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The Epidemiology of Psychosis in Indigenous Populations in Cape York and the Torres Strait

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ABSTRACT

Background: The treated prevalence of psychotic disorders in remote communities of Cape York and the Torres Strait, Australia, has been shown to be elevated compared with the Australian population. Our study used a unique dataset to assess treated incidence and prevalence of psychotic disorders and mortality over a 23-year period in the adult Indigenous population of this region.

Methods: Data was collated from a clinical database that contains complete psychiatric records from 1992 to 2015, extracted for all Indigenous patients who received treatment for a psychotic disorder from the Remote Area Mental Health Service, and linked to the Queensland Deaths Registry. We calculated 12-month treated prevalence and incidence for each calendar year. Mortality rates were compared to the overall and Indigenous population death rates in Queensland.

Findings: Between 1992 and 2015, 424 patients were treated for psychosis – an age-standardised 12-month prevalence of 1·7% in 2015, approximately two times higher in men than women, and three times higher in Aboriginal versus Torres Strait Islander populations. The highest treated prevalence was observed in 2015 in Aboriginal men (4.0%). A range of psychotic disorders were detected, including many substance-induced cases (n = 93) and schizophrenia (n = 252). The age-standardised 12-month incidence rate over the study period was 3.61 per 1000 person-years for women and 4.23 per 1000 person-years for men. Treated prevalence increased throughout the study period, largely attributable to increases in incidence of schizophrenia and schizoaffective disorder – in contrast, the incidence and prevalence of bipolar and mood disorders remained low and stable. Increased mortality risk compared to the Queensland Indigenous population (SMR = 1.9; 95% CI 1.4–2.6) was attributable to the elevated risk shown in the Aboriginal population in our study (SMR = 2.6; 95% CI 1.8–3.7).

Interpretation: Our results show extremely high prevalence rates of psychosis; increasing prevalence over time; differences in the distribution of psychosis between Aboriginal and Torres Strait Islander populations; and increased mortality risk for Aboriginal people living with psychosis in this region. These observations strongly suggest an aetiological role of environmental and neurodevelopmental factors, and the contribution of social factors to vulnerability and premature mortality.

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1. Introduction

Aboriginal and Torres Strait Islander Australians together constitute the nation's Indigenous population. Whereas Aboriginal populations are widely dispersed across the continent, the state of Queensland is home

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Research in context

Evidence before this study

Although mental illness is known to be a major contributor to the health gap for Indigenous adults, baseline data for specific disorders remain scarce and unreliable. A systematic review of prevalence estimates for psychiatric disorders in Australia's Indigenous populations found only four studies with data on psychotic disorders: three cross-sectional studies focussing on prison populations, and one cohort study of people engaged with a mental health service (by the authors of this paper). Our previous study reported the treated prevalence of psychotic disorders in remote communities of Cape York and the Torres Strait, Australia, serviced by The Remote Area Mental Health Service (RAMHS, Queensland Health). Data for that study were collected during routine clinical community visits over three months in 2010, and the results obtained were alarming: the treated prevalence of psychotic disorders in Indigenous men was around 4 times higher than in the general Australian population (2·60% and 0·89% for Indigenous men and women respectively). This study begins to expand on the findings of our previous work by exploring trends over time, differential vulnerability of Aborigina and Torres Strait Islander populaitons, and relevant correlates. Further analyses based on record likage are proceeding.

Added value of this study

Using data from a unique clinical database we assessed the prevalence, incidence, and mortality of psychotic disorders among the treated adult Indigenous population of Cape York and the Torres Strait over more than two decades. This study, the first of its kind, reports extremely high prevalence of psychosis and increasing prevalence of schizophrenia and schizoaffective disorder. However, the most important findings from our study are the dramatic differences in prevalence of psychosis within and across Aboriginal and Torres Strait populations. We observed stark differences in the distribution of psychosis between Aboriginal and Torres Strait populations in this region and increases in mortality risk for Aboriginal people living with psychosis in this area compared with other populations.

Our findings highlight the particular vulnerability of Aboriginal people who live in places that were once mission and government reserves and which were subject to draconian social controls that continued to the 1980s and in which the dire consequences of that history continue to unfold. Furthermore, our findings also support our contention that the contextual factors that affect neuropsychological development underlie both health and social outcomes, especially people's vulnerability to the development of mental disorders, including psychoses.

Implications of all the available evidence

This study raises clear issues around service access and provision for Indigenous residents living with psychotic disorders in remote communities. The disparities in mental health outcomes and trends over time we have identified in these Indigenous population of Cape York and the Torres Strait implicate environmental and neurodevelopmental factors in the development of psychosis and show the importance of social and service factors in their vulnerability to premature mortality. While these findings cannot be extrapolated to all Indigenous Australians, it suggests a widening mental health gap between Indigenous and non-Indigenous populations from large areas of remote Queensland. The need for more nuanced understandings of the social drivers of mental illness to inform social policy and to direct response from public health and clinical services remains critical. We believe that it is likely that the early developmental adversity contributing to our findings in relation to psychotic disorders may also inform the excess vulnerability of Indigenous – in particular Aboriginal – Australians to other adverse outcomes including suicide, violence and substance misuse.

to the majority of Torres Strait Islanders of whom nearly half live in and around their traditional island homes in the waters between Papua New Guinea and Cape York. Differentiated by culture, location and post-contact history, Aboriginal and Torres Strait Islander Australians share common disadvantage which in Far North Queensland is compounded by remoteness. In 2008 the Australian Closing the Gap framework was established by the Australian government to address such disadvantages in health, education and employment; the 2018 Closing the Gap Report includes Australian Bureau of Statistics estimates of life expectancy at birth which, for 2010, was calculated to be 10.6 years and 9.5 years less than non-Indigenous males and females, respectively [1]. Although mental illness is known to be a major contributor to the health gap for Indigenous adults, baseline data for specific disorders remains scarce. A systematic review of prevalence estimates for psychiatric disorders in Australia's Indigenous populations [2] found only four studies with data on psychotic disorders: three studies focussing on prison populations [3,4] and one by the authors of this paper [5].

We previously reported on the treated prevalence of psychotic disorders in remote communities of Cape York and the Torres Strait, serviced by the Remote Area Mental Health Service (RAMHS, Queensland Health) [5]. Data for that study was collected during routine clinical community visits over three months in 2010, and the results obtained were alarming: the treated prevalence of psychotic disorders in Indigenous men was 2.60% and in women was 0.89%. By comparison, the 1-month treated prevalence of psychotic disorders in the general Australian population has been measured at 0.38% for men and 0.24% for women [6]. We undertook this study to further investigate this disparity, using data from a unique clinical database.

Commencing in 1992, RAMHS was the first psychiatric service to the communities in Cape York and the Torres Strait in which the Indigenous populations are largely Aboriginal and Torres Strait Islander respectively [7]. There was one adult psychiatrist position prior to 2004 and two thereafter (a position for a child psychiatrist was subsequently added). Except for the period 1996 to 2001, three of the four authors of this paper (EH, BG, KO) were the primary adult clinicians with the service, with the only periods of service disruption being the transition years of 1996 and 2000. Between those years another psychiatrist provided clinical care. During the period of operation, RAMHS was the sole provider of psychiatric services to Cape York and the Torres Strait, apart from an intermittent service to the predominantly non-Indigenous mining township of Weipa. The nature of the psychiatric services provided by RAMHS and the close working relationships with other community-based organisations in the region facilitated the completion of comprehensive clinical case records which were recorded on an electronic database purpose-built in 1992. Because Indigenous migration in and out of these regions is low, this unique database provided an unparalleled opportunity for epidemiological research, this study covering the 23 years through which the authors of this paper provided clinical services.

Over the past three decades there have been significant changes in the government administration of the small remote communities that were included in the study. In the context of nationwide pressures to grant Indigenous Land Rights, in 1984 the Queensland government passed The *Community Services* (*Torres Strait*) *Act* and *Community*

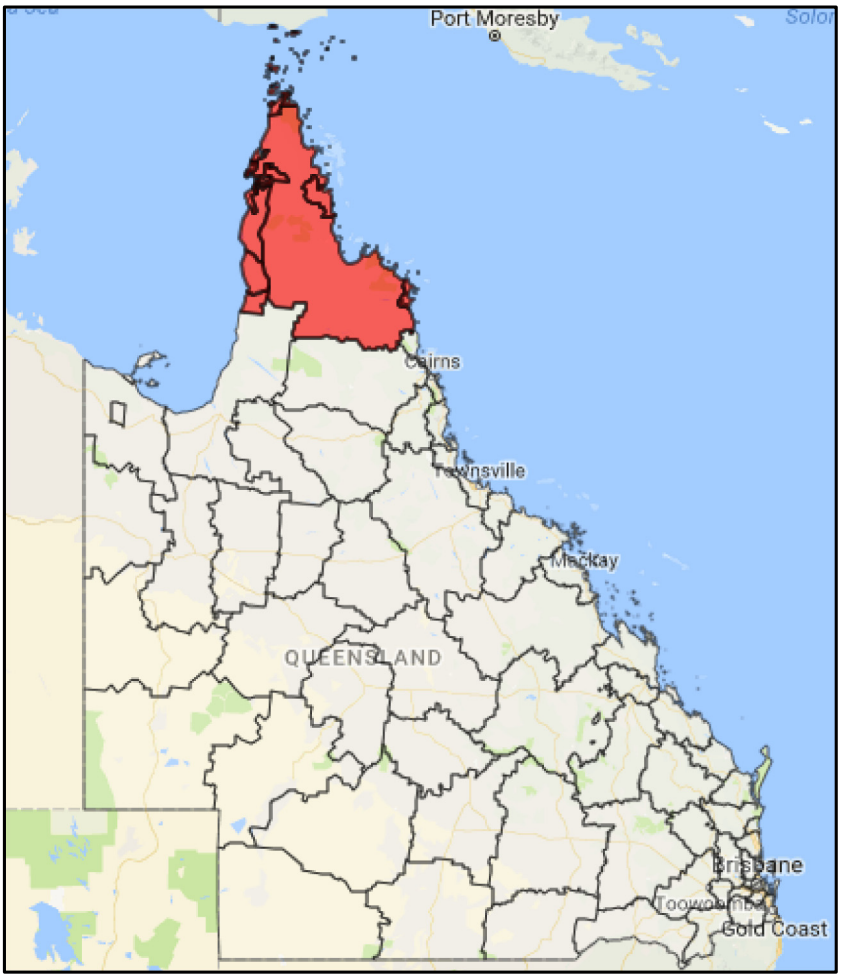

Fig. 1. The geographical catchment area of RAMHS, Cape York, Australia.

Services (*Aborigines*) *Act*, which led to the creation of community councils between 1984 and 1989. At that time these Deed of Grant in Trust (DOGIT) communities, most of which had been mission settlements until the 1960s, were under the administrative control of the Queensland government's Department of Aboriginal Affairs (later Advancement). The social consequences of these changes were complex and were compounded by the government's decision to introduce the sale of alcohol in these communities to offset local administration costs. In spite of further administrative changes, these remote communities remain economically dependent on government funding.

We present estimates of 12-month treated prevalence and incidence of psychotic disorders and mortality trends over a 23-year period in the treated adult Indigenous populations of Cape York and the Torres Strait. We assess for differences in mental health outcomes between men and women, and Aboriginal and Torres Strait populations. We explore the findings of this study within the historical social context of this distinctive population.

2. Methods

2.1. Study Location and Sample

The Cape York and the Torres Strait region has a population of approximately 0·5% of Queensland's population [8] (Fig. 1). In 2016 the region's Indigenous population was estimated at 15,568 (38% Aboriginal, 42% Torres Strait, and 21% both Aboriginal and Torres Strait) [9], of whom 11,406 were aged 15 years and older.

Patients seen by RAMHS psychiatrists were referred by community health and community mental health clinics. Due to the central role that these clinics have in remote communities, clinic staff become aware of the majority of community members who develop psychosis. Psychiatrists usually visited communities every one to three months. At times due to transport problems, weather, or staffing issues there were longer gaps between visits. Patients evacuated to the regional hospital (Cairns) for care were assessed by RAMHS psychiatrists after they had been discharged from hospital and had returned to the community.

The RAMHS clinical database was established in 1992 using Filemaker Pro. In 1998 all records were transferred to and then maintained on Microsoft Access. For this study one investigator (BG), a RAMHS psychiatrist, collated data from the database for all Indigenous patients who received treatment between 1992 and 2015 for a psychotic disorder. Diagnoses were extracted from psychiatrists' clinical notes recorded in the database. These clinical diagnoses would have been informed by ICD 10, and by DSM-III-R (1987), DSM-IV (1994) and DSM-5 (2013). The criteria that psychiatrists used to make the diagnoses were not formally documented within the database. As patients were often treated for many years, diagnoses were often documented on multiple occasions. Diagnoses included: schizophrenia, schizoaffective disorder, delusional disorder, schizophreniform disorder, acute or transient psychotic disorder, drug- or alcohol- induced psychosis, depressive episode with psychotic symptoms, bipolar disorder with psychotic symptoms, and organic psychotic disorder. For the purpose of this study schizophreniform disorder and acute or transient psychotic disorder were considered as a single category (schizophreniform).

Demographic data (such as race, sex, and age at first diagnosis of psychosis) and patient history data (such as harmful substance use) were also extracted for these patients from clinical notes maintained on the RAMHS database.

2.2. Ethics and Data Linkage

Ethics approval for this study was obtained from Far North Queensland Human Research Ethics Committee and the University of Queensland. Approval for the research was also obtained in accordance with the Queensland *Public Health Act 2005*. We linked data to the Queensland Deaths Registry to ascertain which patients in our sample had died, and their age at and cause of death.

As this is a retrospective study it was not possible to obtain consent from patients. The information recorded in the RAMHS database was gathered in the course of normal clinical service delivery. The results are published with no disclosure of community of origin other than being located in Cape York and the Torres Strait. It is hoped that results will be of benefit to the community by facilitating improved service delivery. Support for the study was received from Indigenous community organisations.

2.3. Statistical Methods

To derive the denominator for estimating 12-month treated prevalence and incidence of psychosis we used data from the Indigenous population estimates for the Cape York and Torres Strait, stratified by age and sex, for the years 2001–2015 [10,11]. These population estimates were extrapolated backwards to 1992, using separate linear regression models for each sex and age group. Table S1 in the Appendix details population size by year. We used data from patients included in RAMHS as the numerator for estimation. When diagnoses changed over time (e.g., from schizophreniform psychosis to schizophrenia), we analysed psychosis subtype according to the final diagnosis recorded for an individual.

12-Month prevalence and incidence were age-standardised based on the total Cape York and Torres Strait Indigenous population aged over 15 in the year 2015. We used the direct method of standardisation [12]. Prevalence of conditions in living patients being treated by the RAMHS was calculated for each calendar year. Incidence rates were calculated based on new diagnoses for each calendar year. Prevalence and incidence rates are presented as 3-year moving averages to facilitate more meaningful interpretation of the results. Incident cases were stratified by concurrent substance use (alcohol and/or cannabis) where significant substance use was annotated as either a formal diagnosis of substance-induced psychosis or substance use disorder, or if the psychiatrist notes indicated that substance use appeared to predispose or precipitate illness, or that substance use was an ongoing problem for patient health and management.

Rates of mortality for the Queensland population and the Queensland Indigenous population were available for the years 2006–2015 [13,14]. Age-specific and sex-specific death rates were extrapolated back to 1992 using linear regression. We calculated Standardised Mortality Ratios (SMR) and used Poisson regression modelling to compare death rates between different groups within RAMHS. The expected mortality rates were calculated for each age, sex, and Indigenous subgroup, and then these were combined to produce overall estimates.

Analyses were stratified to assess for differences between age, sex, and Indigenous groups.

3. Results

Between September 1992, and December 2015, 426 patients were treated for psychosis by RAMHS. Two patients were under 15 years of age and were excluded from analyses. Of the remaining 424 patients, approximately two-thirds were Aboriginal (n = 257). Approximately two-thirds of patients were from the Cape York region (n = 268), and almost all of these came from ex-DOGIT communities (n = 239) (Table 1).

Table 1
Demographic characteristics (N = 424).

Demographics	N	(%)
Age at RAMHS diagnosis		
15–19	96	(22.6)
20–29	152	(35.8)
30–39	92	(21.7)
40–49	48	(11.3)
50–79	30	(7.1)
Missing	6	(1.4)
Year of diagnosis		
1992–1995	89	(21.0)
1996–2000 (none in 1996)	42	(9.9)
2001–2005	103	(24.3)
2006–2010	101	(23.8)
2011–2015	88	(20.8)
Missing	1	(0.2)
Sex		
Female	146	(34.4)
Male	278	(65.6)
Marital status		
Married/de facto	80	(18.9)
Separated	63	(14.9)
Single	270	(63.7)
Widow	5	(1.2)
Missing	6	(1.4)
Race		
Aboriginal	257	(60.6)
Torres Strait	131	(30.9)
Aboriginal and Torres Strait	36	(8.5)
Location		
Cape York	268	(63.2)
Torres Strait Island	154	(36.3)
Missing	2	(0.5)
Ex DOGIT (Cape only)		
No	29	(10.8)
Yes	239	(89.2)

The median age of diagnosis was 26 years (range 15 to 79 years) and the mean age of diagnosis was 28 years for men and 30 years for women. The largest percentage (36%, n = 152) of patients were diagnosed between the ages of 20 and 29, with over 80% (n = 340) of patients presenting to the service before the age of 40. The mean time from the onset of first symptoms to diagnosis was approximately 1 year.

3.1. 12-Month Treated Prevalence

The age-standardised 12-month treated prevalence of psychosis was 1·7% in 2015 (Table 2). In both 2011 and 2015 treated prevalence of psychosis was approximately 2-times higher in men than women, and 3 times higher in Aboriginal versus Torres Strait Islander populations (Table 2). The highest treated prevalence was observed in 2015 in Aboriginal men (4.0%), and for both groups in the 30–39-year age group (3.0%) (Table 2, Appendix Fig. S1). The most frequently identified disorder subtype was schizophrenia (n = 252), equivalent to an age-standardised 12-month treated prevalence of 1·1% in 2015. However, a range of psychotic disorders were detected across the study period, including many substance-induced cases (n = 93) with a 12-month treated prevalence of 0.3%.

We observed variations in age-standardised prevalence of psychosis over time, with the highest rates in men in 2009 (2.9%), and in women between 2008 and 2012 (1.3%). Treated prevalence increased throughout the study period – notably between 1997 and 2009 for men and 2001 to 2012 for women – largely because of an increase in diagnoses of schizophrenia and schizoaffective disorder; prevalence of other psychosis subtypes showed little variation over time (Fig. 2).

Table 2
All age (15+) 12-month treated prevalence of psychotic disorders in the Indigenous population of Cape York and the Torres Strait.

	Year = 2011 (N = 201)		Year = 2015 (N = 194)	
	n (%)	Prevalence (%)	n (%)	Prevalence (%)
Sex				
Male	135 (67.2%)	2.6% (95% CI 2.2–3.0)	132 (68.0%)	2.3% (95% CI (2.0–2.8)
Female	66 (32.8%)	1.2% (95% CI 0.9–1.5)	62 (32.0%)	1.1% (95% CI 0.8–1.4)
Total	201	1.9% (95% CI 1.6–2.2)	194	1.7% (95% CI 1.5–2.0)
Age group				
15–29	70 (36.2%)	1.7% (95% CI 1.3–2.1)	60 (30.9%)	1.4% (95% CI 1.1–1.8)
30–39	64 (30.0%)	3.0% (95% CI 2.2–3.8)	64 (33.0%)	3.0% (95% CI 2.3–3.8)
≥40	67 (33.8%)	1.5% (95% CI 1.2–1.9)	70 (36.0%)	1.4% (95% CI 1.1–1.8)
Ethnicity				
Aboriginal				
Male	88 (43.8%)	4.0%[a](3.2, 4.9) 3.3%[b](2.7, 4.0)	83 (42.8%)	4.0%[a] (3.2, 4.9) 2.8%[b](2.3, 3.4)
Female	45 (22.4%)	2.0%[a](1.5, 2.7) 1.6%[b](1.2, 2.1)	41 (21.1%)	1.9%[a](1.3, 2.5) 1.4%[b] (1.0, 1.8)
Total	133 (66.2%)	3.0% [a](2.5, 3.5) 2.5% [b](2.1, 2.9)	124 (63.9%)	2.9%[a] (2.4, 3.4) 2.1%[b] (1.7, 2.4)
Torres Strait				
Male	34 (16.9%)	1.5% [a](1.1, 2.1) 1.5%[b](1.1, 2.0)	40 (20.6%)	1.7%[a](1.2, 2.3) 1.4%[b](1.0, 1.8)
Female	15 (7.5%)	0.7%[a](0.4, 1.1) 0.7%[b](0.4, 1.0)	14 (7.2%)	0.6%[a](0.3, 1.0) 0.6%[b](0.3, 0.8)
Total	49 (24.4%)	1.1%[a](0.8, 1.4) 1.1% [b](0.8, 1.4)	54 (27.8%)	1.1%[a](0.9, 1.5) 0.9%[b](0.7, 1.2)
Disorder subtype				
Schizophrenia	124 (61.7%)	1.2% (1.0, 1.4)	124 (63.9%)	1.1% (0.9, 1.3)
Substance-induced psychotic disorder	34 (16.9%)	0.3% (0.2, 0.4)	29 (14.9%)	0.3% (0.2, 0.4)
Schizoaffective disorder	14 (7.0%)	0.1% (0.07, 0.22)	12 (6.2%)	0.1% (0.05, 0.18)
Bipolar or mood disorder with psychotic features	10 (5.0%)	0.09% (0.04, 0.17)	5 (2.6%)	0.04% (0.01, 0.10)
Brief psychotic disorder	6 (3.0%)	0.06% (0.02, 0.12)	9 (4.6%)	0.08% (0.04, 0.15)
Organic psychotic disorder	5 (2.5%)	0.05% (0.02, 0.10)	3 (1.5%)	0.03% (0.005, 0.08)
Schizophreniform	3 (1.5%)	0.03% (0.006, 0.08)	5 (2.6%)	0.04% (0.01, 0.10)
Delusional disorder	2 (1.0%)	0.01% (0.002, 0.07)	3 (1.5%)	0.03% (0.005, 0.08)
NOS	3 (1.5%)	0.03% (0.006, 0.08)	0	–

[a] 'Both Aboriginal and Torres Strait' removed from calculations.
[b] 'Both Aboriginal and Torres Strait' included in both 'Aboriginal' and 'Torres Strait' denominators. 2016 population estimates were used for 2015 calculations.

3.2. 12-Month Treated Incidence

The age-standardised 12-month treated incidence rate over the study period was 3.61 per 1000 person-years for women and 4.23 per 1000 person-years for men. The rapid identification of existing cases of psychosis with the commencement of the RAMHS service in the early 1990s is reflected in high age-standardised incidence rates for schizophrenia and schizoaffective disorder (approximately 1.7 per 1000 persons per year for both men and women) and substance-induced psychoses (primarily alcohol) for men (1.3 per 1000 persons per year) (Fig. 3). The fall in incidence in Fig. 3 around 1997 is at least in part artifactual as there was a gap in service delivery between January

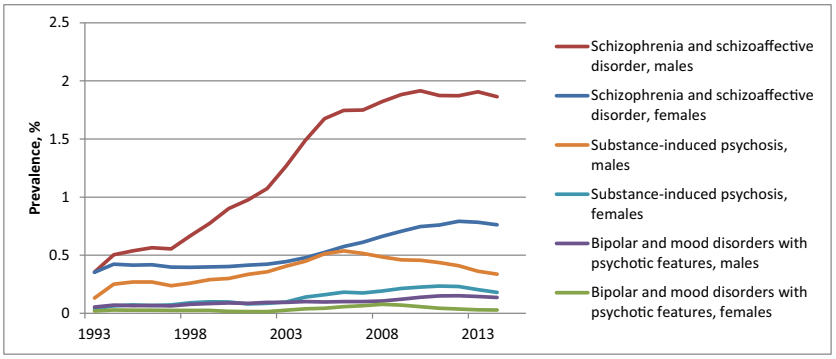

Fig. 2. Age-standardised treated prevalence of psychosis subtypes (moving 3-year average) by sex, 1993 to 2015.

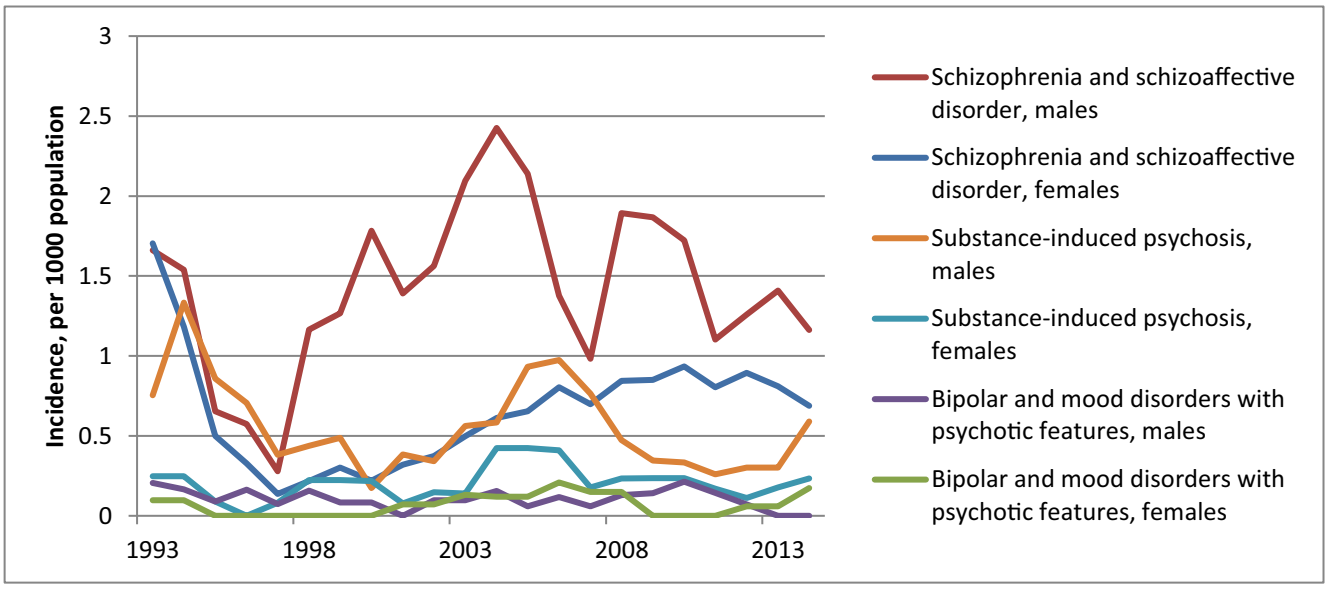

Fig. 3. Age-standardised incidence of psychosis subtype (moving 3-year average) by sex, 1993 to 2015.

1996 and November 1996 prior to a replacement clinician commencing work. There was another gap in service delivery between July 2000 and July 2001 after the replacement clinician left, but this isn't apparent in Fig. 3 due to the moving 3-year average. Apart from this period, incidence of schizophrenia and schizoaffective disorder increased during our study period, whereas the incidence of bipolar and mood disorders remained low and stable (Fig. 3).

In Aboriginal populations, from 2002 onwards the proportion of incident cases of psychosis with combined use of alcohol and cannabis was greater than that for either alcohol or cannabis use alone (Fig. 4) -

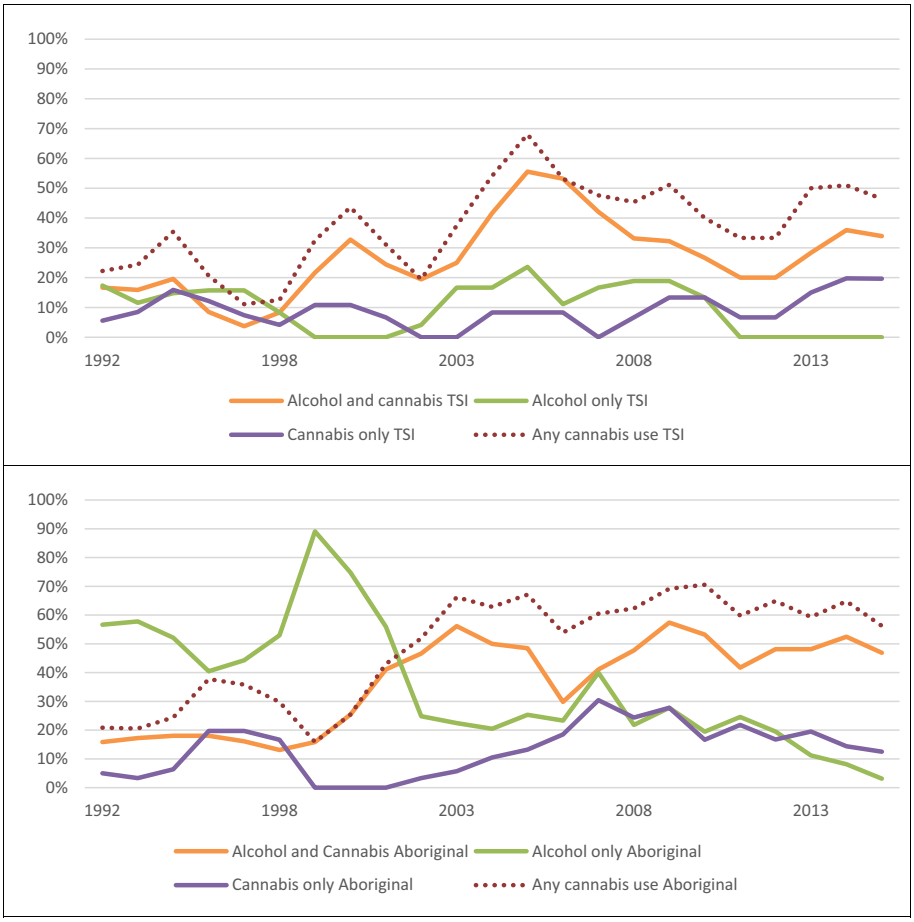

Fig. 4. Incidence cases of psychosis associated with alcohol or cannabis use as a proportion of total incident cases (moving 3-year average) by race, 1992 to 2015.

Table 3
Mortality rates in people living with psychosis compared to the QLD overall population.

	Aboriginal (2682 pyrs)		Torres Strait (1535 pyrs)		Total (4604 pyrs)	
	Deaths (rate per 1000 pyrs)	Expected deaths	Deaths (rate per 1000 pyrs)	Expected deaths	Deaths (rate per 1000 pyrs)	Expected deaths
Male						
15–24	0 (0)	0.2	0 (0)	0.1	0 (0)	0.4
25–34	4 (6.9)	0.6	1 (2.6)	0.4	6 (5.5)	1.3
35–44	5 (9.8)	0.7	0 (0)	0.4	5 (5.8)	1.2
45–54	6 (21.4)	0.8	1 (11.0)	0.3	7 (18.0)	1.1
55–64	1 (11.0)	0.6	0 (0)	0.4	1 (6.6)	1.0
65+	1 (62.1)	0.2	2 (34.8)	3.0	3 (40.8)	3.2
Total	17 (9.7)	3.2	4 (3.8)	4.6	22 (7.0)	8.2
SMR 95% CI	5.4 (3.3, 8.7)	P < 0.0001	0.9 (0.3, 2.3)	P = 0.77	2.7 (1.8, 4.1)	P < 0.0001
Female						
15–24	2 (13.0)	0	0 (0)	0	2 (9.3)	0.1
25–34	0 (0)	0.1	0 (0)	0.1	0 (0)	0.2
35–44	2 (7.8)	0.2	0 (0)	0.1	2 (4.9)	0.3
45–54	8 (57.2)	0.2	2 (33.3)	0.1	10 (50.0)	0.3
55–64	0 (0)	0.2	1 (24.3)	0.2	2 (19.5)	0.4
65+	1 (22.2)	0.6	2 (45.6)	0.8	3 (33.8)	1.5
Total	13 (14.1)	1.5	5 (10.5)	1.3	19 (12.8)	2.8
SMR 95% CI	8.8 (5.1, 15.2)	P < 0.0001	3.8 (1.6, 9.2)	P = 0.003	6.7 (4.3, 10.6)	P < 0.0001
Persons	30 (11.2)	4.6	9 (5.9)	5.99	41 (8.9)	11.00
SMR 95% CI	6.5 (4.5, 9.2)	P < 0.0001	1.5 (0.8, 2.9)	0.92	3.7 (2.7, 5.1)	P < 0.0001

prior to 2002 alcohol use was proportionally greatest. Cannabis use was associated with 60–70% of psychosis cases in the Aboriginal population from 2003 onwards. In Torres Strait Islander populations, combined use of alcohol and cannabis became greater than alcohol or cannabis use alone from 1998 onwards (Fig. 4); however, substance use was proportionally observed less in incident psychosis cases than in the Aboriginal population. A spike in incidence of substance-induced psychoses was observed around 2005 for both men and women (1.0 per 1000 persons year and 0.8 per 1000 persons year respectively, Fig. 3).

3.3. Mortality

Compared with the general Queensland population our study population had a significantly elevated mortality risk (SMR 3.7; 95% CI 2.7–5.1). This increased risk is largely attributed to the risk among the Aboriginal population (SMR 6.5; 95% CI 4.5–9.2); no increased risk was observed in the Torres Strait population overall (Table 3). However, when we assessed mortality by sex we noted a significantly raised mortality rate in the female Torres Strait population (SMR 3.8; 95%CI 1.6–9.2). The highest mortality rates were shown in Aboriginal women (SMR 8.8; 95% CI 5.1–15.2) followed by Aboriginal men (SMR 5.4; 95% CI 3.3–8.7).

Standardising mortality rates against that of the Indigenous population of Queensland showed an additional excess mortality in our study population (Appendix, Table S2). This increased risk (SMR 1.9; 95% CI 1.4, 2.6) appears to be attributable to raised mortality rates in both Aboriginal men (SMR 2.2; 95% CI 1.3–3.5) and Aboriginal women (SMR 3.5; 95% CI 2.0–6.0), but not the Torres Strait population.

The mean age of death in our cohort was 48·2 years; the median was 47 years for both men and women. Over one-third of deaths in our sample were attributed to cancer (18.6%) or cardiovascular diseases (16.3%). Suicide (9.3%) and respiratory disease (9.3%) were the next most frequently recorded causes of death (Table 4).

Table 4
Causes of death in those with psychosis.

Cause	N	(%)
Cancer	8	(18.6)
Cardiovascular	7	(16.3)
Suicide	4	(9.3)
Respiratory disease	4	(9.3)
Renal failure	3	(6.9)
Diabetes	2	(4.7)
Liver disease	2	(4.6)
Schizophrenia	1	(2.3)
Other	12	(27.9)
Total	43	

4. Discussion

This study is the first to assess the prevalence and incidence of psychotic disorders over a period of more than two decades in the treated adult Indigenous population of Australia, and mortality rates of those so affected. Our results confirm the alarmingly high rates of psychosis previously documented in the Indigenous population of this region [5]. We found age-standardised treated prevalence of psychosis to be approximately 5 times higher for men and 3 times higher for women than that of the national population (Appendix Fig. S2) [15]. By contrast, rates of bipolar and depressive psychosis in our study were similar to those in the general Australian population.

Our findings contribute to pathogenetic research, adding weight to a study of new presentations to acute mental health services in New Zealand showing that Māori people present with schizophrenia-related disorders at twice the rate of non-Māori [16]. The steady increase in treated prevalence of schizophrenia and schizoaffective disorder for men from 1997 to 2009 and for women from 2001 to 2012, and the significantly higher prevalence of psychosis among Aboriginal people compared to Torres Strait populations in our study, suggest that environmental or neurodevelopmental risk factors that predispose to psychosis differentially affect these populations. Of note, the prevalence of bipolar and mood disorders remained stable throughout our study period, suggesting that these risk factors are specific for schizophrenia and schizoaffective disorder.

The scientific literature documents a range of environmental factors that could contribute to the high rates of psychosis found in our study. Developmental adversity—such as childhood trauma or maladaptive family functioning—have been shown to increase rates of psychoses across all stages of the life-course [17–19], with a dose–response relationship between increases in childhood adversities and increased risk of psychosis [18,20,21]. History of obstetric complications, low birth weight, in-utero infections, developmental delay, sibling bullying,

adolescent tobacco smoking, and severe infections are associated with increased risks of psychosis or schizophrenia [22–25]. It has been suggested that risk factors for schizophrenia are cumulative and interactive, both with each other, and with critical periods of neurodevelopmental vulnerability [19].

The impact of historical and contemporary social factors on mental health has been demonstrated in other Aboriginal settings [26] and has been suggested previously by these authors (EH, BG) to explain the vulnerability of Aboriginal populations of Cape York, especially those who are residents of ex-DOGIT communities [27]. While the social disadvantage of Indigenous Australians is polymorphous, pervasive and persistent, discrete elements – such as changes in alcohol availability – exemplify the causal connection. Heavy alcohol consumption has been demonstrated to be associated with symptoms including paranoid ideation, visual and auditory hallucinations and extreme fear in the Kimberley Aboriginal population [28] and with increased all-cause mortality at thirteen-year follow-up [29]. In the previous study by these authors (EH, BG), functional availability of alcohol influenced current mental health status among patients being treated for psychotic disorders [27]. Access to alcohol in these populations and its consequences has, however, varied across time and subpopulations and the impacts of two policy changes bear mention.

The first was the start of alcohol sales in Queensland's DOGIT communities from 1985, with local community administrations becoming economically reliant on that trade. Dramatic social upheaval with escalating rates of violence followed, with consequences both for community and family stability [30–32] and the neurodevelopmental environment of childhood. The adverse effects of the introduction of alcohol were substantially more pronounced in Aboriginal than Torres Strait settings [33]. The second policy shift was the 2004 restriction or prohibition of alcohol sales across the majority of Cape York (by now, ex-DOGIT communities) in response to the extraordinary levels of alcohol-related violence [34], in the immediate aftermath of which evacuations for severe physical trauma fell in affected communities [35], as did evacuations of Indigenous residents from Cape York in 2004/2005 to the regional psychiatric admission hospital which after five years of progressive increases fell by over 50% [36] while Indigenous admissions from Far North Queensland as a whole were stable [34].

In this study the highest prevalence of psychosis was observed in 2015 among Aboriginal men aged 30 to 39 (Fig. S1)—i.e., among those who were between age 0 and 9 at the time of the introduction of alcohol into DOGIT communities (mid to late 1980s). Effects of alcohol ranged from diversion of resources away from sustenance, with consequences for compromised infant nutrition, to inconsistent parental engagement and exposure to violence in heavy-drinking households, with substantial potential impact on children's neurodevelopment and, we propose, the development of psychosis later in life. By comparison to alcohol which, despite legislative controls, was a constant across the study period, cannabis use was uncommon in the early 1990s but has increased since. Our results show a sustained increase in the proportion of incident cases of psychosis associated with combined use of alcohol and cannabis in Aboriginal populations from 2000 onwards (Fig. 4). The proportion of incident cases associated with cannabis use with or without alcohol reached 70% in 2009. Although it is not possible to establish a causal link from our data, cannabis [37] and alcohol have both indirect and direct mental health effects. In terms of the former, both result in major resource diversion in these welfare-dependent sustenance economies with alcohol, in particular, associated with violence [38], powerfully compromising the stability of the neurodevelopmental environment. Further, cannabis use during adolescence is associated with an increased risk of psychosis [39], and cannabis-induced psychosis can convert to schizophrenia, with highest risk for those aged 16–25 [40]. The high proportion of cases associated with combined use of alcohol and cannabis (Fig. 4) suggests the possibility of an interaction of risk factors.

The mortality data in our study show an increase in mortality among Aboriginal men and women, and in Torres Strait women, as compared with the general Queensland population. Such results are in keeping with the shorter life expectancy of Indigenous people in the Australia-wide population. Furthermore, our results show an increased mortality risk for Aboriginal men and women who have been diagnosed with a psychotic disorder living in the Cape York and Torres Strait region as compared with the Aboriginal population in the rest of Queensland. Although this elevated risk might be related to the increased prevalence of psychosis observed in this population, it could also be associated with the increased burden of chronic diseases experienced by subgroups of this population. More than one third of deaths in our study population were caused by cardiovascular disease or cancer. This observation suggests important issues in engagement with broader health services and access to effective treatment.

Our study has several limitations. As a retrospective study using data from clinical records, this work has all the associated disadvantages, with some variation in the thoroughness of documentation and the possibility of clinician bias in diagnosis. Reported diagnoses were not the result of standardised diagnostic interviews, but were clinical diagnoses which would have been informed by different editions of DSM between 1992 and 2015. The judgement by RAMHS psychiatrists as to whether substance abuse was clinically significant was subjective and may have varied between psychiatrists. Movement of patients to and from these communities will have had some impact on the results, although the Indigenous population of this region is fairly static and the effects of population migration are likely to be small. Some people with psychosis in this population will not have been identified by RAMHS, although this number is also likely to be small because it was the only service providing psychiatric clinics in Cape York and the Torres Strait during the study period and had close links and good relationships with community members and organisations. Particularly in terms of incidence, our results will have been influenced by service provision. This observation can be seen in the artefactual peak in diagnoses at the beginning of the service, with active case finding and diagnosis of existing chronic cases, and by the fall in incident cases following a change in service provider in 1996. New cases of psychosis during the period, when a different psychiatrist covered the area, are likely to have been identified in the following years. Caution should be taken in interpreting our reported mean age of death, which may be skewed by deaths at a younger age in the proportion of the cohort which have died. Finally, while the authors cannot exclude the possibility that cross-cultural factors influenced the diagnoses of psychosis in this study, we believe that any such influences will have been very small. While traditional cultural practices and beliefs are strong, they are unlikely to have increased over this short period of time, whereas both incidence and prevalence of psychoses have, and those increases have differentially affected Aboriginal and Torres Strait Islander populations in both of which cultural beliefs are strong. Further, the clinicians operating this service each had many years' experience in the region and were attentive to the imperative to avoid both pathologizing culture and culturally rationalising pathology, through both specific consideration of cultural and social contexts in assessment, and use of Indigenous informants [41].

Nonetheless, our study of psychotic disorders in the treated adult Indigenous population of Cape York and the Torres Strait over a 23-year period shows portentous findings: extremely high prevalence of psychosis; increasing prevalence of schizophrenia and schizoaffective disorder over time; differences in the distribution of psychosis between Aboriginal and Torres Strait populations in this region; and increases in mortality risk for Aboriginal people living with psychosis in this area. These differences and trends implicate environmental and neurodevelopmental factors in the development of psychosis and show the importance of social and service factors in people's vulnerability to early mortality.

This study clearly raises issues of service access and provision for Indigenous residents of remote communities living with psychotic

disorders, but the most important and challenging findings are the dramatic differences in psychosis rates within and across Aboriginal and Torres Strait populations. By interrogating this unique database covering nearly a quarter-century, we show changes in prevalence over time and suggest contextual factors that might have affected population subgroups differently. A substantial amount of data across a range of social and health outcomes—from compromised foetal and infant development to rates of juvenile detention and adult offending—show the increased risk of Aboriginal Queenslanders in these adverse outcomes as compared with Torres Strait Queenslanders, and the particular vulnerability of Aboriginal people who live in places that were once mission and government reserves and became DOGIT communities [27]. Our findings also support our earlier contention that factors affecting neuropsychological development underlie both health and social outcomes, especially vulnerability to the development of mental disorders including psychoses. We will build on this study using data from our unique dataset to further assess patterns of comorbidity, and to explore associations with historical and contemporary social factors that might help inform effective policy decisions.

The disadvantage that affects Australia's remote Indigenous populations is deep, widespread, and intransigent. In terms of health and wellbeing the Aboriginal and Torres Strait Islander residents of Cape York and the Torres Strait are doubly jeopardised both because of their Indigenous status and as a consequence of where they live. Those among them living with mental illness are exposed to triple jeopardy: an issue of human rights as much as health status [42]. Tarantola has noted that such jeopardy also presents opportunities, foremost among which is addressing the rights of Indigenous children to safe and nurturing developmental environments. As Jorm and Mulder note in relation to the impact of public health action to prevent chronic disease, preventing adverse childhood experiences may be a critical opportunity to reduce the global burden of mental disorders [43].

The title of Malcolm Turnbull's introduction to the 2018 Prime Minister's Closing the Gap report – 'An ongoing journey' – suggests that after a decade and four Prime Ministers (as of 2018, five Prime Ministers) since the strategy was announced, there is a long way to go. While the report documents niche areas of improvement in key outcome areas nationally, the picture is variable. As demonstrated by this research, in terms of psychosis in Cape York and the Torres Strait, and from work documenting increasing rates of suicide in the Kimberley region of Western Australia [44], in relation to Indigenous mental health in large areas of remote Australia the gap is widening. The need, then, for more nuanced understandings of the social drivers to inform policy and direct public health and clinical service responses remains critical.

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Author Contributions

EH, KO and BG undertook data collection. FC, EH, and BG were responsible for study design. FC, MW and DS undertook statistical analyses. FC, BG, EH and KO were responsible for interpretation of results. All authors were responsible for writing and editing of the manuscript.

Declaration of Interests

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Appendix A. Supplementary Data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.eclinm.2019.04.009.

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