However, recent evidence suggests that early-onset diabetes is more aggressive, associated with more rapid decline in beta-cell function, greater likelihood of insulin therapy and greater risk of comorbidities and death [10–13]. Epidemiological data regarding the in-

Table 1 Social correlates of reporting diabetes (n = 11,075)

Potential correlate	Proportion Reporting Diabetes (%)	Association with Reporting Diabetes[a] Odds Ratio (95 % Confidence Interval; p value)	
		Unadjusted	Adjusted[b]
Known risk factors			
Age			
18 – 24 years, n = 1,951	1.44	1.0 (Not Applicable)	1.0 (Not Applicable)
25 – 34 years, n = 3,035	1.55	1.08 (0.67 – 1.73; 0.748)	1.0 (0.62 – 1.60; 0.991)
35 – 44 years, n = 4,053	3.45	2.46 (1.63 – 3.70; <0.001)	2.16 (1.42 – 3.27; <0.001)
45 – 49 years, n = 2,036	5.84	4.3 (2.81 – 6.47; <0.001)	3.61 (2.36 – 5.51; <0.001)
County of birth			
At risk region[c], n = 1,245	3.94	1.37 (1.0 – 1.87; 0.045)	1.75 (1.28 – 2.41; 0.001)
Other country, n = 9,823	2.90	1.0 (Not Applicable)	1.0 (Not Applicable)
Parents' country of birth			
Not from at risk region[c], n = 9,073	2.90	1.0 (Not Applicable)	1.0 (Not Applicable)
One from at risk region[c], n = 340	3.24	1.12 (0.61 – 2.07; 0.717)	1.25 (0.67 – 2.34; 0.474)
Both from at risk region[c], n =1,518	3.62	1.26 (0.94 – 1.69; 0.127)	1.54 (1.14 – 2.08; 0.005)
Other Potential Correlates			
ASGS region of residence			
Major city, n =6,503	2.77	1.0 (Not Applicable)	1.0 (Not Applicable)
Inner regional, n = 2,510	3.82	1.40 (1.09 – 1.80; 0.009)	1.29 (1.0 – 1.67; 0.048)
Outer regional, n =2,053	2.83	1.02 (0.76 – 1.38; 0.891)	0.90 (0.67 – 1.22; 0.503)
Marital status			
Married/de facto rel., n = 7,136	3.11	1.0 (Not Applicable)	1.0 (Not Applicable)
Previously married, n = 555	4.86	1.59 (1.06 – 2.40; 0.026)	1.40 (0.92 – 2.11; 0.114)
Never married, n = 3,308	2.51	0.80 (0.62 – 1.03; 0.090)	1.44 (1.08 – 1.92; 0.013)
Highest education level			
Bachelor degree or higher, n =2,788	2.73	1.0 (Not Applicable)	1.0 (Not Applicable)
Non-degree qualification, n = 4,836	3.02	1.11 (0.84 – 1.47; 0.464)	0.92 (0.69 – 1.23; 0.575)
Secondary school or less, n = 2,766	3.25	1.20 (0.88 – 1.64; 0.249)	1.13 (0.82 – 1.56; 0.449)
Employment status			
Employed, n = 9,292	2.49	1.0 (Not Applicable)	1.0 (Not Applicable)
Unemp. (looking for work), n = 962	5.30	2.20 (1.61 – 3.0; <0.001)	2.75 (1.99 – 3.80; <0.001)
Unemp. (not looking), n =589	6.96	2.93 (2.08 – 4.14; <0.001)	2.94 (2.07 – 4.20; <0.001)
Before-Tax Income			
AU$100 K+, n = 4,422	2.40	1.0 (Not Applicable)	1.0 (Not Applicable)
AU$60 K - < AU$100 K, n = 2,637	3.19	1.34 (1.0 – 1.79; 0.048)	1.39 (1.03 – 1.86; 0.029)
< AU$60 K, n = 2,291	3.97	1.68 (1.27 – 2.24; <0.001)	1.93 (1.44 – 2.59; <0.001)
Above-average number of life events, n = 163	3.18	1.14 (0.92 – 1.43; 0.236)	1.28 (1.02 – 1.60; 0.035)

includes the association of worse socioeconomic status [31], cardiovascular comorbidities [11] and worse physical and mental health with a known diabetes diagnosis [32]. Our study is unusual in terms of exploring the association of diabetes with a more general set of comorbidities and health status measures and exploring socioeconomic correlates in greater depth.

This study has some limitations. Our analyses were based on self-report data, such that some respondents may have been misclassified as living without diabetes or

Table 2 Health-related correlates of reporting diabetes ($n = 11{,}075$)

Potential correlate	Proportion Reporting Diabetes (%)	Association with Reporting Diabetes[a] Odds Ratio (95 % Confidence Interval; *p* value)	
		Unadjusted	Adjusted[b]
Known Risk Factors			
Smoking status			
Never smoked, *n* = 6,320	2.52	1.0 (Not Applicable)	1.0 (Not Applicable)
Ex-smoker, *n* = 2,415	3.81	1.53 (1.18 – 1.99; 0.001)	1.17 (0.90 – 1.53; 0.251)
Current smoker, *n* = 2,175	3.72	1.50 (1.14 – 1.97; 0.004)	1.38 (1.04 – 1.81; 0.024)
Less than daily fruit/veg. consumption, n = 415	3.86	1.30 (0.78 – 2.17; 0.316)	1.31 (0.78 – 2.21; 0.306)
Physical activity level			
Sufficient for health, *n* = 5,663	2.38	1.0 (Not Applicable)	1.0 (Not Applicable)
Insufficient for health, *n* = 2,917	2.91	1.23 (0.93 – 1.62; 0.142)	1.03 (0.78 – 1.36; 0.825)
Sedentary, *n* = 1,381	5.14	2.22 (1.65 – 2.98; <0.001)	1.66 (1.23 – 2.25; 0.001)
BMI			
Healthy range or less, *n* = 3,340	1.53	1.0 (Not Applicable)	1.0 (Not Applicable)
Overweight, *n* = 4,116	2.02	1.33 (0.93 – 1.89; 0.115)	1.12 (0.78 – 1.59; 0.537)
Obese, *n* = 2,235	6.76	4.67 (3.39 – 6.45; <0.001)	3.83 (2.77 – 5.31; <0.001)
Missing, *n* = 1,384	3.54	2.37 (1.59 – 3.52; <0.001)	2.35 (1.58 – 3.50; <0.001)
High blood pressure (ever), *n* = 1,468	10.22	6.30 (5.02 – 7.90; <0.001)	4.38 (3.44 – 5.56; <0.001)
Other Potential Correlates			
Reported good to excellent self-rated health, *n* = 10,153	2.22	0.17 (0.13 – 0.21; <0.001)	0.23 (0.18 – 0.29; <0.001)

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another comorbidity since they may experience the condition without a formal diagnosis. Furthermore, a self-reported diagnosis may not always represent clinically-important disease (for example, a patient experiencing symptoms of depression without meeting clinical thresholds for depression). Additionally, since the study questionnaire did not distinguish type 1 diabetes from type 2 diabetes and given the expected ratio of type 1:type 2 diabetes cases of 1:3, even though our study focused on factors that are associated with type 2 diabetes [3, 5, 30]; it is likely that the strength of the association of such factors with type 2 diabetes has been under-estimated in this study.

A further limitation is that since this study is based on cross-sectional and lifetime frequency data, we cannot be certain which of the associated factors are causes of diabetes, sequelae of diabetes or concurrent experiences. However, based on the findings of our study, assessing how diabetes impacts on socioeconomic status and whether a reported diagnosis of diabetes predisposes younger adult men to other comorbidities beyond commonly-associated conditions such as cardiovascular comorbidities warrants further investigation using longitudinal data.

Conclusions

Australian males aged 18–49 years and living with a diabetes diagnosis are more likely to be socio-economically disadvantaged and suffer worse health status than Australian males aged 18–49 years who are living

Table 3 Differences in proportion reporting diabetes by comorbidity status (n = 11,075)

Potential comorbidity	Potential comorbidity status				Evidence of difference in proportion with diabetes P value from $\chi 2$ test
	Never diagnosed		Lifetime diagnosis		
	Number of respondents	% with early-onset diabetes[a]	Number of respondents	% with early-onset diabetes[a]	
Angina	10,941	2.5	98	17.5	<0.001
Anxiety disorder	9,595	2.3	1,440	4.1	<0.001
Arthritis	10,160	2.4	876	5.2	<0.001
Asthma	8,487	2.5	2,548	3.0	0.215
Cancer	10,806	2.4	231	12.3	<0.001
Cataract	10,960	2.5	86	15.1	<0.001
Chronic bronchitis	10,537	2.4	486	5.1	<0.001
Chronic Obstructive Pulmonary Disease	10,993	2.5	50	18.2	<0.001
Depression	8,977	2.0	2,070	5.2	<0.001
Eczema	9,825	2.5	1,207	3.0	0.320
Heart attack	10,972	2.4	81	28.7	<0.001
Heart failure	10,998	2.5	49	35.5	<0.001
High blood pressure	9,579	1.7	1,468	8.7	<0.001
High cholesterol	9,608	1.7	1,435	7.7	<0.001
Schizophrenia	10,952	2.4	84	16.9	<0.001
Sleep apnoea	10,199	2.2	841	8.2	<0.001
Stroke	10,984	1.9	60	19.0	<0.001

without a diabetes diagnosis. Based on the associations detected in this study, single males living in regional areas who are socioeconomically disadvantaged and/or inactive or obese or who have other comorbidities may be an important subgroup to target for diabetes screening, disease management and prevention efforts.

Abbreviations

ASGS: Australian Statistical Geography Standard; BMI: Body mass index; MCS: SF-12 mental component score; PCS: SF-12 physical component score; PWI SWS: Personal wellbeing index subjective wellbeing score; PWI-A: Personal wellbeing index for adults

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Declaration

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Availability of data and materials

Ten to Men response data are available to researchers via a request and review process. Information on accessing Ten to Men data is available at http://www.tentomen.org.au/index.php/researchers.html.Copies of Wave 1 questionnaires, Wave 1 data books, and the Ten to Men Data User's Manual are also available at that site.

Enquires about potential collaborations including sub-studies involving members of the Ten to Men cohort can be addressed to the Study Coordinator at info@tentomen.org.au.

Authors' contributions

RK, DE and SD were responsible for the analytical design. RK undertook data analysis. RK, DE and SD were involved in interpreting the analysis. RK drafted the manuscript. All authors undertook critical revision of the manuscript and have approved this manuscript version for submission.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

Ethics approval and consent to participate

The Australian Longitudinal Study on Male Health was approved by the University of Melbourne Human Research Ethics Committee (HREC 1237897 & 1237376). Participants provided written consent for their participation.

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