Awareness of Pre-diabetes or Diabetes and Associated Factors in People With Psychosis

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Objective: To estimate awareness of pre-diabetes or type 2 diabetes and associated factors in people with psychosis, a known high-risk group. **Methods:** Cross sectional analysis of a national sample with psychosis who were aged 18–64 years, gave a fasting blood sample ($n = 1155$), had pre-diabetes or diabetes based on testing ($n = 359$) and reported if they knew they had high blood sugar or diabetes at survey ($n = 356$). Logistic regression was used to identify factors associated with awareness of pre-diabetes or diabetes prior to testing. **Results:** The prevalence of pre-diabetes (19.0% 219/1153) or type 2 diabetes (12.1%, 140/1153) was 31.1% (359/1153); 45% (160/356) were known prior to testing. Factors associated with detection were higher fasting blood glucose, older age, a perception of poor health, severe obesity, dyslipidaemia or treatment with a lipid regulating drug, a family history of diabetes, Aboriginal or Torres Strait Islander descent, decreased cognitive functioning, regional economic disadvantage, treatment with an antihypertensive drug, and an elevated 5-year risk for cardiovascular disease. The prevalence of undiagnosed pre-diabetes/diabetes was highest in those aged 25–34 years at 34.2%. **Conclusions:** Clinical detection of pre-diabetes or diabetes in people with psychosis was strongly dependent on established risk factors for type 2 diabetes in the population but not on current antipsychotic drug treatment or psychiatric case management which should ensure regular screening. Screening must become a clinical priority and should not wait until age 40.

Key words: psychosis/metabolic disorders/diabetes treatment/patient knowledge

Introduction

Elevated plasma glucose levels when fasting (impaired fasting glucose) or after an oral glucose load (impaired glucose tolerance) are categories of glucose metabolism that are intermediate between euglycaemia and diabetes and referred to as pre-diabetes. Improving diet, decreasing body weight, and increasing physical activity in those with pre-diabetes can substantially delay or prevent the development of type 2 diabetes and reduce cardiovascular events and cardiovascular mortality.^{1–4} Intensive treatment of multiple cardiovascular risk factors can halve mortality among people with established type 2 diabetes.^{5,6}

Early detection and ongoing intervention may be especially important in subgroups at high risk of diabetes at a relatively young age such as people with psychosis.⁷ Cardiovascular disease (CVD) is the most common source of excess deaths in people with psychosis, accounting for 46% of excess deaths in women with schizophrenia and 32% of excess deaths in men with schizophrenia.⁸ There is also a pronounced increased risk of type 2 diabetes in young adults with psychosis which peaks in middle age,⁷ a time when excess deaths due to CVD are accumulating.⁹ Pre-diabetes and diabetes are therefore a logical focus for early intervention programs designed to improve the cardiovascular health and life expectancy of those with psychosis.

Antipsychotic drug treatment is one of the reasons people with psychosis are at elevated risk for diabetes mellitus.¹⁰ Screening people on antipsychotic medication

for diabetes is therefore advocated but still not standard practice¹¹ and pre-diabetes or diabetes in the context of psychosis often remains undetected and untreated.

Characterizing the detection of pre-diabetes or type 2 diabetes across different risk strata such as severity of obesity can inform future detection efforts by showing where cases or pre-diabetic states are being diagnosed and where they are most likely to be missed.¹² Identification of other factors that predict detection can also identify important contextual factors for screening and diagnosis. Factors that predict detection of pre-diabetes or type 2 diabetes have been described in the population¹³ but not previously in people with psychosis.

The aim of this study was to estimate the prevalence of detected pre-diabetes or type 2 diabetes and associated factors in a large national cohort of men and women with psychosis.

Methods

Data Source and Study Population

The Australian National Survey of Psychosis is a population-based cross-sectional study with a target population defined by psychosis, place of residence, age 18–64 years and contact with public mental health services or relevant non-government organizations. The survey took place at 7 catchment sites in 5 Australian states, covering an estimated resident population aged 18–64 years of 1 464 923 people, approximately 10% of Australians in that age range. The study sample comprised people aged 18–64 years, resident in the catchment sites and in contact with designated public mental health services (in-patient, out-patient, ambulatory and community mental health) and nongovernment organizations supporting people with mental illness. The census of people with psychosis was in March 2010. Interviews were conducted between April and December 2010. A 2-phase design was employed. In phase 1, a psychosis screener was used to identify individuals likely to meet diagnostic criteria. In addition to census month enumeration, administrative records were examined in order to identify individuals with psychosis who were in contact with public mental health services in the 11 months prior to census but not in the census month. There were 7955 people who screened positive for psychosis and met eligibility criteria. Of these, in phase 2, $n = 2364$ were contacted but declined to participate or did not attend scheduled assessments; $n = 2107$ could not be traced or contacted, or they were too ill; $n = 501$ were sampled but excluded by study exclusion criteria; and $n = 1158$ were not sampled because the requisite number of interviews had been completed. This left $n = 1825$ people who were screen-positive in phase 1 who were randomly selected and interviewed. The sample was stratified by site and age group (18–34 years; 35–64 years). The latter stratification aimed to achieve equally representation of younger and older individuals. Of the 1825 who

screened positive in phase 1, 1642 met formal criteria for a psychotic disorder at interview in phase 2. The design and methodology have been described in full elsewhere.¹⁴

The research protocol for the study was approved by relevant institutional ethics committees and, after complete description of the study to the subjects, written informed consent was obtained.

Data analyzed here are from the 356 participants who: (1) had an ICD-10 psychotic disorder ($n = 1642/1825$), (2) gave a fasting blood sample ($n = 1155/1642$), (3) met study criteria for current pre-diabetes or diabetes (359/1155), and (4) reported whether they knew they had high blood sugar or diabetes at survey ($n = 356/359$). The eligible sample comprised 52.2% ($n = 186/356$) with schizophrenia, 18.8% (67/356) with schizoaffective disorder, 19.4% ($n = 69/356$) with bipolar disorder with psychotic features, 5.1% (18/356) with depressive psychosis, and 4.5% (16/356) with delusional disorders or other nonorganic psychoses.

Measures

Diabetes and pre-diabetes were defined using American Diabetes Association guidelines.¹⁵ Type 2 diabetes was defined as a current fasting plasma glucose level of at least 7.0 mmol/L or the use of prescribed anti-diabetic medication during the month prior to survey. Pre-diabetes (impaired fasting glucose) was defined as a current fasting plasma glucose level greater than 5.5 but less than 7.0 mmol/L.

Clinical detection and awareness of pre-diabetes or diabetes prior to testing was surveyed by asking participants “Do you have diabetes or have you been told your blood sugars are high?”

The Diagnostic Interview for Psychosis¹⁶ was used to diagnose psychotic disorders using ICD-10 criteria.¹⁷

The following were evaluated for their association with detection and awareness of pre-diabetes or diabetes prior to testing by this study: (1) *established risk factors for type 2 diabetes*—age, race (Aboriginal or Torres Strait Islanders) or country of birth (COB) (Southern and Central Asia, North Africa and the Middle East, South East Asia, and Southern and Eastern Europe, which along with indigenous Australian ancestry all identify high risk groups in the Australian population), obesity (assessed by measured body mass index [BMI] as class I [≥ 30 BMI < 35], class II [≥ 35 BMI < 40], and class III [BMI ≥ 40]), hypertension/prescribed drug treatment for hypertension (systolic hypertension defined as measured systolic blood pressure of 130+ mmHg; diastolic hypertension defined as measured diastolic pressure of 85+ mmHg), dyslipidemia/prescribed drug treatment for dyslipidemia (at-risk level high density lipoprotein cholesterol (HDL-c) was defined as a fasting level of 1.03+ mmol/L (39.8+ mg/dl) (in men) or 1.29+ mmol/L (49.8+ mg/dl) (in women) or greater, and at-risk level triglycerides (TG) was defined as

a fasting level of 1.70+ mmol/L [65.7 mg/dl] or greater), family history of diabetes and, for comparative purposes, family history of heart disease and family history of kidney disease (assessed by participant report of a history in any first degree relative), physical inactivity (level and frequency of physical activity during the previous week was assessed using the International Physical Activity Questionnaire,¹⁸ and defined as a 4-category variable that reflects the very low level of regular physical activity in this sample [1—any level of vigorous activity, at least once for at least 10 consecutive minutes; 2—any level of moderate activity, at least once for at least 10 consecutive minutes; 3—any walking, at least once for at least 10 consecutive minutes; 4—no activity, ie, not 1 or 2 or 3]), dietary adequacy (daily fruit and vegetable intake in the previous week with those consuming at least 2 serves of fruit and 5 serves of vegetables were coded as having an adequate intake), and current and past tobacco smoking (and history of quit attempts among current smokers); (2) *clinical features of psychosis*—psychosis sub-type (schizoaffective disorder, bipolar disorder with psychotic features, depressive psychosis, delusional disorders or other nonorganic psychoses vs schizophrenia), duration of psychiatric illness, level of negative (deficit) symptoms (assessed using a 6-item scale that rates diminished sense of purpose, loss of motivation and interest, diminished emotional range, restricted affect, poverty of speech, and impairment in socializing),^{19,20} current antipsychotic medication (the most commonly prescribed antipsychotic medications—clozapine, olanzapine, quetiapine or risperidone—vs no prescribed antipsychotic medication; current refers to the month prior to study and is based on participant report, with inspection of pill bottles or medication chart review for those in hospital at the time of interview); (3) *cognition*—premorbid IQ (National Adult Reading Test-Revised (NART-R),²¹ current cognitive functioning (Digit Symbol Coding Test (DSCT) from the Repeatable Battery for the Assessment of Neuropsychological Status²² which assesses processing speed and efficiency, a domain that is impaired in those with diabetes²³), both NART and DSCT scores were modeled as 3 categories—top, middle and lower—reflecting scores that were >1 SD of the mean, within 1 SD of the mean and <1 SD of the mean, respectively); (4) *case management, private health insurance and medical checks* in the year prior to survey. (A case manager is a mental health professional employed by a community mental health service to act on behalf of patients to ensure they get the best services.) Having a case manager and health insurance was rated based on participant report, as were medical checks in the year prior to survey—physical examination, waist circumference, fasting blood, smoking status and the participant's perception of their overall health; (5) the Australian Bureau of Statistics (ABS) Socio-Economic Indexes for Areas (SEIFA) Index of Economic Resources (IER) (coded as quintiles) for the area from which participants resided. The IER focuses on

the financial aspects of relative socioeconomic advantage and disadvantage by summarizing variables related to income and wealth. A low score indicates a relative lack of access to economic resources in general—eg, an area may have a low score if there are many households with low income, or many households paying low rent and few households with high income, or few owned homes—whereas a high score indicates relatively greater access to economic resources in general—eg, an area may have a high score if there are many households with high income, or many owned homes and few low income households, or few households paying low rent²⁴); and (6) *other factors associated with detection in the population* (probability of a cardiovascular event within 5 years was estimated by the Framingham Risk Equation).²⁵

Data Analysis

The Pearson Chi-square test was used to compare the prevalence of current pre-diabetes or type 2 diabetes by gender. Logistic regression was used to identify factors associated with detection of pre-diabetes or diabetes prior to testing in this survey, adjusted for age in years and gender. The outcome variable was detection of pre-diabetes or diabetes status prior to testing by this survey. The reference group was undetected pre-diabetes or diabetes. Reported *P* values are 2-sided.

Results

Characteristics of the Sample

The prevalence of pre-diabetes (19.0%, 219/1153) or type 2 diabetes (12.1%, 140/1153) was 31.1% (359/1153). The prevalence of pre-diabetes was higher in men than women and the prevalence of type 2 diabetes was slightly higher in women than men, but not significantly so (pre-diabetes—men 21.0% [149/709] and women 15.8% [70/444]; type 2 diabetes—men 11.6% [82/709] and women 13.1% [58/444] [$\chi^2 = 5.02$; $df = 2$; $P = .081$]).

Just under half of all pre-diabetes or type 2 diabetes diagnosed by this survey (45.9%, 160/356) was already known to participants (table 1). Awareness of pre-diabetes or diabetes was nonsignificantly higher in women (51.2%, 65/127) than men (41.5% 95/229) ($\chi^2 = 3.10$; $df = 1$; $P = .095$).

Factors Associated With Awareness of Pre-diabetes or Type 2 Diabetes

Factors associated with awareness of pre-diabetes or type 2 diabetes were increasing age and, adjusted for age and gender, severe obesity (Class II OR = 4.96; 95% CI = 1.94–12.66; $P = .001$, Class III OR = 5.39; 95% CI = 2.10–13.80; $P < .0001$ vs normal weight), treatment with lipid regulating drugs OR = 5.41; 95% CI = 3.06–9.58; $P < .0001$), a positive family history of diabetes (OR = 4.12; 95% CI = 2.52–6.72; $P < .0001$), Aboriginal or Torres Strait

Table 1. Detection and Awareness of Diabetes or Pre-diabetes in a National Cohort of Adults With Psychosis Prior to Testing

			Tested and Met Study Criteria for Pre-diabetes or Type 2 Diabetes at Survey					
			No		Yes		Total	
			N	%	N	%	N	%
Participant reported pre-diabetes or type 2 diabetes previously detected	Men	No	433	62	134	19	567	81
		Yes	36	5	95	14	131	19
		Total	469	67	229	33	698	100
	Women	No	275	62	62	14	337	76
		Yes	40	9	65	15	105	24
		Total	315	71	127	29	442	100
	Total	No	708	62	196	17	904	79
		Yes	76	7	160	14	236	21
		Total	784	69	356	31	1140	100

Note: The eligible sample with a fasting blood sample comprised $n = 1155$; of those $n = 2$ were missing a valid result for their fasting plasma glucose test and $n = 13$ were missing a valid response regarding prior detection and awareness of pre-diabetes/diabetes.

Islander descent (OR = 2.87; 95% CI = 1.10–7.46; $P = .03$), treatment with antihypertensive drugs (OR = 2.18; 95% CI = 1.20–3.97; $P = .01$) and, whether treated or not, at-risk levels of HDL-cholesterol (OR = 1.92; 95% CI = 1.21–3.05; $P = .005$) or TG (OR = 2.29; 95% CI = 1.42–3.79; $P = .001$), increased 5-year risk for CVD (OR = 1.39; 95% CI = 1.15–1.67; $P < .0001$), slower processing speed/efficiency (OR = 2.56; 95% CI = 1.08–6.06; $P = .03$; for middle vs upper scores) and living in an area characterized by relatively worse economic resources (quintile 1 [worse resources] vs 5 [better resources] OR = 2.57; 95% CI = 1.03–6.48; $P = .04$; [table 2](#)). Medical checks associated with detection were fasting blood (OR = 3.48; 95% CI = 1.90–6.37; $P < .0001$) or body weight in the past year (OR = 2.13; 95% CI = 1.10–4.11; $P = .02$).

Detection rates were especially low in young adults ([table 2](#)).

Factors not Significantly Related to Awareness of Pre-diabetes or Type 2 Diabetes

Factors that were not significantly associated with awareness of pre-diabetes or diabetes included physical activity level, dietary adequacy, current or past smoking, quit attempts among current smokers, having waist circumference or blood pressure checked in the past year, hospitalization for physical or mental ill health in the past year, clinical features of psychosis, including diagnostic sub-type, premorbid IQ, current treatment with antipsychotic drugs and health insurance ([table 2](#)). Those who were aware of their pre-diabetes or diabetes prior to testing in this survey had a longer duration of psychiatric illness but not significantly so (mean duration = 20 years vs 15 years $P = .06$). Having a psychiatric case manager was negatively associated with awareness of pre-diabetes or diabetes but not significantly so (OR = 0.75; 95% CI = 0.47–1.20; $P = .24$).

Conclusions

One in 5 people with psychosis had impaired fasting glucose and 1 in 8 had diabetes based on fasting blood glucose level or current anti-diabetic medication. In all, almost 1 in 3 people aged 18–64 years in this national survey had pre-diabetes or diabetes when tested. Less than half of those were aware they had elevated blood sugar or diabetes even though every participant was in contact with psychiatric services or a nongovernmental organization that supported patients, and 2 out of 3 had a mental health case manager employed to coordinate their care.

There was evidence of multiple, missed opportunities to increase detection, ranging from recent physical examination to hospitalization, suggesting a low level of awareness of the extent and seriousness of diabetes risk in people with psychosis. The Australian National Evidence Based Guidelines for Case Detection and Diagnosis of Type 2 Diabetes recognizes people treated with antipsychotic drugs as a high risk group. Regular screening is recommended even in the absence of other risk factors, but only from age 40.¹³ Based on our findings there is a strong case to recommend age should not be a criterion for screening. All people with psychosis should be screened. Undetected pre-diabetes or diabetes was most likely in those with psychosis who were 25–34 years of age; the prevalence of known and of undiagnosed pre-diabetes/diabetes was 11.9% and 34.2%, respectively. In a national comparator sample, The Australian Diabetes, Obesity and Lifestyle (AusDiab) study), conducted 10 years earlier, the prevalence of known and of undiagnosed diabetes in the same age group was 0.2% and 0.1%, respectively.^{13,26} Even allowing for an increased prevalence of diabetes in the decade between surveys, the magnitude of the problem in young adults with psychosis is enormous. It is telling in this context that having a case manager responsible for the overall welfare of patients receiving psychiatric care

Table 2. Factors Associated With Detected Pre-diabetes or Diabetes in a National Sample of Adults With Psychosis

Predictor	Category	Total (<i>n</i> = 1155)		Detected (<i>n</i> = 160)		Undetected (<i>n</i> = 196)		Odds of Detection in Association With Individual Predictors (<i>n</i> = 356)		
		%		%		%		OR	CI	<i>P</i>
Age group	45–54 years	21.1		38.8		18.9		1.32	0.70, 2.51	.381
	35–44 years	27.4		29.4		30.1		0.60	0.32, 1.13	.116
	25–34 years	31.9		11.9		34.2		0.21	0.10, 0.41	<.0001
	18–24 years	10.5		4.4		6.1		0.40	0.14, 1.13	.085
	<i>Ref. group: 55–64 years</i>	9.1		15.6		10.7				
Sex	Male gender	61.6		59.4		68.4		0.73	0.46, 1.14	.171
	Diabetes	37.3		60.8		28.5		4.12	2.52, 6.72	<.0001
	Heart disease	36.0		45.1		36.0		1.18	0.74, 1.87	.46
Ethnicity/Country of birth (COB)	Kidney disease	8.5		13.3		6.9		1.94	0.90, 4.16	.08
	Aboriginal/Torres Strait Islander	5.0		8.1		4.1		2.87	1.10, 7.46	.03
	Other high risk group based on COB	4.5		4.4		3.6		1.03	0.33, 3.22	.94
	<i>Ref. Group: Not high risk based on COB</i>	90.5		87.5		92.3				
	First language is not English	7.7		5.6		8.2		0.61	0.25, 1.48	.28
Language Education	Completed year 9 or below	22.3		25.5		20.5		1.62	0.88, 2.97	.11
	Completed year 10	30.3		35.7		29.2		1.40	0.80, 2.44	.22
	Completed year 11	15.6		12.1		17.4		0.91	0.45, 1.85	.80
	<i>Ref. Group: Finished secondary school (year 12)</i>	31.8		26.8		32.8				
	Excellent	6.3		2.5		5.6		0.14	0.03, 0.55	.005
Perceived health	Very good	16.7		10.0		18.5		0.21	0.08, 0.50	<.0001
	Good	35.9		33.1		39.5		0.29	0.14, 0.61	.001
	Fair	28.0		33.8		28.7		0.40	0.19, 0.84	.016
	<i>Ref. group—Poor</i>	12.7		20.6		7.7				
	Premorbid IQ (NART)—Lower tertile	16.1		15.4		15.6		1.45	0.64, 3.29	.366
Cognition	Premorbid IQ (NART)—Middle tertile	66.2		68.5		64.8		1.52	0.81, 2.84	.184
	<i>Ref. Group: IQ (NART)—Upper tertile</i>	17.6		16.1		19.6				
	Premorbid IQ (NART)—Score	Mean = 98.2		Mean = 97.95		Mean = 99.32		0.98	0.96, 1.003	.088
	Current cognitive functioning (DSCT)—Lower tertile	15.0		15.1		16.0		1.78	0.63, 5.04	.274
	Current cognitive functioning (DSCT)—Middle tertile	70.4		79.5		69.1		2.56	1.08, 6.06	.032
BMI category	<i>Ref. Group: Current cognitive functioning (DSCT)</i>	14.6		5.5		14.9				
	Upper tertile	Mean = 38.32		Mean = 35.94		Mean = 37.63		0.99	0.96, 1.01	.415
	Current cognitive functioning (DSCT)—Score	1.4		0.6		1.5		1.79	0.15, 20.21	.637
	Underweight	29.7		16.9		30.3		1.24	0.50, 3.10	.636
	Overweight	23.0		24.7		28.2		2.18	0.90, 5.30	.084
Weight measured	Obesity Class 1 BMI 30–34.9	12.7		26.0		12.3		4.96	1.94, 12.66	.001
	Obesity Class 2 BMI 35–39.9	11.5		26.0		12.8		5.39	2.10, 13.80	<.0001
	Obesity Class 3 BMI 40+	19.9		5.8		14.9				
	<i>Ref. group: normal weight</i>	79.0		90.0		39.5		2.13	1.10, 4.11	.024
	Past year	38.7		47.2		39.5		1.31	0.84, 2.03	.22
Waist measured	Past year	49.4		76.9		57.9		2.29	1.42, 3.79	.001
	At risk triglycerides (TG)									

Table 2. Continued

Predictor	Category	Total (n = 1155)		Detected (n = 160)		Undetected (n = 196)		Odds of Detection in Association With Individual Predictors (n = 356)		
		%		%		%		OR	CI	P
Hypertension	At risk TG or lipid regulating medication	52.5		86.3		59.5		1.36	0.86, 2.14	.178
	At risk HDL-c	50.7		65.2		53.4		1.92	1.21, 3.05	.005
	At risk HDL-c or lipid regulating medication	56.2		79.1		58.5		3.04	1.82, 5.06	<.0001
	Lipid regulating medication	12.6		41.9		10.2		5.41	3.06, 9.58	<.0001
	Fasting blood test past year	67.7		89.2		68.0		3.48	1.90, 6.37	<.0001
	At risk BP	49.6		59.6		53.3		1.24	0.79, 1.93	.33
	At risk BP or antihypertensive medication	53.9		70.7		57.4		1.55	0.98, 2.47	.06
Cardiovascular disease (CVD)	Antihypertensive medication	11.0		29.4		11.7		2.18	1.20, 3.97	.01
	Blood pressure checked past year	87.4		95.6		91.7		1.78	0.70, 4.56	.22
	Ever diagnosed	12.8		21.4		14.3		1.33	0.75, 2.37	.13
	Past	15.8		19.4		10.8		1.93	0.89, 4.22	.09
Smoking cigarettes	Current	65.4		63.7		72.8		1.18	0.64, 2.18	.57
	Ref group: never smoked	18.8		16.9		16.4				
	None but would have liked help to quit	9.6		12.1		11.8		1.41	0.60, 3.33	.42
	Yes in past year	23.8		22.4		16.0		1.58	0.76, 3.28	.21
Quit attempts in smokers	Yes but not in past year	19.8		25.0		21.0		1.29	0.65, 2.54	.45
	Ref group: None & no help wanted to quit	46.8		40.5		51.3				
	Smoking status checked past year	68.5		69.6		50.0		1.28	0.74, 2.21	.36
	10+ minutes of vigorous	21.7		11.3		21.4		0.59	0.25, 1.40	.23
Activity past week	10+ minutes of moderate	20.6		21.3		20.4		1.15	0.52, 2.15	.71
	10+ minutes of walking	46.2		55.0		47.4		1.06	0.53, 2.15	.85
	Ref group: Completely inactive	11.4		12.5		10.7				
	2 fruits and 5 vegetable servings a day	6.2		8.8		6.7		1.15	0.50, 2.56	.73
Dietary adequacy	Schizoaffective disorder	18.2		23.8		14.8		1.55	0.86, 2.78	.14
	Bipolar with psychotic features	19.5		16.9		21.4		0.63	0.35, 1.15	.13
	Depressive psychosis	5.5		4.4		5.6		0.65	0.23, 1.83	.41
	Delusional disorders, other nonorganic psychoses	5.7		3.8		5.1		0.84	0.28, 2.50	.76
Psychosis diagnosis	Ref group: Schizophrenia	51.2		51.2		53.1				
	Clozapine	18.3		28.7		26.5		1.71	0.74, 3.92	.20
	Olanzapine	18.7		23.1		17.9		0.96	0.38, 2.43	.94
	Quetiapine	22.1		24.4		22.4		1.65	0.69, 3.97	.25
Physical exam	Risperidone	21.1		18.1		20.4		1.14	0.48, 2.66	.76
	Ref group: Not currently prescribed any	13.8		8.8		11.2				
	Past year	66.6		73.6		67.7		1.19	0.74, 1.93	.46
	For physical illness past year	12.6		20.6		25.9		2.07	0.98, 4.35	.054
Hospital admission	For mental illness past year	35.8		28.1		34.7		0.66	0.27, 1.56	.34
	Past year	65.9		61.5		71.7		0.75	0.47, 1.20	.24
	Health insurance	15.6		18.1		15.3		1.34	0.74, 2.41	.32
	SEIFA Index	25.6		30.0		18.5		2.57	1.025, 6.478	.04
of Economic Resources	Quintile 1									

Table 2. Continued

Predictor	Category	Total (<i>n</i> = 1155)		Detected (<i>n</i> = 160)		Undetected (<i>n</i> = 196)		Odds of Detection in Association With Individual Predictors (<i>n</i> = 356)		
								OR	CI	<i>P</i>
		%	Mean	%	Mean	%	Mean			
	Quintile 2	19.5		16.9		22.6		1.11	0.432, 2.856	.82
	Quintile 3	28.2		31.3		34.4		1.27	0.527, 3.084	.59
	Quintile 4	17.8		14.4		16.4		1.30	0.488, 3.470	.59
	Ref. group: Quintile 5	8.9		7.5		8.2				
		Mean	Mean	Mean	Mean			OR	CI	<i>P</i>
	Age in years	38.38	44.62	39.29				1.04	1.02, 1.07	<.0001
	BMI	30.83	35.73	31.35				1.08	1.05, 1.12	<.0001
	Waist circumference	107.05	119.66	108.93				1.03	1.01, 1.04	<.0001
	Fasting plasma glucose	5.42	7.12	6.20				1.35	1.18, 1.56	<.0001
	Fasting triglyceride level	2.01	2.99	2.20				0.35	0.16, 0.75	.008
	Fasting HDL cholesterol level	1.16	1.04	1.11				0.99	0.97, 1.01	.623
	Diastolic BP	82.81	84.23	85.08				0.99	0.98, 1.01	.851
	Systolic BP	123.00	125.88	123.87				1.39	1.15, 1.67	<.0001
	5-year CVD risk	0.64	1.30	0.66				0.99	0.99, 1.00	.059
	SEIFA Index of Economic Resources Score	4.74	4.51	4.89				1.04	0.93, 1.18	.43
	Level of negative symptoms of psychosis	2.66	2.77	2.66				1.02	0.99, 1.05	.06
	Duration of psychiatric illness	14.72	20.03	15.35						

Note: HDL, high density lipoprotein; DSCT, Digit Symbol Coding Test; SEIFA, Socio-Economic Indexes for Areas; BMI, body mass index; NART, National Adult Reading Test. The odds ratio for age in years is adjusted for sex, all other odds ratios are adjusted for age in years and sex; prevalence and means are unadjusted; *The reference group* for Aboriginal or Torres Strait Islander is those who are not considered to be a high risk group based on country of birth and assumed race/ethnicity in the general population; for participant rated health is poor health; for DSCT categories is those who are 1 or more SD above the sample mean (the “higher” category); for BMI categories is normal weight; for SEIFA Index of Economic Resources is the highest quintile—which represents the most advantaged—this index focuses on the financial aspects of relative socioeconomic advantage and disadvantage, by summarizing variables related to income and wealth and excludes education and occupation variables because they are not direct measures of economic resources; test for age effects used age group 2 as a predictor and reports the *P* value for the interaction between age group 2 and the predictor.

did not increase the likelihood that pre-diabetes or diabetes was detected. Similarly, antipsychotic drug treatment, including clozapine treatment—clozapine is the antipsychotic drug with the worst diabetes risk profile^{10,27,28}—was not associated with awareness of pre-diabetes or diabetes.

Undetected type 2 diabetes was associated with younger age in the population only in association with other factors—being of Aboriginal or Torres Strait Islander descent or from a high risk non-English speaking background in those aged 35+ years, or obesity, hypertension or a family history of diabetes in those aged 45+.²⁹ Divergence from the AusDiab sample on BMI, waist circumference, diastolic blood pressure, triglyceride and HDL-cholesterol levels was evident from at least age 25 for people with psychosis in this survey.³⁰ Younger age in those with psychosis is therefore already partly a proxy for multiple emerging cardiometabolic risk factors.

Factors associated with detection in the context of younger age in the population, and other risk factors for type 2 diabetes, were also associated with detection of pre-diabetes and diabetes in people with psychosis. In descending order of association they were severe obesity,^{12,31} treatment with lipid regulating drugs,³² a family history of diabetes,³² Aboriginal or Torres Strait Islander descent,¹³ treatment with an antihypertensive drug³² and at-risk levels of HDL-cholesterol or TG.³² Relatively slower cognitive processing speed and efficiency—a risk factor for psychosis, an index of functional outcome of psychosis and a potential outcome of diabetes—and a regional indicator of relatively worse economic resources, also a risk factor for diabetes and an index of functional outcome of psychosis—were also associated with awareness of pre-diabetes or diabetes.

Reduced cognitive processing speed and efficiency is associated with risk for psychotic illness³³ and associated functional outcome.³⁴ Cognitive decline, including a decline in processing speed and efficiency, is also associated with type 2 diabetes²³ and worsens with duration of diabetic illness. This makes the cross-sectional association between poorer cognitive processing speed and prior detection and awareness of diabetes in people with psychosis difficult to interpret. It may index an increased awareness of diabetes in those with a longer duration of diabetic illness, which may be correlated with duration of psychotic illness. It may index severity of psychosis and associated functioning which may be correlated with duration and severity of diabetes. A longitudinal survey of glucose metabolism and cognitive processing speed, as well as other cognitive domains associated with diabetes,²³ is required to clarify if a negative cross-sectional association between cognition and awareness of pre-diabetes or diabetes is an index of severity of psychosis and/or progression of diabetes in the context of psychosis. There is substantial interest in cognitive capacity and cognitive decline in people with psychotic illnesses³⁵ and there is an elevated risk of both vascular dementia and Alzheimer's

disease in type 2 diabetes.³⁶ It will therefore be important to determine how much pre-diabetes or diabetes may be contributing to change in cognitive profile in people with psychosis over time, and what impact early detection and intervention to delay progression of pre-diabetes or diabetes may have on cognitive outcomes of psychosis.

Economic disadvantage is associated with risk for type 2 diabetes,³⁷ the course of psychosis³⁸ and with detection of diabetes.³¹ Contextual factors should therefore be considered when designing programs to improve detection and awareness of pre-diabetes and diabetes in people with psychosis. In this case undetected diabetes may be a problem of relatively more economically advantaged social groups.

Lifestyle modifications can slow the development of diabetes in people with pre-diabetes¹⁻³ but awareness of pre-diabetes or diabetes in people with psychosis was not associated with healthier dietary practices, higher physical activity levels, a lower prevalence of smoking or more quit attempts, consistent with findings for the population.³⁹ An intervention strategy that builds on early detection and awareness is therefore required to alter the course of pre-diabetes and diabetes in people with psychosis. Psychosis was an exclusion criterion for the ADDITIONS study⁴⁰ and there is consequently no data regarding the efficacy of early intensive intervention, relative to any comparator, for those with psychosis and screen detected type 2 diabetes. Given the greatly elevated risk for type 2 diabetes in young adulthood in those with psychosis,^{7,30} and the low level of detection, young adults with psychosis and screen detected pre-diabetes or type 2 diabetes are arguably one of the groups most in need of such trials.

Potential limitations of the current study are using only fasting plasma glucose and current anti-diabetic medication to define diabetes and only fasting plasma glucose to define pre-diabetes. Fasting plasma glucose is considered less reliable than an oral glucose tolerance test or glycated haemoglobin (HbA1c) but fasting plasma glucose is easier to obtain than an oral glucose tolerance test on a large sample of people with psychosis. Fasting plasma glucose is cheaper than HbA1c and permits assessment of fasting plasma lipids, as well as glucose. To our knowledge there are no other large national samples of people with psychosis with information about detected pre-diabetes or diabetes and fasting plasma glucose, let alone fasting plasma glucose, oral glucose tolerance and HbA1c. Identification of detected pre-diabetes or diabetes may rely on access to registries, inspection of primary care record, other healthcare records or participant report. Participant report, the method we used, is distinguished by requiring understanding and recall of prior detection to be reported in a research study. People with psychosis often have cognitive deficits that could impact their recall or awareness of health-related information but there was no positive association between current cognitive

performance and increased awareness of pre-diabetes or diabetes. Instead we found fewer participants who reported awareness of pre-diabetes or diabetes among those with the highest cognitive processing speed scores.

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