuring a joint response from health and disability services with rapid response to assessment of new and emerging support needs, timely provision of funding to meet those needs, and finally, establishing a pipeline of available alternative high support housing options.(10, 37)

Although our study was set in Australia, the issue of inappropriate placement of younger people in RAC is one of international significance.(5, 8, 42). While policy contexts and models of health and disability service delivery differ across countries, our findings do highlight opportunities for international enhancements to support the

development and provision of age-appropriate care and rehabilitation pathways for younger people at risk of transfer to RAC. This may include the development and implementation of routine minimum datasets to enable capture of the number of younger people living in RAC, their diagnoses, and their health and support needs.(43) Capture and reporting of this data would assist with advocacy, policy and service enhancements, to better meet the needs of younger people with neuropsychiatric disorders within community-based care settings.

Strengths of our study include the use of a large dataset including all hospital admissions in NSW over a period of 14 years. Furthermore, our study was done in consultation with a Lived Experience Advisory Group who provided feedback on our interpretation of the results, ensuring that our research was relevant to the needs and experiences of younger people living in RAC. Limitations include the restricted cohort, which only included people hospitalised in NSW, Australia, with a recorded neuropsychiatric diagnosis. Diagnoses used for cohort formation in the broader data linkage on which this study is based did not include other related diagnoses (e.g., traumatic brain injury and stroke). As such, the findings must be interpreted in the context of younger people with neuropsychiatric disorders (who represent a substantial proportion of younger people living in RAC in Australia),(3) but not the entire population of younger people at risk of transfer to RAC. Further, we could not confirm that index admissions for cases reflected the first ever transfer to RAC, though we attempted to do this by using a lookback period and excluding persons with any indication of previous placement in RAC. Finally, other information relevant to the risk of transfer to RAC was not available in the datasets used, including reason for placement in RAC (e.g., respite, residential, or palliative care), time since

diagnosis, detailed information about functional abilities, and information about informal care.

Our study has identified sociodemographic and diagnostic factors associated with transfer to RAC on discharge from hospital for younger people with neuropsychiatric disorders in NSW, Australia. Significant investment in health and disability support pathways as alternatives to RAC, as well as cross-sector support to rapidly respond to escalating needs, may prevent the movement of younger people from hospital to RAC.

Acknowledgements: We thank the Lived Experience Advisory Group (including Imelda Gilmore, Chanelle McKenna, Lisa Corcoran, Denis Cavanagh, Andrew Wallner, Paulene Bates, Helen Burt, and others) for their continued input into this study. We also thank Andrew Giles (National Policy Manager, MS Australia) for his ongoing contributions to this project.

Funding statement: This project was funded by the Summer Foundation (award number: N/A; Title: Understanding the health and support needs of younger people with disabilities discharged from hospital to residential aged care) and was supported by a National Health and Medical Research Council Australia Partnerships for Better Health grant (Award number: APP1056128; Title: Improving the Mental Health Outcomes of People with an Intellectual Disability).

Competing interests: Dr Di Winkler is Chief Executive Officer of the Summer Foundation. No other disclosures.

Author contributions: RCC led the drafting and finalisation of this manuscript, and contributed to the overall project direction and interpretation of results; TRW led the statistical analyses, and contributed to the overall project direction, interpretation of results, and drafting and finalisation of this manuscript; ARW led consultations with the Lived Experience Advisory Group, contributed to the overall project direction, interpretation of results, and drafting and finalisation of this manuscript; PS contributed to the statistical analyses, and contributed to the overall project direction, interpretation of results, and drafting and finalisation of this manuscript; SR, BD, AW, DW, IH, DM, and JNT all contributed to the overall project direction, interpretation of results, and drafting and finalisation of this manuscript.

Data sharing statement: Datasets used in this project cannot be shared publicly due to the data usage agreement between the Department of Developmental Disability Neuropsychiatry, The University of New South Wales Sydney, and the data custodians who provide access to this data.

Ethics approval: This study was approved by the NSW Population & Health Services Research Ethics Committee (CINSW 2013/02/445, AU RED reference: HREC/13/CIPHS/7, substudy number 2019UMB0601). Ethics approval included a waiver of consent.

References

1. Australian Institute of Health and Welfare. GEN Aged Care Data: People using aged care; 2022 [cited 18th May 2022]. Available from: URL: https://www.gen-agedcaredata.gov.au/Topics/People-using-aged-care#Aged%20care%20use%20and%20age.
2. Australian Institute of Health and Welfare. Younger People in Residential Aged Care- GEN Aged Care Data; 2022 [cited 18th May 2022]. Available from: URL: https://www.gen-agedcaredata.gov.au/Resources/Younger-people-in-residential-aged-care.
3. Winkler DF, Farnworth L, Sloan S. People under 60 living in aged care facilities in Victoria. Australian Health Review 2006; 30(1):100–8.
4. Cameron C, Pirozzo S, Tooth L. Long-term care of people below age 65 with severe acquired brain injury: appropriateness of aged care facilities. Australian and New Zealand Journal of Public Health, 2001; 25(3):261–4.
5. McMillan TM, Laurie M. Young adults with acquired brain injury in nursing homes in Glasgow. Clin Rehabil 2004; 18(2):132–8.
6. Tracey R, Briggs L. Royal Commission into Aged Care Quality and Safety: Interim report. Royal Commission into Aged Care Quality and Safety; 2019 [cited 18th May 2022]. Available from: URL: https://agedcare.royalcommission.gov.au/publications/Pages/interim-report.aspx.
7. Persson DI, Ostwald SK. Younger residents in nursing homes. Journal of Gerontological Nursing 2009; 35(10):22–31.
8. Dwyer A, Heary C, Ward M, MacNeela P. Adding insult to brain injury: young adults' experiences of residing in nursing homes following acquired brain injury. Disabil Rehabil 2019; 41(1):33–43.

9. Smith, B., Caddick, N. The Impact of living in a care home on the health and wellbeing of spinal cord injured people. International Journal of Environmental Research and Public Health 2015; 12(4):4185–202.
10. Oliver S, Gosden-Kaye EZ, Jarman H, Winkler D, Douglas JM. A scoping review to explore the experiences and outcomes of younger people with disabilities in residential aged care facilities. Brain Inj 2020; 34(11):1446–60.
11. Winkler DF, Farnworth LJ, Sloan SM, Brown T. Young people in aged care: progress of the current national program. Aust Health Rev 2011; 35(3):320–6.
12. Royal Commission into Aged Care Quality and Safety. Final Report: Care, Dignity and Respect. Commonwealth of Australia; 2021 [cited 18th May 2022]. Available from: URL: https://agedcare.royalcommission.gov.au/publications/final-report.
13. Reppermund S, Heintze T, Srasuebkul P, Reeve R, Dean K, Smith M et al. Health and wellbeing of people with intellectual disability in New South Wales, Australia: a data linkage cohort. BMJ Open 2019; 9(9):e031624.
14. Gmatch: SAS macro. http://bioinformaticstools.mayo.edu/research/gmatch/; 2007.
15. Australian Institute of Health and Welfare. Pathways of younger people entering permanent residential aged care. Canberra: AIHW; 2019 Cat. no. AGE 89 [cited 18th May 2022]. Available from: URL: https://www.gen-agedcaredata.gov.au/Resources/Reports-and-publications/2019/July/Pathways-of-younger-people-entering-permanent-resi.
16. Australian Institute of Health and Welfare. Australian Burden of Disease Study: Methods and supplementary material 2015; 2019 [cited 18th May 2022].

Available from: URL: https://www.aihw.gov.au/getmedia/a99468c5-4048-4ee9-972e-d76b9fb65a88/aihw-bod-23.pdf.

17. Greenland S, Mansournia MA, Altman DG. Sparse data bias: A problem hiding in plain sight. BMJ 2016; 352:i1981.
18. Westreich DJ, Greenland S. The Table 2 Fallacy: Presenting and Interpreting Confounder and Modifier Coefficients. American Journal of Epidemiology 2013; 177(4):292–8.
19. Wheelock VL, Tempkin T, Marder K, Nance M, Myers RH, Zhao H, Kayson E, Orme, C, Shoulson I, the Huntington Study Group. Predictors of nursing home placement in Huntington disease. Neurology 2003; 60(6):998–1001.
20. Rosenblatt A, Kumar BV, Margolis RL, Welsh CS, Ross CA. Factors contributing to institutionalization in patients with Huntington's disease. Mov Disord 2011; 26(9):1711–6.
21. Bakker C, Vugt ME de, van Vliet D, Verhey FRJ, Pijnenburg YA, Vernooij-Dassen MJFJ, Koopmans RTCM. Predictors of the time to institutionalization in young- versus late-onset dementia: results from the Needs in Young Onset Dementia (NeedYD) study. J Am Med Dir Assoc 2013; 14(4):248–53.
22. Fisher F, Andrews S, Churchyard A, Mathers S. Home or Residential Care? The Role of Behavioral and Psychosocial Factors in Determining Discharge Outcomes for Inpatients with Huntington's Disease. Journal of Huntington's Disease 2012; 1:187–93.
23. Luppa M, Luck T, Brähler E, König H-H, Riedel-Heller SG. Prediction of Institutionalisation in Dementia. Dement Geriatr Cogn Disord 2008; 26(1):65–78.
24. Harrison JK, Walesby KE, Hamilton L, Armstrong C, Starr JM, Reynish EL, MacLullich AMJ, Quinn TJ, Shenkin SD. Predicting discharge to institutional

long-term care following acute hospitalisation: a systematic review and meta-analysis. Age Ageing 2017; 46(4):547–58.

25. Burton JK, Ferguson EEC, Barugh AJ, Walesby KE, MacLullich AMJ, Shenkin SD, Quinn TJ. Predicting Discharge to Institutional Long-Term Care After Stroke: A Systematic Review and Metaanalysis. J Am Geriatr Soc 2018; 66(1):161–9.
26. Banerjee S, Murray J, Foley B, Atkins L, Schneider J, Mann A. Predictors of institutionalisation in people with dementia. Journal of Neurology, Neurosurgery & Psychiatry 2003; 74(9):1315.
27. Brown RT, Diaz-Ramirez LG, Boscardin WJ, Lee SJ, Williams BA, Steinman MA. Association of Functional Impairment in Middle Age With Hospitalization, Nursing Home Admission, and Death. JAMA Intern Med 2019; 179(5):668–75.
28. Knapp M, Chua K-C, Broadbent M, Chang C-K, Fernandez J-L, Milea D, Romeo R, Lovestone S, Spencer M, Thompson G, Stewart R, Hayes RD. Predictors of care home and hospital admissions and their costs for older people with Alzheimer's disease: findings from a large London case register. BMJ Open 2016; 6(11):e013591.
29. Mak MK, Wong-Yu IS, Shen X, Chung CL. Long-term effects of exercise and physical therapy in people with Parkinson disease. Nat Rev Neurol 2017; 13(11):689–703.
30. Hale LA, Mirfin-Veitch BF, Treharne GJ. Prevention of falls for adults with intellectual disability (PROFAID): a feasibility study. Disabil Rehabil 2016; 38(1):36–44.
31. McKenzie K, Ouellette-Kuntz H, Martin L. Frailty as a Predictor of Institutionalization Among Adults With Intellectual and Developmental Disabilities. Intellectual and Developmental Disabilities 2016; 54(2):123–35.

32. Latt N, Dore G. Thiamine in the treatment of Wernicke encephalopathy in patients with alcohol use disorders. Intern Med J 2014; 44(9):911–5.
33. Saposnik G, Cote R, Rochon PA, Mamdani M, Liu Y, Raptis S et al. Care and outcomes in patients with ischemic stroke with and without preexisting dementia. Neurology 2011; 77(18):1664.
34. Mizrahi E-H, Arad M, Adunsky A. Pre-stroke dementia does not affect the post-acute care functional outcome of old patients with ischemic stroke. Geriatr Gerontol Int 2016; 16(8):928–33.
35. Prime Minister of Australia. Response to Aged Care Royal Commission Interim Report: Media Release; 2019 [cited 18th May 2022]. Available from: URL: https://www.pm.gov.au/media/response-aged-care-royal-commission-interim-report.
36. Australian Government Department of Health. Australian Government response to the final report of the Royal Commission into Aged Care Quality and Safety; 2021 [cited 18th May 2022]. Available from: URL: https://www.health.gov.au/sites/default/files/documents/2021/05/australian-government-response-to-the-final-report-of-the-royal-commission-into-aged-care-quality-and-safety.pdf.
37. Cubis L, Ramme R, Roseingrave E, Minter E, Winkler D, Douglass J. Evaluating the discharge planning process: Barriers, challenges, and facilitators of timely and effective discharge for people with disability and complex needs. Melbourne, Australia: Summer Foundation; 2022 [cited 23rd May 2022]. Available from: URL: https://apo.org.au/sites/default/files/resource-files/2022-05/apo-nid317909.pdf.

38. Australian Government Department of Health. Transition Care Programme; 2022 [cited 18th May 2022]. Available from: URL: https://www.health.gov.au/initiatives-and-programs/transition-care-programme.

39. Australian Government Department of Health. Health Care Homes; 2021 [cited 18th May 2022]. Available from: URL: https://www1.health.gov.au/internet/main/publishing.nsf/Content/health-care-homes.

40. National Disability Insurance Agency. What is the NDIS?; 2021 [cited 18th May 2022]. Available from: URL: https://www.ndis.gov.au/understanding/what-ndis.

41. The Royal Australian & New Zealand College of Psychiatrists. General issues around the implementation and performance of the NDIS Submission 21; 2020 [cited 18th May 2022]. Available from: URL: https://www.aph.gov.au/Parliamentary_Business/Committees/Joint/National_Disability_Insurance_Scheme/GeneralIssues/Submissions.

42. Ritter AZ, Freed S, Coe NB. Younger Individuals Increase Their Use of Nursing Homes Following ACA Medicaid Expansion. J Am Med Dir Assoc 2022; 23(5):852-857.e5.

43. Burton JK, Wolters AT, Towers A-M, Jones L, Meyer J, Gordon AL et al. Developing a minimum data set for older adult care homes in the UK: exploring the concept and defining early core principles. The Lancet Healthy Longevity 2022; 3(3):e186-e193

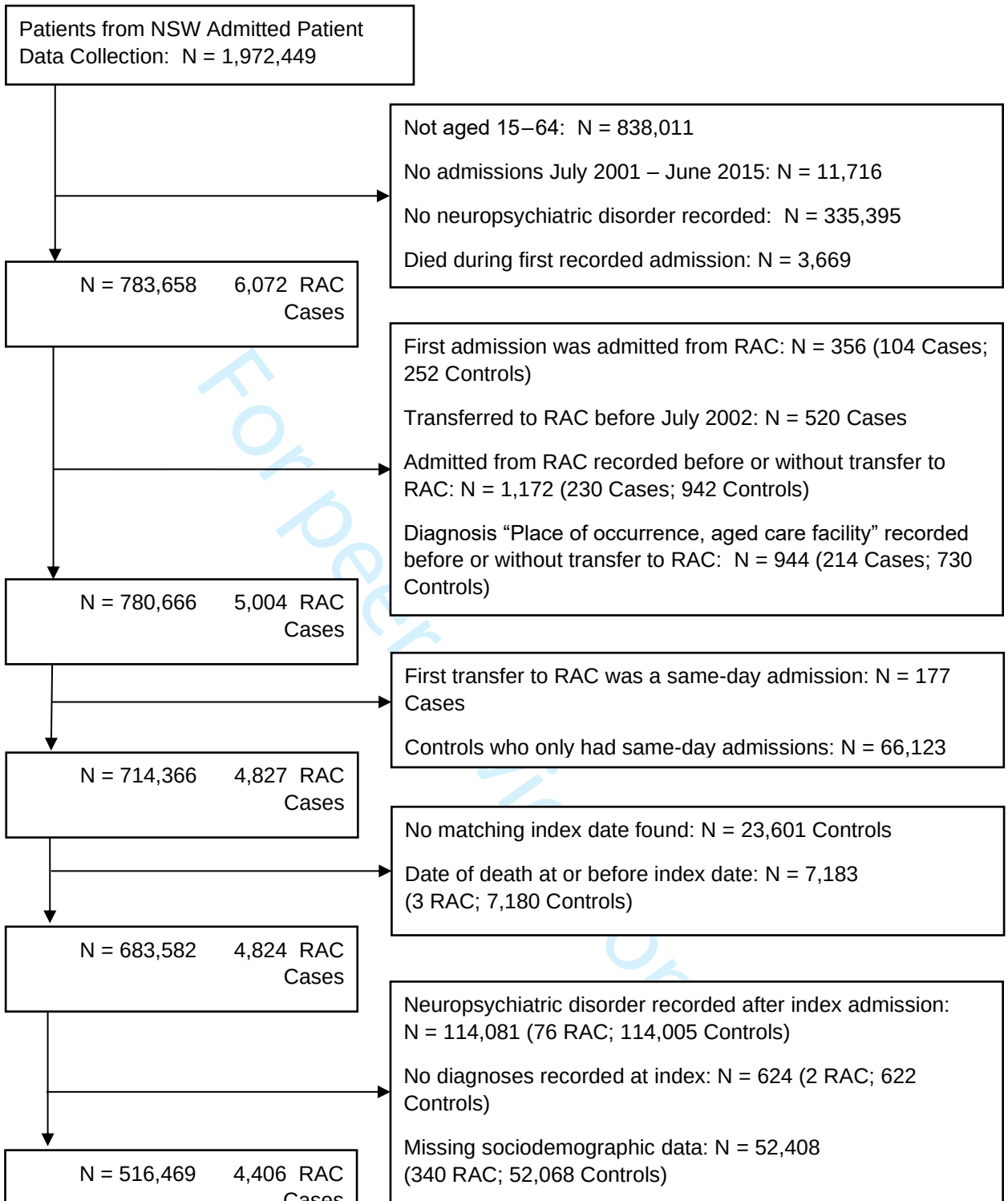

Figure 1. Selection of cases and controls. RAC= residential aged care.

Supplementary Tables

Supplementary Table A. Diagnostic categories

Collapsed diagnosis group	ICD-10 codes
Infections	A, B (not B18), G00-G07, J0-J2, J85, J86, Y95, Z22
Primary malignant cancers	C0-C6, C70-C76, C8-C9
Secondary malignant cancers	C77-C79
Other cancers	D0-D4
Blood disorders	D55-D59, D6-D9
Other endocrine, nutritional and metabolic diseases	D50-D53, E0, E12 (not E12.2), E15, E16, E2-E5 (not E51.2), E60, E61, E63-E68, E7, E8, E9
Diabetes	E10 (not E10.2), E11 (not E11.2), E13 (not E13.2), E14 (not E14.2), O24
Wernicke's encephalopathy	E51.2
Dementia	F00, F01, F02, F03, G30, G31.0, G31.3
Delirium	F05
Secondary mental disorders	F06, F07, F09
Alcohol, substance and other mental disorders	F04, F1, F38, F44, F45, F48, F5 (not F50), F6, F8 (not F84), F9
Schizophrenia	F2
Other common mental disorders	F30-F33, F34 (not F34.0), F39, F40-F43, F50
Autism spectrum disorders	F84
Huntington's disease	G10
Motor neurone disease	G12.2
Parkinson disease	G20
Multiple sclerosis	G35
Epilepsy	G40, G41
Other neurological conditions	G08, G09, G11, G12 (not G12.2), G13, G14, G2 (not G20), G3 (not G30, G31.0, G31.3, G35), G43, G44, G47, G5-G7, G81-G83, G9
Cerebral palsy	G80
Diseases of eyes and ears	H (not H0.00)
Coronary heart disease	I20-I25
Stroke	I6
Other circulatory system disorders	G45, G46, I0, I10, I11, I13, I15, I26-I28, I3, I4, I50-I52, I7, I8 (not I85), I9
Asthma	J45, J46
Chronic respiratory diseases	J40-J44, J47, J6, J7, J80-J84, J9
Upper respiratory diseases	J3 (not J34.0)
Dental caries	K02, K04
Other oral disorders	K00, K01, K03, K05-K09, K1
Chronic liver disease	B18, I85, K70-K76
Diseases of the digestive system	K2-K5, K6 (not K62.2, K62.3) K77, K8, K9
Skin disease	A46, B08, B86, H00.0, H60, J34.0, L0-L7, L8 (not L89), L90-L95, L98 (not L98.4), L99
Pressure injury and ulcers	L89, L97, L98.4
Musculoskeletal	M
Acute and chronic renal disease	E10.2, E11.2, E12.2, E13.2, E14.2, I12, N0 (not N00, N01), N1, N20-N28, N35, N36, N37, N39.1, N39.2, Q61

Supplementary Tables

Other genitourinary diseases	D25, K62.2, K62.3, N30-N32, N34, "N39", N39.0, N39.3, N39.4, N4, N50, N6, N7, N8, N9, O94, R15, R32
Other symptoms and signs	R00, R02, R20-R23, R30, R31, R33-R39, R47-R49, R50-R55, R57-R65
Neurological symptoms and signs	R25-R29, R40-R44, R56
Gastrointestinal symptoms and signs	R10-R14, R16-R19
Circulatory and respiratory symptoms and signs	R01, R03-R09
Behavioural and emotional symptoms and signs	R45, R46
Traumatic brain injury	"S02", S02.0, S02.1, S02.7, S02.9, S06
Spinal cord injury	"S14", S14.0, S14.1, S14.7, 'S24', S24.0, S24.1, S24.7, "S34", S34.0, S34.1, S34.7, T06.0, T06.1, T09.3
Fractures	S02.2-S02.6, S02.8, S12, S22, S32, S42, S49, S52, S59.7, S62, S69, S72, S82, S92, T02, T08, T10, T12, T14.2
Other injuries	S00, S01, S03-S05, S07, S08, S09, S10, S11, S13, S14.2-S14.6, S15, S16, S17, S18, S19, S20, S21, S23, S24.2-S24.6, S25, S26, S27, S28, S29, S30, S31, S33, S34.2-S34.6, S34.8, S35-S41, S43-S48, S50, S51, S53-S58, "S59", S59.7, S59.8, S59.9, S60, S61, S63-S68, S69.8, S69.9, S70, S71, S73-S78, S80, S81, S83–S91, S93-S99, T00, T01, T03-T05, T06.2-T06.8, T07, "T09", T09.0-T09.2, T09.4-T09.9, T11, T13, "T14", T14.0, T14.1, T14.3-T14.9, T15-T19, T2, T3, T4, T5, T6, T70-T74, T75 (not T75.1), T79, T80, T81, T88, T89, V (not V90, V92), W2-W6, W70, W73-W79, W8, W9, X0-X5, X85-X89, X9, Y0, Y35, Y36, Y4-Y7, Y80-Y86, Y87 (not 87.0), Y88, Y89
Falls	W0, W1
Intentional self-harm	X6, X7, X80-X84, Y87.0
Rehabilitation, convalescence and respite	Z50, Z54, Z75.5
Housing and living situation	Z59-Z65
Palliative care	Z51.5
Mobility and personal care	Z74, Z75.0, "Z99", Z99.3, Z99.8, Z99.9
Other Z codes	Y93, Y96, Y98, Z00-Z07, Z11-Z13, Z20, Z21, Z28, Z29, Z4, "Z51", Z51.0-Z51.4, Z51.6, Z51.81, Z51.88, Z51.9, Z52, Z53, Z55-Z59, Z71-Z73, "Z75", Z75.1-Z75.4, Z75.8, Z75.9, Z76, Z8, Z90, Z91 (not Z91.7), Z92-Z98, Z99.0-Z99.2

Supplementary Tables

Supplementary Table B. Diagnostic predictors of transfer from hospital to RAC on discharge using diagnoses recorded during hospital admissions in the 365 days prior to the index admission

Diagnosis variable	**Cases**[a] n=4,406	**Controls**[b] n=512,063	**Unadjusted** Odds ratio (95%CI)	**Partially adjusted** Odds ratio[d] (95%CI)	**Full model** Odds ratio[c] (95% CI)
Huntington disease	87 (2.0%)	187 (0.0%)	55.14 (42.68–71.23)	30.84 (22.82–41.67)	33.41 (23.56–47.37)
Dementia	621 (14.1%)	1,131 (0.2%)	74.12 (66.87–82.16)	18.26 (16.24–20.56)	13.39 (11.66–15.37)
Multiple sclerosis	199 (4.5%)	3,067 (0.6%)	7.85 (6.78–9.09)	7.67 (6.52–9.04)	6.71 (5.54–8.12)
Wernicke's encephalopathy	70 (1.6%)	239 (0.0%)	34.57 (26.44–45.20)	7.81 (5.73–10.65)	5.91 (4.14–8.42)
Need for palliative care	471 (10.7%)	2,567 (0.5%)	23.76 (21.43–26.34)	7.53 (6.72–8.44)	4.99 (4.24–5.87)
Motor neurone disease	58 (1.3%)	562 (0.1%)	12.14 (9.25–15.94)	6.53 (4.86–8.79)	4.74 (3.34–6.71)
Parkinson's disease	149 (3.4%)	1,255 (0.2%)	14.25 (11.99–16.93)	5.33 (4.39–6.46)	4.57 (3.61–5.77)
Intellectual disability	700 (15.9%)	17,257 (3.4%)	5.42 (4.99–5.88)	3.89 (3.52–4.30)	3.51 (3.12–3.95)
Stroke	1,063 (24.1%)	14,373 (2.8%)	11.01 (10.26–11.82)	3.65 (3.38–3.96)	2.86 (2.57–3.18)
Problems with mobility and personal care	1,063 (24.1%)	5,308 (1.0%)	30.36 (28.19–32.69)	7.99 (7.33–8.71)	2.73 (2.47–3.01)
Other genitourinary diseases	2,195 (49.8%)	41,614 (8.1%)	11.22 (10.57–11.92)	5.48 (5.13–5.87)	2.35 (2.17–2.55)
Cerebral palsy	90 (2.0%)	2,182 (0.4%)	4.87 (3.94–6.03)	5.89 (4.62–7.52)	2.32 (1.77–3.05)
Pressure injury and ulcers	1,007 (22.9%)	6,728 (1.3%)	22.25 (20.66–23.97)	4.32 (3.96–4.72)	2.17 (1.96–2.41)
Falls	1,165 (26.4%)	25,109 (4.9%)	6.97 (6.51–7.46)	2.77 (2.57–2.99)	1.70 (1.52–1.89)
Epilepsy	508 (11.5%)	15,652 (3.1%)	4.13 (3.76–4.54)	3.31 (2.98–3.68)	1.64 (1.45–1.86)
Neurological symptoms and signs	1,837 (41.7%)	36,962 (7.2%)	9.19 (8.65–9.77)	4.06 (3.80–4.34)	1.62 (1.49–1.76)

Supplementary Tables

Primary malignant cancers	711 (16.1%)	18,282 (3.6%)	5.20 (4.79–5.64)	2.16 (1.98–2.36)	1.57 (1.35–1.82)
Secondary mental disorders	228 (5.2%)	2,285 (0.4%)	12.17 (10.59–14.00)	3.31 (2.79–3.92)	1.45 (1.20–1.76)
Other factors influencing health status and contact with health services	3,608 (81.9%)	270,761 (52.9%)	4.03 (3.73–4.35)	1.91 (1.76–2.07)	1.40 (1.28–1.54)
Chronic liver disease	539 (12.2%)	16,403 (3.2%)	4.21 (3.84–4.62)	1.84 (1.67–2.04)	1.38 (1.22–1.56)
Infections	2,550 (57.9%)	83,614 (16.3%)	7.04 (6.63–7.48)	2.95 (2.76–3.15)	1.37 (1.26–1.50)
Delirium	417 (9.5%)	4,707 (0.9%)	11.27 (10.15–12.51)	3.14 (2.79–3.54)	1.32 (1.15–1.53)
Gastrointestinal symptoms and signs	1,368 (31.0%)	44,335 (8.7%)	4.75 (4.45–5.07)	2.73 (2.54–2.93)	1.32 (1.21–1.44)
Chronic respiratory diseases	1,179 (26.8%)	26,339 (5.1%)	6.74 (6.30–7.21)	1.87 (1.74–2.02)	1.31 (1.19–1.43)
Other neurological conditions	2,203 (50.0%)	148,120 (28.9%)	2.46 (2.32–2.61)	2.21 (2.07–2.36)	1.30 (1.20–1.42)
Other endocrine, nutritional and metabolic diseases	2,463 (55.9%)	84,603 (16.5%)	6.40 (6.03–6.80)	2.19 (2.06–2.34)	1.24 (1.14–1.35)
Problems related to housing, economic and social situation	995 (22.6%)	57,548 (11.2%)	2.30 (2.15–2.47)	1.47 (1.36–1.59)	1.23 (1.12–1.35)
Behavioural and emotional symptoms and signs	502 (11.4%)	23,666 (4.6%)	2.65 (2.42–2.91)	1.83 (1.64–2.04)	1.22 (1.07–1.39)
Dental caries	92 (2.1%)	3,123 (0.6%)	3.48 (2.82–4.29)	1.60 (1.25–2.06)	1.20 (0.91–1.59)
Diabetes	983 (22.3%)	35,856 (7.0%)	3.81 (3.55–4.10)	1.37 (1.26–1.48)	1.20 (1.09–1.31)
Other symptoms and signs	2,153 (48.9%)	73,456 (14.3%)	5.71 (5.38–6.06)	2.71 (2.53–2.89)	1.13 (1.04–1.23)
Traumatic brain injury	215 (4.9%)	12,094 (2.4%)	2.12 (1.85–2.44)	1.57 (1.34–1.84)	1.13 (0.94–1.36)
Alcohol, substance and other mental disorders	1,457 (33.1%)	153,056 (29.9%)	1.16 (1.09–1.23)	1.06 (0.99–1.14)	1.07 (0.98–1.17)
Skin disease	981 (22.3%)	28,613 (5.6%)	4.84 (4.50–5.20)	1.83 (1.68–1.99)	1.07 (0.97–1.17)
Diseases of eyes and ears	761 (17.3%)	20,568 (4.0%)	4.99 (4.61–5.40)	1.85 (1.69–2.02)	1.06 (0.96–1.18)

Supplementary Tables

Other injuries	2,332 (52.9%)	134,307 (26.2%)	3.16 (2.98–3.36)	1.80 (1.69–1.92)	1.02 (0.93–1.10)
Diseases of the digestive system	1,778 (40.4%)	83,648 (16.3%)	3.47 (3.26–3.68)	1.59 (1.49–1.70)	0.99 (0.92–1.07)
Secondary malignant cancers	350 (7.9%)	6,874 (1.3%)	6.34 (5.67–7.09)	2.61 (2.32–2.94)	0.98 (0.81–1.19)
Fractures	612 (13.9%)	28,682 (5.6%)	2.72 (2.49–2.96)	1.48 (1.35–1.63)	0.97 (0.85–1.10)
Other circulatory system disorders	2,323 (52.7%)	88,989 (17.4%)	5.30 (5.00–5.63)	1.57 (1.47–1.68)	0.95 (0.87–1.03)
Circulatory and respiratory symptoms and signs	610 (13.8%)	33,924 (6.6%)	2.26 (2.08–2.47)	1.16 (1.06–1.27)	0.92 (0.83–1.03)
Other common mental disorders	1,099 (24.9%)	136,978 (26.8%)	0.91 (0.85–0.97)	0.85 (0.79–0.92)	0.92 (0.84–1.00)
Schizophrenia	464 (10.5%)	34,839 (6.8%)	1.61 (1.46–1.78)	0.41 (0.36–0.46)	0.90 (0.79–1.03)
Other oral disorders	166 (3.8%)	6,828 (1.3%)	2.90 (2.48–3.39)	1.40 (1.17–1.69)	0.87 (0.71–1.06)
Rehabilitation, convalescence and respite	1,484 (33.7%)	22,958 (4.5%)	10.82 (10.15–11.53)	2.38 (2.20–2.58)	0.85 (0.77–0.94)
Acute and chronic renal disease	744 (16.9%)	20,147 (3.9%)	4.96 (4.58–5.37)	1.39 (1.27–1.52)	0.85 (0.76–0.95)
Musculoskeletal	1,861 (42.2%)	105,794 (20.7%)	2.81 (2.64–2.98)	1.48 (1.38–1.58)	0.85 (0.77–0.92)
Asthma	107 (2.4%)	10,767 (2.1%)	1.16 (0.96–1.41)	0.81 (0.66–1.00)	0.84 (0.67–1.05)
Other cancers	203 (4.6%)	15,683 (3.1%)	1.53 (1.33–1.76)	0.92 (0.79–1.07)	0.75 (0.63–0.89)
Blood disorders	827 (18.8%)	20,929 (4.1%)	5.42 (5.02–5.86)	1.58 (1.44–1.72)	0.73 (0.65–0.81)
Coronary heart disease	326 (7.4%)	18,079 (3.5%)	2.18 (1.95–2.45)	0.69 (0.61–0.77)	0.62 (0.54–0.71)
Intentional self-harm	93 (2.1%)	29,150 (5.7%)	0.36 (0.29–0.44)	0.45 (0.36–0.56)	0.59 (0.46–0.75)
Upper respiratory diseases	65 (1.5%)	12,798 (2.5%)	0.58 (0.46–0.75)	0.73 (0.56–0.95)	0.56 (0.42–0.76)
Spinal cord injury	25 (0.6%)	775 (0.2%)	3.76 (2.53–5.61)	0.32 (0.20–0.51)	0.29 (0.18–0.47)

Reporting checklist for cohort study.

Based on the STROBE cohort guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the STROBE cohortreporting guidelines, and cite them as:

von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	6
Objectives	#3	State specific objectives, including any prespecified hypotheses	7
Methods			
Study design	#4	Present key elements of study design early in the paper	7
Setting	#5	Describe the setting, locations, and relevant dates, including periods	7

		of recruitment, exposure, follow-up, and data collection	
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up.	7
Eligibility criteria	#6b	For matched studies, give matching criteria and number of exposed and unexposed	8
Variables	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	9
Bias	#9	Describe any efforts to address potential sources of bias	10
Study size	#10	Explain how the study size was arrived at	7
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	10
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	
10			
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	10
Statistical methods	#12c	Explain how missing data were addressed	9
Statistical methods	#12d	If applicable, explain how loss to follow-up was addressed	N/A
Statistical methods	#12e	Describe any sensitivity analyses	
10			
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible,	11

		included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	
Participants	#13b	Give reasons for non-participation at each stage	11
Participants	#13c	Consider use of a flow diagram	
11			
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	12
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	
N/A			
Descriptive data	#14c	Summarise follow-up time (eg, average and total amount)	
7			
Outcome data	#15	Report numbers of outcome events or summary measures over time. Give information separately for exposed and unexposed groups if applicable.	
12			
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	15
Main results	#16b	Report category boundaries when continuous variables were categorized	N/A
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
N/A			
Other analyses	#17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	14

Discussion

Key results	#18	Summarise key results with reference to study objectives	21
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	24
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	24
Generalisability	#21	Discuss the generalisability (external validity) of the study results	24
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

This checklist was completed on 22. June 2022 using https://www.goodreports.org/, a tool made by the EQUATOR Network in collaboration with Penelope.ai