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## Original Research

# Mental Health Crises in Rural and Remote Australia: An Assessment of Direct Medical Costs of Air Medical Retrievals and the Implications for the Societal Burden

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## A B S T R A C T

**Objective:** Adequate mental health service provision in rural and remote Australian communities is problematic because of the tyranny of distance. The Royal Flying Doctor Service provides air medical retrieval for people in rural and remote areas. The economic impact on both the Royal Flying Doctor Service and the public hospital system for mental health-related air medical retrievals is unknown. We aimed to estimate the direct medical costs associated with air medical retrievals and subsequent hospitalizations for mental and behavioral disorders for the 2017 calendar year.

**Methods:** All patients with a primary working diagnosis of *International Statistical Classification of Diseases and Related Health Problems, 10th Version, Australian Modification* F00 to F99 (mental and behavioral disorders) who underwent an air medical retrieval were included in this cost analysis. *International Statistical Classification of Diseases and Related Health Problems, 10th Edition, Australian Modification* codes were mapped to Australian Refined Diagnosis Related Group codes, with hospital costs applied from the National Hospital Cost Data Collection (2016/2017). All costs are reported in 2017 Australian dollars (AUDs).

**Results:** One hundred twenty-two primary evacuations and 926 interhospital transfers occurred with an in-flight diagnosis of F00 to F99, most commonly psychotic disorders, including schizophrenia and schizotypal disorders. The total direct medical costs were estimated to be AUD \$20,070,527. Costs for primary evacuations accounted for 13% (AUD \$2,611,260), with the majority of this associated with the subsequent hospital admission (AUD \$1,770,139). Similarly, the majority of the costs associated with interhospital transfers (total costs = AUD \$17,459,267) were also related to hospital costs (AUD \$13,569,187).

**Conclusion:** Direct medical costs associated with air medical retrievals for people experiencing a mental health crisis are substantial. The majority of costs are associated with hospital admission and treatment; however, the indirect (loss of productivity) and intangible (quality of life) costs are likely to be far greater.

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**Acknowledgment**In-flight patient data were extracted from the confidential Royal Flying Doctor Service data set, and cost data for Australian Refined Diagnosis Related Groups codes were sourced from the publicly available National Hospital Cost Data Collection (2016/2017) website.

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1067-991X/\$36.00

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<https://doi.org/10.1016/j.amj.2020.06.010>

Approximately 29% of the Australian population lives in rural or remote settings.<sup>1</sup> The prevalence of mental health conditions in rural and remote Australia is comparable with inner regional and major city areas<sup>2</sup>; however, the burden of disease is far greater for people living in rural and remote settings.<sup>3,4</sup> This is most clearly

demonstrated by suicide rates, which increase in line with the degree of remoteness, ranging from 9.4 per 100,000 persons in major cities to 18.1 per 100,000 in very remote settings.<sup>5</sup>

Although the drivers of this unbalanced burden of mental health conditions are many and complex, 1 of the key factors is the supply of mental health services. The majority of mental health professionals, measured as full-time equivalent (FTE) per 100,000 population, are located in major cities. Specifically, 15.1 FTE psychiatrists per 100,000 persons are based in major cities compared with 5.7 per 100,000 in outer-regional settings, 3.8 per 100,000 in remote settings, and 1.9 per 100,000 in very remote areas of Australia.<sup>6</sup> Similar trends are observed for mental health nurses (91.0 FTE nurses/100,000 persons in major cities, 56.9/100,000 in remote setting, and 36.3/100,000 in very remote settings) and clinical psychologists (105.3/100,000 in major cities, 35.4/100,000 in remote settings, and 27.3/100,000 in very remote settings).<sup>7</sup>

In addition to these supply-side issues, demand for mental health services differs from that in major cities and many urban centers. Although the overall prevalence of mental health conditions is similar across settings, people in rural and remote settings experience higher rates of substance use and acuity of mental health conditions along with the aforementioned rates of suicide.<sup>8,9</sup> Furthermore, increased environmental challenges including drought, fires, and climate change, and the recent Coronavirus pandemic, are placing greater pressure on the mental health of many rural and remote communities.<sup>10–13</sup>

In this context, the Royal Flying Doctor Service (RFDS) provides air medical retrievals for Australians living in rural and remote communities experiencing health crises, including acute mental health presentations. Patients are typically transferred by aircraft to large metropolitan or inner regional public hospitals for urgent acute care. The economic costs of this approach, including those incurred by the RFDS and public hospitals, has not been quantified.

The primary aim of this article is to determine the annual air medical retrieval and in-patient hospital-direct medical costs associated with mental and behavioral disorders from a health payer perspective. A secondary aim includes determining the mismatch of the supply and the capacity of rural and remotely located mental health services with the demand of acute presentations, with retrieval signaling as a potential proxy for this unmet need.

## Methods

### Setting and Perspective

The RFDS provides air medical, road ambulance, and primary health care to rural and remote areas of Australia without traditional medical services, such as those associated with the Medicare Benefits Schedule, a listing of the Medicare services subsidized by the Australian government.<sup>14</sup> The focus of this article is on air medical retrievals for mental health crises from a health care payer perspective.<sup>15,16</sup>

### Design and Participants

A partial economic evaluation was undertaken using routinely collected air medical data for patients diagnosed in flight with a mental and behavioral disorder (*International Statistical Classification of Diseases and Related Health Problems, 10th Edition, Australian Modification [ICD-10 AM]*, Chapter V) between January 1, 2017, and December 31, 2017. Participants included all RFDS patients who underwent an air medical retrieval, including a primary evacuation and interhospital transfer, for mental and behavioral disorders within Australia in 2017. The majority of the RFDS air medical retrievals are conducted in Western Australia, Central Australia, Queensland, and New South Wales, with limited air medical retrievals coming from Tasmania and Victoria. Tasmania and Victoria air medical services are mainly conducted by other services; however,

the RFDS in 2017/2018 conducted substantial road transportation in Victoria and Tasmania (N = 75,147).<sup>17</sup>

### Data Sources

For the primary aim, data were collected and coded on each patient's in-flight working diagnosis using the *ICD-10-AM* coding method.<sup>18</sup> The in-flight primary working diagnosis was based on referral assessment information and an assessment of the current medical status by the in-flight medical team, which, in this patient group, mainly consisted of a senior medical officer and/or a senior flight nurse. The in-flight primary working diagnosis was then coded by trained administrative staff and cross-checked by 2 of the authors (L.B. and F.G.). Data were collected within flight on the patient's sex, age, and indigenous status. Both paper-based and electronic methods were used in data collection. Detailed patient histories were not routinely collected. All air medical retrieval patients with a primary working diagnosis of *ICD-10-AM* Chapter V codes F00–F99 (mental and behavioral disorders) were included in the analysis. All other diagnoses were excluded from analysis.

We defined 2 separate types of air medical retrievals: 1) primary evacuations of a patient and 2) interhospital transfers that involve an RFDS air medical evacuation from, typically, a small regional hospital to an inner regional or major city hospital.

### Cost Data

To determine the economic costs per primary evacuation, we collected the costs incurred by each RFDS section and operation (loosely state based), including the Queensland Section, Western Operations, South Eastern Section, and Central Operations. This included determining the individual primary evacuation costs by RFDS base from each section and operation. To protect patient and RFDS base confidentiality (particularly for those bases conducting a small number of retrievals), these costs were then averaged. Costs included engine hour and staffing by an RFDS registered nurse (present on all flights) and RFDS medical officer as required.

The costs for interhospital transfers were based on \$2,912 per engine hour, which includes an RFDS registered nurse. For transfers in which an RFDS medical officer was also required, an additional \$2,223 per hour was added to the cost of each interhospital transfer. This formula is consistent with other published literature.<sup>19</sup>

To estimate inpatient admission costs, we mapped the *ICD-10-AM* codes to Australian Refined Diagnosis Related Group (AR-DRG) codes provided in the National Hospital Cost Data Collection (2016/2017) (Table 1).<sup>20</sup> This mapping was performed by 1 of the authors (B.d.G.) and independently checked by 2 of the authors (F.G. and M.C.). It is important to note that although there are > 40,000 *ICD-10-AM* codes and > 8,000 AR-DRG codes, the National Hospital Cost Data Collection only contains 807 codes. Cost data were then extracted from the 2016/2017 National Hospital Cost Data Collection for each relevant AR-DRG (Table 2).

The costs were then applied to each primary evacuation and interhospital transfer, respectively. For interhospital transfers, the costs associated for the first admission (ie, the hospital from which the patient was transferred from) were not included because no *ICD-10-AM* or AR-DRG data are collected for this. The total aggregate costs were estimated for both primary evacuations and interhospital transfers. To further understand where costs are incurred, the disaggregated “cost buckets” reported in the National Hospital Cost Data Collection were assessed. These disaggregated costs include ward medical, ward nursing, nonclinical salaries, pathology, imaging, allied pharmacy, critical care, operating room, emergency department, ward supplies, specialist procedure suites, prostheses, on-costs (eg, indirect salary costs such as superannuation), hotel and depreciation (ie, domestic services within the hospital that are not directly related to patient care), and emergency department (ED)

**Table 1**Mapping *International Statistical Classification of Diseases and Related Health Problems, 10th Edition (ICD-10), Australian Modification* to Australian Refined Diagnosis Related Groups (AR-DRGs)<sup>a</sup>

	ICD-10 Description	Corresponding AR-DRG	
F00-F09 Organic, including symptomatic, mental disorders	F00 Dementia in Alzheimer disease	B63A Dementia and Other Chronic Disturbances of Cerebral Function, Major Complexity	
	F01 Vascular dementia	B63A Dementia and Other Chronic Disturbances of Cerebral Function, Major Complexity	
	F02.2 Dementia in Huntington disease	B63A Dementia and Other Chronic Disturbances of Cerebral Function, Major Complexity	
	F03 Unspecified dementia	B63A Dementia and Other Chronic Disturbances of Cerebral Function, Major Complexity	
	F05 Delirium, not induced by alcohol and other psychoactive substances	B63A Dementia and Other Chronic Disturbances of Cerebral Function, Major Complexity	
	F06 Other mental disorders due to brain damage and dysfunction and to physical disease	B63A Dementia and Other Chronic Disturbances of Cerebral Function, Major Complexity	
	F07 Personality and behavioral disorders due to brain disease, damage and dysfunction	U67A Personality Disorders and Acute Reactions, Major Complexity	
	F09 Unspecified organic or symptomatic mental disorder	U60A Mental Health Treatment W/O ECT, Sameday, Major Complexity	
	F10-F19 Mental and behavioral disorders due to psychoactive substance use	F10 Mental and behavioral disorders due to use of alcohol	V62A Alcohol Use and Dependence, Major Complexity
F11 Mental and behavioral disorders due to use of opioids		V63Z Opioid Use and Dependence	
F12 Mental and behavioral disorders due to use of cannabinoids		V61A Drug Intoxication and Withdrawal, Major Complexity	
F13 Mental and behavioral disorders due to use of opioids		V64Z Other Drug Use and Dependence	
F15 Mental and behavioral disorders due to use of other stimulants, including caffeine		V61A Drug Intoxication and Withdrawal, Major Complexity	
F16 Mental and behavioral disorders due to use of hallucinogens		V61A Drug Intoxication and Withdrawal, Major Complexity	
F18 Mental and behavioral disorders due to use of volatile solvents		V64Z Other Drug Use and Dependence	
F19 Mental and behavioral disorders due to multiple drug use and use of other psychoactive substances		V61A Drug Intoxication and Withdrawal, Major Complexity	
F20-F29 Schizophrenia, schizotypal and delusional disorders		F20 Schizophrenia	U61A Schizophrenia Disorders, Major Complexity
		F21 Schizotypal disorder	U61A Schizophrenia Disorders, Major Complexity
	F22 Persistent delusional disorders	U62A Paranoia and Acute Psychotic Disorders, Major Complexity	
	F24 Induced delusional disorder	U62A Paranoia and Acute Psychotic Disorders, Major Complexity	
	F23 Acute and transient psychotic disorders	U62A Paranoia and Acute Psychotic Disorders, Major Complexity	
	F25 Schizoaffective disorders	U61A Schizophrenia Disorders, Major Complexity	
	F28 Other nonorganic psychotic disorders	U61A Schizophrenia Disorders, Major Complexity	
	F29 Unspecified nonorganic psychosis	U62A Paranoia and Acute Psychotic Disorders, Major Complexity	
	F30-F39 Mood [affective] disorders	F30 Manic episode	U63A Major Affective Disorders, Major Complexity
F31 Bipolar affective disorder		U63A Major Affective Disorders, Major Complexity	
F32 Depressive episode		U63A Major Affective Disorders, Major Complexity	
F33 Recurrent depressive disorder		U63A Major Affective Disorders, Major Complexity	
F34 Persistent mood [affective] disorders		U63A Major Affective Disorders, Major Complexity	
F38 Other mood [affective] disorders		U63A Major Affective Disorders, Major Complexity	
F39 Unspecified mood [affective] disorder		U63A Major Affective Disorders, Major Complexity	
F40-F48 Neurotic, stress-related and somatoform disorders	F41 Other anxiety disorders	U65A Anxiety Disorders, Major Complexity	
	F43 Reaction to severe stress, and adjustment disorders	U65A Anxiety Disorders, Major Complexity	
	F44 Dissociative [conversion] disorders	U65A Anxiety Disorders, Major Complexity	
	F50 Eating disorders	U66A Eating and Obsessive-Compulsive Disorders, Major Complexity	
	F50-F59 Behavioral syndromes associated with physiological disturbances and physical factors	F52 Sexual dysfunction not caused by organic disorder or disease	U64A Other Affective and Somatoform Disorders, Major Complexity
F53 Mental and behavioral disorders associated with the puerperium not elsewhere classified		U62A Paranoia and Acute Psychotic Disorders, Major Complexity	
F54 Psychological and behavioral factors associated with disorders or diseases classified elsewhere		U60A Mental Health Treatment W/O ECT, Sameday, Major Complexity	
F59 Unspecified behavioral syndromes associated with physiological disturbances and physical factors		U64A Other Affective and Somatoform Disorders, Major Complexity	
F60-F69 Disorders of adult personality and behavior		F60 Specific personality disorders	U67A Personality Disorders and Acute Reactions, Major Complexity
		F61 Mixed and other personality disorders	U67A Personality Disorders and Acute Reactions, Major Complexity
	F63 Habit and impulse disorders	U67A Personality Disorders and Acute Reactions, Major Complexity	
	F68 Other disorders of adult personality and behavior	U67A Personality Disorders and Acute Reactions, Major Complexity	
	F69 Unspecified disorder of adult personality and behavior	U67A Personality Disorders and Acute Reactions, Major Complexity	
	F70-F79 Mental retardation	F78 Other mental retardation	U60A Mental Health Treatment W/O ECT, Sameday, Major Complexity

Table 1 (Continued)

	ICD-10 Description	Corresponding AR-DRG
F80-F89 Disorders of psychological development	F82 Specific developmental disorder of motor function	U67A Personality Disorders and Acute Reactions, Major Complexity
F90-F98 Behavioral and emotional disorders with onset usually occurring in childhood and adolescence	F91 Conduct disorders	U68A Childhood Mental Disorders, Major Complexity
Unspecified MH disorder	F98 Other behavioral and emotional disorders with onset usually occurring in childhood and adolescence	U68A Childhood Mental Disorders, Major Complexity
	Unspecified MH disorder	U60A Mental Health Treatment W/O ECT, Sameday, Major Complexity

<sup>a</sup> Independent Hospital Pricing Authority. National Hospital Cost Data Collection Report, Public Sector, Round 21 (Financial year 2016-17). Canberra, Australia: Independent Hospital Pricing Authority; 2019.

product (ie, the average cost per admitted ED patient) elements. Estimated expenditure on each cost bucket was then calculated as a proportion of the total hospital costs.

To determine the secondary aim, we used the RFDS Service Planning and Operational Tool (SPOT) to map service provision throughout Australia. SPOT uses data from the Australian Bureau of Statistics and data from Health Direct to derive geographic population estimates reflective of mental health services.<sup>21</sup> Primary evacuation statistical areas were defined according to the Australian Bureau of Statistics Statistical Area Level 3 code.<sup>22</sup> SPOT has been designed to help determine the geographic coverage of health care in Australia. SPOT graphically represents population concentrations and health care services and calculates the proportion of the Australian population who are covered by specific health care facilities (in this case, general mental health services) within a 60-minute drive time.<sup>23</sup> To map the location of air medical retrievals for diagnoses associated with mental health, we used Tableau mapping software (Tableau Software, Salesforce Company, Seattle, WA United States of America).<sup>24</sup>

Table 2  
Unit Costs

Item	AUD (\$)
Air retrieval costs (primary evacuations) <sup>a</sup>	6,623
Interhospital transfers: hourly cost for engine time and in-flight nursing care <sup>b</sup>	2,912
Interhospital transfers: hourly cost for in-flight medical officer <sup>c</sup>	2,223
AR-DRGs <sup>d</sup> B63A: Dementia and Other Chronic Disturbances of Cerebral Function, Major Complexity	14,205
U60A: Mental Health Treatment W/O ECT, Sameday, Major Complexity	1,357
U61A: Schizophrenia Disorders, Major Complexity	16,741
U62A: Paranoia and Acute Psychotic Disorders, Major Complexity	15,488
U63A: Major Affective Disorders, Major Complexity	17,219
U64A: Other Affective and Somatoform Disorders, Major Complexity	9,599
U65A: Anxiety Disorders, Major Complexity	9,824
U66A: Eating and Obsessive-Compulsive Disorders, Major Complexity	32,701
U67A: Personality Disorders and Acute Reactions, Major Complexity	10,470
U68A: Childhood Mental Disorders, Major Complexity	17,371
V61A: Drug Intoxication and Withdrawal, Major Complexity	9,644
V62A: Alcohol Use and Dependence, Major Complexity	13,651
V63Z: Opioid Use and Dependence	7,213
V64Z: Other Drug Use and Dependence	6,287

AR-DRGs = Australian Refined Diagnosis Related Groups; AUD = Australian dollar.

<sup>a</sup> Air retrieval costs were estimated by averaging costs incurred by each Royal Flying Doctor Service section and operation. These costs include engine hour and staffing by a Royal Flying Doctor Service registered nurse (present on all flights) and a Royal Flying Doctor Service medical officer as required.

<sup>b</sup> Interhospital transfer costs were based on \$2,912 per engine hour and a Royal Flying Doctor Service registered nurse.

<sup>c</sup> Where a Royal Flying Doctor Service medical officer was also required, an additional \$2,223 per hour was added to the cost of each interhospital transfer.

<sup>d</sup> Independent Hospital Pricing Authority. National Hospital Cost Data Collection Report, Public Sector, Round 21 (Financial year 2016-17). Canberra, Australia: Independent Hospital Pricing Authority; 2019.

### Statistical Analysis

This study used descriptive statistics to summarize findings. Cost data were extracted from the 2016/2017 National Hospital Cost Data Collection for each AR-DRG derived from the ICD-10-AM mapping exercise. Costs associated with RFDS air medical retrievals were applied to each AR-DRG. These costs were then summed and multiplied by the number of retrievals per AR-DRG.

Expenditure based on cost buckets was extracted from the 2016/2017 National Hospital Cost Data Collection. Each item in the cost bucket was multiplied by the number of air medical transfers with the corresponding AR-DRG. Costs for each cost bucket were summed for all AR-DRGs, allowing for the calculation of the proportion of the total expenditure associated with each cost bucket. All costs are reported in 2017 Australian dollars. Analyses were conducted in Excel (Microsoft, Redmond, WA). In addition, cell sizes with 5 or less patients are suppressed for confidentiality.

### Ethics Approval

This project was deemed a low-risk quality assurance project by the RFDS Clinical and Health Services Research Committee, which provides oversight for RFDS research projects, on March 18, 2019. Because this project involved routinely collected data, specific patient consent forms were not required.

### Results

Over the 2017 calendar year, the RFDS conducted 122 primary evacuations and 926 interhospital transfers for patients with an in-flight diagnosis associated with a mental and behavioral disorder (ICD-10-AM Chapter V F00-F99).

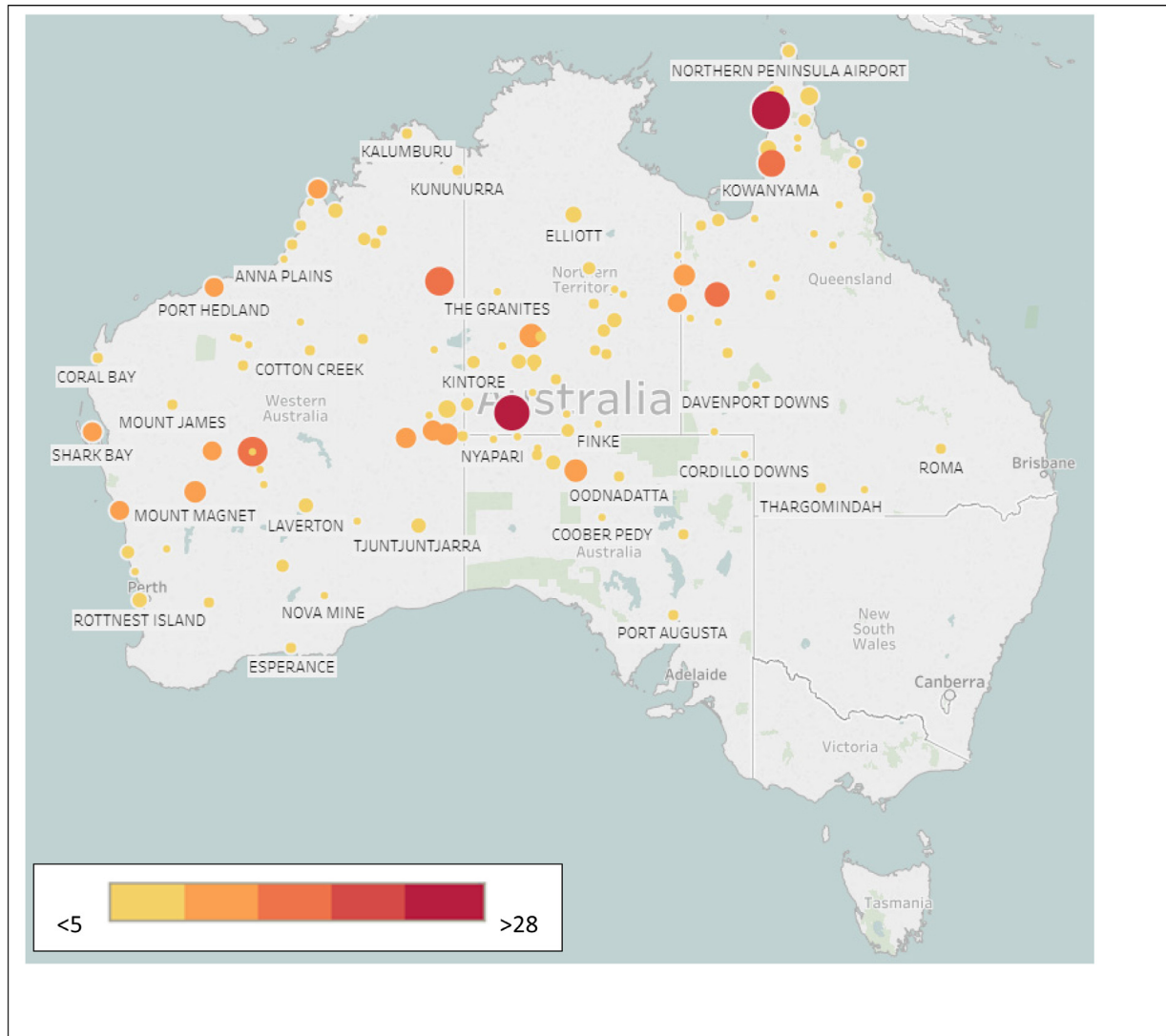
### Availability of Services

All of the primary evacuations and interhospital transfers were from remote and very remote areas to inner regional or metropolitan centers (Fig. 1A). The primary evacuation Statistical Areas Level 3 included Alice Springs (Northern Territory) (30.4%, n = 73), The Far North (Northern Queensland) (27.1%, n = 65), Gold Fields (Western Australia) (25.8%, n = 62), and the Kimberly (17.1%, n = 41).

Figure 1B provides an illustration of the supply of mental health services derived from SPOT. When looking at the general mental health service coverage within these areas reflective of population concentrations, the Gold Fields (76.2%, n = 5,690) had the highest remote and very remote population level without coverage followed by Alice Springs (32.1%, n = 13,275), Kimberly (23.3%, n = 8,577), and the Far North (9.5%, n = 1,907).

### ICD-10-AM In-flight Diagnoses

For primary evacuations, the leading diagnoses were for the F20 to F29 group of psychotic disorders, including schizophrenia, schizotypal, delusional disorders, and other non-mood-related psychotic disorders (43.3%, n = 104). Schizophrenia (15.0%, n = 36), acute and transient psychotic disorders (12.1%, n = 29), and unspecified nonorganic psychosis (7.1%, n = 17) were the most common diagnoses. One



(a)

**Figure 1.** A, The primary evacuation patient pickup location. B, The non-RFDS and RFDS mental health services rural and remote coverage in 2017 to 2018. \*This figure estimates the rural and remote provision of mental health services and excludes metropolitan areas using HealthDirect, RFDS, and Australian Bureau of Statistics (ABS) data sources. \*\*The dots indicate population concentrations, with larger dots equaling more people. The green dots indicate population concentrations that are able to access services within a 60-minute drive time, whereas the gray dots indicate population concentrations that are not able to access services within a 60-minute drive time.

fifth of mental and behavioral disorder evacuations were for F30 to F39, mood (affective) disorders (19.2%,  $n = 46$ ), largely related to depressive disorders (13.8%,  $n = 33$ ). F10 to F19, mental and behavioral disorders caused by psychoactive substance use, were reported for 13.3% ( $n = 32$ ) of evacuations and 8.3% ( $n = 20$ ) for F00 to F09, organic, including symptomatic, mental disorders. Relatively small numbers of evacuations were for F40 to F48, neurotic, stress-related, and somatoform disorders (5.4%,  $n = 13$ ), and F99, unspecified mental health disorders (7.9%,  $n = 19$ ). Five or less evacuations were reported for F50 to F59, behavioral syndromes associated with physiological disturbances and physical factors; F60–F69, disorders of adult personality and behavior; and F90–F98, behavioral and emotional disorders with onset usually occurring in childhood and adolescence.

Similar to primary evacuations, the majority of interhospital transfers were associated with F20 to F29, schizophrenia, schizotypal, delusional disorders, and other non-mood-related psychotic disorders (45.8%,  $n = 424$ ). One fifth of the transfers were for F30 to F39, mood (affective) disorders (20.7%,  $n = 192$ ); 15.1% ( $n = 140$ ) were for F10 to F19, mental

and behavioral disorders caused by psychoactive substance use; and 7.7% ( $n = 71$ ) for F00 to F09, organic, including symptomatic, mental disorders. Small numbers of interhospital transfers were reported for F60 to F69, disorders of adult personality and behavior (3.0%,  $n = 28$ ); F40 to F48, neurotic, stress-related, and somatoform disorders (2.8%,  $n = 26$ ); F99, unspecified mental disorders (2.4%,  $n = 22$ ); and F50 to F59, behavioral syndromes associated with physiological disturbances and physical factors (1.8%,  $n = 17$ ). Five or less evacuations were reported for F90 to F98, behavioral and emotional disorders with onset usually occurring in childhood and adolescence; F80 to F89, disorders of psychological development; and F70 to F79, mental retardation.

#### Costs Associated With Air Medical Retrievals

The total costs for all mental and behavioral disorder air medical retrievals and subsequent hospital admissions in 2017 was \$20,070,527. The cost associated with the 122 primary evacuations was estimated to be \$2,611,260. Two thirds of this (\$1,770,139, 68.0%) was related to in-patient admissions (AR-DRG costs) and the

remaining \$841,121 on air retrieval costs. Reflecting the numbers of patients, the highest combined air retrieval and in-patient costs were for U61A (Schizophrenia Disorders, Major Complexity; \$654,192), U62A (Paranoia and Acute Psychotic Disorders, Major Complexity; \$641,219), and U63A (Major Affective Disorders, Major Complexity; \$596,050). The average cost per primary evacuation patient was \$21,404.

The total cost related to interhospital transfers was \$17,459,267. Similar to primary evacuations, the majority of these costs were related to in-patient admission costs (\$13,569,187). Reflecting the numbers of interhospital transfers, the greatest total costs were associated with U61A (Schizophrenia Disorders, Major Complexity; \$4,709,094), U62A (Paranoia and Acute Psychotic Disorders, Major Complexity; \$4,099,211), and U63A (Major Affective Disorders, Major Complexity; \$3,983,904). The average cost per interhospital transfer patient was \$18,855 (see Table 3 for cost breakdowns for primary evacuations and interhospital transfers).

Almost one third of all hospital costs (for both primary evacuations and interhospital transfers) were associated with the ward nursing cost bucket (30.2%) (Fig. 2). These costs are associated with nursing care provided in general wards.<sup>20</sup> The ward medical cost bucket, which includes both salaries and wages for medical officers, accounted for 13.1% of hospital costs. Other notable cost buckets were 9.4% for ward supplies (costs for medical and surgical supplies, ward and clinical department overheads, and goods and services), 8.9% for nonclinical salaries (other costs of service provision, predominantly wages for carers such as patient care assistants), 7.9% for on-costs (eg, superannuation, fringe benefits tax, long service leave, worker's compensation, and recruitment), and 7.0% for ED product (ie, the average cost per admitted ED patient).

**Discussion**

This is the first study to quantify the direct medical costs associated with air medical retrievals of patients experiencing mental health crises in Australian rural and remote settings. We estimated that the annual direct medical cost associated with this was \$20,070,527 for 2017. Most of these costs were attributable to hospital costs, with over 50% of this expended on ward nursing staff, medical staff, and ward supplies.

Importantly, this total cost represents a substantial underestimate of both the health payer and the societal impacts of these acute mental health events in the rural and remote areas of Australia. More specifically, in regard to the direct medical costs, the costs of the first hospital (or retrieval site) admission for the 926 patients who received an interhospital transfer were not included. Furthermore, the substantial indirect costs associated with air medical retrievals have not been assessed. These costs include those associated with the lost productivity of patients, their families, and caregivers. In addition, intangible costs, largely the suffering associated with a condition that can be captured using quality of life instruments, is likely to be substantial from both a physical and, importantly, from a psychosocial perspective and has not been assessed in this study. For patients, particularly for those experiencing a first episode of psychosis, inpatient admission in addition to air medical retrieval and dislocation from usual social supports and networks can be a traumatic experience, with a recent systematic review reporting 42% of first-episode psychosis patients experienced symptoms of post-traumatic stress disorder.<sup>25</sup> Although the impact of this experience is partially understood with patients, less is known regarding the impact and costs for families and caregivers.

Further research is required to fully understand the true costs, including indirect (loss of productivity) and intangible costs (quality of life), associated with air medical retrievals for mental health care and the current level of service provision to rural and remote communities in location. Ultimately, the implications of these health

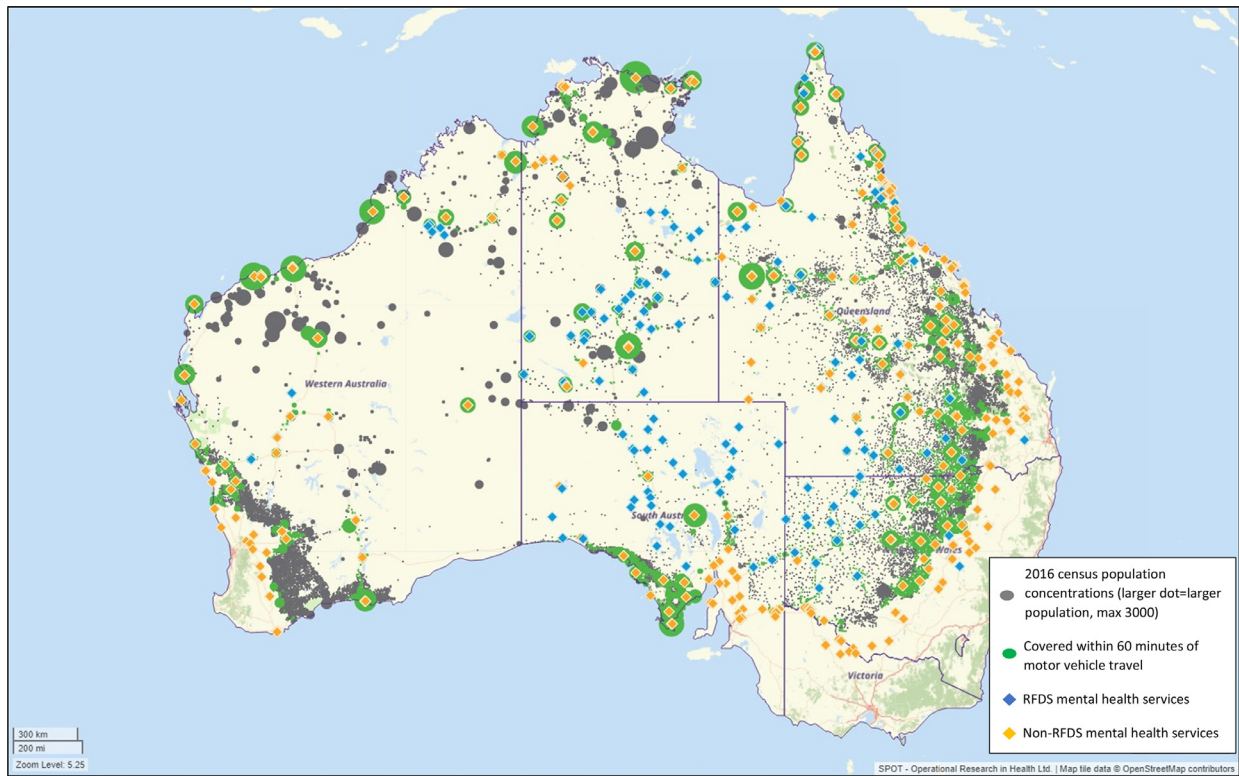
**Table 3**  
Total Medical Costs for Primary Evacuations and Interhospital Retrievals: 2017<sup>a</sup>

AR-DRG	N	Primary Evacuations			Interhospital Transfers				Total Costs (\$)
		Air Retrieval Costs (\$)	AR-DRG Inpatient Costs (\$) <sup>b</sup>	Total Costs (\$)	n	RFDS Nursing Costs (\$) <sup>a</sup>	RFDS Medical Officer Costs (\$) <sup>a</sup>	AR-DRG Inpatient Costs (\$)	
B63A: Dementia and Other Chronic Disturbances of Cerebral Function, Major Complexity	NR	33,115	71,025	104,140	62	203,840	26,676	880,695	1,111,211
U60A: Mental Health Treatment W/O ECT, Same-day, Major Complexity	8	52,984	10,856	63,840	33	115,024	15,561	44,795	175,380
U61A: Schizophrenia Disorders, Major Complexity	28	185,444	468,748	654,192	222	836,909	155,610	3,716,575	4,709,094
U62A: Paranoia and Acute Psychotic Disorders, Major Complexity	29	192,067	449,152	641,219	204	761,779	177,840	3,159,592	4,099,211
U63A: Major Affective Disorders, Major Complexity	25	165,575	430,475	596,050	192	611,083	66,690	3,306,131	3,983,904
U64A: Other Affective and Somatoform Disorders, Major Complexity	NR	33,115	47,995	81,110	n/r	8,445	0	19,168	27,643
U65A: Anxiety Disorders, Major Complexity	7	46,361	68,768	115,129	26	84,157	8,892	255,428	348,477
U66A: Eating and Obsessive-Compulsive Disorders, Major Complexity	—	—	—	—	10	26,208	0	327,011	353,219
U67A: Personality Disorders and Acute Reactions, Major Complexity	NR	19,869	31,410	51,279	30	96,970	17,784	314,092	428,846
U68A: Childhood Mental Disorders, Major Complexity	NR	6,623	17,371	23,994	n/r	13,191	0	86,857	100,048
V61A: Drug Intoxication and Withdrawal, Major Complexity	11	72,853	106,084	178,937	106	418,163	100,035	1,022,288	1,540,486
V62A: Alcohol Use and Dependence, Major Complexity	NR	33,115	68,255	101,370	30	113,859	20,007	409,527	543,394
V63Z: Opioid Use and Dependence	0	—	—	—	NR	6,261	0	14,425	20,686
V64Z: Other Drug Use and Dependence	0	—	—	—	NR	5,096	0	12,574	17,670
Total	122	841,121	1,770,139	2,611,260	192	3,300,985	589,095	13,569,187	17,459,267

AR-DRG = Australian Refined Diagnosis Related Group; NR = not reported (cell size of 5 or less are suppressed for confidentiality).

<sup>a</sup> Costs based on internal Royal Flying Doctor Service data.

<sup>b</sup> Independent Hospital Pricing Authority. National Hospital Cost Data Collection Report, Public Sector, Round 21 (Financial year 2016–17). Canberra, Australia: Independent Hospital Pricing Authority, 2019.



(b)

**Figure 2.** The breakdown of all hospital inpatient costs. Deprec = depreciation; EDPro = emergency department produce.

payer and societal costs need to be understood in the context of considered funding and capacity considerations for rural and remote mental health services and providers. Tough longer-term health care policy decisions are required by governments and health planners through the prism of the known economic costs for air medical retrievals, albeit as an underestimate of the likely true costs identified in this study. Additional attention and research are required to qualify the grossly under-researched costs to rural and remote communities of retrieving patients with mental and behavioral disorders out of their communities from a societal impact perspective.

The severe lack of psychiatrists, mental health nurses, psychologists, and social workers in rural and remote areas requires structural change to the supply of a qualified and competent rural and remote workforce. The recent Australian Senate inquiry into the burden of mental health conditions on rural and remote communities recommends longer-term and more flexible funding and contract processes, in addition to working with professional colleges to improve support and training of workers in rural and remote communities, with the goal of supporting high-quality workers and services to remain in communities, thereby providing consistency of service provision.<sup>26</sup> Importantly, our article suggests that RFDS air medical retrievals are a symptom of this unmet demand and also a potential proxy for the services and capacity that currently does not exist in rural and remote communities.

To provide high-quality mental health services to rural and remote communities will require adequate resourcing. Although the costs to governments will likely be substantial, we suggest that the societal benefits that will be gained from resourcing action to meet the unmet demand are likely to outweigh these costs. In other words, the poor mental health outcomes experienced by people in rural and remote communities deserves and demands

action. Furthermore, we do not understand the impact of high-acuity mental illnesses, the high rates of suicide and substance use on the indirect (productivity) and intangible (quality of life) costs for rural and remote communities, and the Australian society more broadly. It is important to quantify these costs because they are likely to be substantial and offset much of the costs related to the provision of high-quality mental health services for rural and remote communities.

A strength of this article is that it has provided annual direct medical costs associated with air medical retrievals in Australia. These costs have not been quantified before and are important because they can be used to assess the total costs associated with the current approaches to mental health service provision in rural and remote communities. A limitation of this study is that to apply hospital costs from the National Hospital Cost Data Collection, we mapped *ICD-10-AM* codes (of which there are > 40,000) to the 807 AR-DRG codes costed by the National Hospital Cost Data Collection. As such, the costs reported here are an estimate of the costs to governments through the public hospital system. A further limitation was that we were unable to access the *ICD-10-AM* codes that were listed for the initial hospital admission before interhospital transfers; therefore, we were unable to apply these costs.

In conclusion, the direct medical costs of air medical retrievals for mental and behavioral disorders in Australia's most remote communities are substantial. The societal implications of these costs to the families and communities of these regions is unknown; nevertheless, the flow-on effects of these societal costs are likely to far exceed the direct medical costs. We challenge policy and decision makers to understand these societal implications for future health policy and planning of mental health services in Australia's rural and remote communities.



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