

Impact of a type 2 diabetes diagnosis on mental health, quality of life, and social contacts: a longitudinal study

Xiaoqi Feng,^{1,2,3} Thomas Astell-Burt^{1,2,3}

To cite: Feng X, Astell-Burt T. Impact of a type 2 diabetes diagnosis on mental health, quality of life, and social contacts: a longitudinal study. *BMJ Open Diabetes Research and Care* 2017;**5**: e000198. doi:10.1136/bmjdr-2016-000198

Received 16 January 2016
Revised 3 December 2016
Accepted 17 December 2016



CrossMark

¹Population Wellbeing and Environment Research Lab (PowerLab), School of Health and Society, Faculty of Social Sciences, University of Wollongong, Wollongong, New South Wales, Australia
²Early Start Research Institute, Faculty of Social Sciences, University of Wollongong, Wollongong, New South Wales, Australia
³Illawarra Health and Medical Research Institute, University of Wollongong, Wollongong, New South Wales, Australia

Correspondence to
Dr Xiaoqi Feng;
xfeng@uow.edu.au

ABSTRACT

Aims: The aim was to examine whether a type 2 diabetes mellitus (T2DM) diagnosis increases the odds of psychological distress, a worsening in overall quality of life, and a potential reduction in social contacts.

Method: Longitudinal data were obtained from the 45 and Up Study (baseline 2006–2008; 3.4±0.95 years follow-up time). Fixed effects logistic and negative binomial regression models were fitted on a complete case on outcome sample that did not report T2DM at baseline (N=26 344), adjusted for time-varying confounders. The key exposure was doctor-diagnosed T2DM at follow-up. Outcome variables examined included the Kessler Psychological Distress Scale, self-rated quality of life, and four indicators of social contacts.

Results: A modest increase in the odds of psychological distress associated with T2DM diagnosis (OR=1.30) was not statistically significant (95% CI 0.75 to 2.25). A T2DM diagnosis was associated with a fivefold increase in the odds of a participant reporting that their quality of life had become significantly poorer (OR 5.49, 95% CI 1.26 to 23.88). T2DM diagnosis was also associated with a reduction in times spent with friends and family (RR 0.88, 95% CI 0.82 to 0.95), contacts by telephone (RR 0.95, 95% CI 0.87 to 1.02), attendance at social clubs or religious groups (RR 0.82, 95% CI 0.73 to 0.91), and the number of people nearby but outside the home that participants felt they could rely on (RR 0.92, 95% CI 0.86 to 0.98).

Conclusions: A T2DM diagnosis can have important impacts on quality of life and on social contacts, which may have negative impacts on mental health and T2DM management in the longer term.

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a preventable non-communicable disease requiring a multifactorial approach to management that incorporates lifestyle change and pharmacotherapy.¹ Less than ideal management increases the risk of developing complications and comorbidities such as cardiovascular disease (CVD)² and various unfavorable social and economic penalties.³ Unfortunately, many hurdles remain for the effective management of T2DM.⁴ The

Significance of this study

What is already known about this subject?

There is a correlation between mental health and type 2 diabetes (T2DM) statuses.

What are the new findings?

This study reports negative impacts of a T2DM on quality of life and social contacts. If not addressed, these impacts may contribute to the increased risk of poor mental health associated with T2DM in the longer term.

How might these results change the focus of research or clinical practice?

The absence of an immediate impact on an indicator of psychological distress suggests that other indicators of mental health, quality of life, and potential social isolation ought to be monitored by general practitioners in order to support the optimal management of T2DM. Long-term follow-up research is needed to understand the pathways and opportunities for intervention.

potential toll that a T2DM diagnosis has on mental health is a major concern.⁵ Depression is more prevalent among people living with T2DM compared with those who are not⁶ and increases the risk of premature death.⁷ Studies suggest that the presence of minor psychological morbidity increases non-adherence to T2DM treatment.^{8–9} Elevated stress levels as a result of becoming aware of a T2DM diagnosis may be an underlying cause of worsening mental health, which could also have negative impacts on overall quality of life such as the levels of contact a person may have with friends and family. With rising awareness of T2DM-related stigma,^{10–12} it may be that many people receiving a diagnosis avoid contact with (or are shunned by) others due to a fear that they may be blamed for their T2DM status, as has been observed among people with liver and lung-related health problems.^{13–16}

The impact of a T2DM diagnosis on mental health and quality of life has been previously investigated but the vast majority

of studies employed cross-sectional designs make it very challenging to infer a causal relationship. This is likely to be a major factor behind the mixture of findings reported, with some meta-analyses indicating a low to modest increase in risk of experiencing depression among people living with T2DM,^{17 18} whereas other studies suggest no change in mental health as a result of T2DM diagnosis¹⁹ or instead report depression as a risk factor for T2DM.^{18 20} Longitudinal data affords the opportunity to surmount this challenge, but since diabetes status cannot be randomly assigned, this still leaves the door open for confounding. Personality traits that may be consistent over time, for example, like negative affect, may influence mental health, quality of life, and the levels of social contact a person has with others as well as T2DM risk more generally.²¹ Resolving these issues is crucial to bolster adherence to pharmacotherapy regimens and participation in lifestyle modification programs, and to underline the need for investments in initiatives seeking to support mental health and to ameliorate the risk of social isolation among people with T2DM.²²

The purpose of this study was to use a longitudinal study design to examine for potential impacts of a T2DM diagnosis on mental health, quality of life, and a range of types of social contact.

Data

The 45 and Up Study baseline was collected via self-complete survey (response 18%) between 2006 and 2009.²³ The Medicare Australia database (the national provider of universal healthcare in Australia) had been used to randomly sample participants. Follow-up between 2010 and 2011 of the first 100 000 baseline respondents was conducted as part of the Social Economic and Environmental Factors (SEEF) Study, also via self-complete survey. A total of 28 057 men and 32 347 women completed the SEEF follow-up (overall response rate of 60.4%, 3.4±0.95 years follow-up time). Ethical approval for the 45 and Up Study was granted by the University of New South Wales Human Research Ethics Committee (HREC 05035/HREC 10186) and the SEEF Study by the University of Sydney Human Research Ethics Committee (ref no. 10-2009/12187).

Exposure and outcomes variables

The key exposure variable was a diagnosis of T2DM. T2DM status was identified in the baseline and follow-up surveys by responses to the question '*Has a doctor EVER told you that you have diabetes?*'. Participants could report yes or no. Although the question did not specify T2DM, evidence suggests that the majority of new diagnoses among people aged 45 years or older are type 2.²⁴

Six outcome variables were examined. The first was the Kessler Psychological Distress Scale ('K10'),²⁵ which measures symptoms of psychological distress experienced across 4 weeks prior to a participant's completion of the questionnaire. All 10 questions were measured at baseline and follow-up and included whether a

participant had felt tired for no reason, nervous, hopeless, restless, depressed, sad, or worthless. Ranging from scores of 10 to 50, scores of 22 or higher on the K10 denote poorer mental health. In line with previous work, a binary variable was constructed with scores of 22 and over identifying participants at high risk of psychological distress.²⁵⁻²⁷

The second outcome variable was self-reported quality of life. This was measured in the 45 and Up Study with the question '*in general, how would you rate your quality of life?*'. Participants could respond by ticking either 'excellent', 'very good', 'good', 'fair', or 'poor'. A dichotomous variable was constructed with 'poor' contrasted with 'non-poor' responses.

The remaining four outcome variables each measured different types of social contact and were taken from the shortened version of the Duke Social Support Index.²⁸ At baseline and follow-up, participants were asked to report the number of times in the past week they had: (1) spent time with friends or family they did not live with; (2) talked to someone (friends, relatives, or others) on the telephone; and (3) attended meetings at social clubs or religious groups. A fourth question required participants to report how many people outside their home, but within 1-hour travel time, they felt close to or could rely on.

Sample and statistical analysis

Sampling was based on two criteria: (1) participants having complete data on all outcome variables at baseline and at follow-up; (2) no doctor diagnosed T2DM reported at baseline. The resulting sample comprised 26 344 individuals. The restriction of the sample to only those who did not have a doctor-diagnosed T2DM status at baseline was implemented in order to focus the analysis strictly on the impact of a recent T2DM diagnosis on the aforementioned outcomes. Accordingly, two types of statistical models were fitted following a description of the sample with cross-tabulations. For the indicators of psychological distress and poor quality of life, logistic regressions were fitted and parameters expressed as ORs and 95% CIs. For the indicators of social contacts, which were integer counts and exhibited overdispersion (where the variance is greater than the mean), negative binomial regressions with parameters expressed as rate ratios (RR) and 95% CIs were fitted. The T2DM diagnosis variable was added to each model, adjusting for participant age. To address potential confounding, two strategies were employed simultaneously. First, each model was fitted with a fixed effects specification.²⁹ Fixed effects means fitting a unique intercept on every participant, eliminating all time-invariant sources of confounding, measured and unmeasured (eg, negative affect), rendering only longitudinal effects observable.³⁰ Consequently, by focusing parameter estimation on within-person change through time, this restricts the parameter estimate to those participants who experienced a change in T2DM and a change in the outcome

variable. This specification does not, however, account for potential sources of confounding that are subject to change over time, such as socioeconomic circumstances. As such, time-varying confounders (in addition to age) were adjusted in each model, including annual household income, economic status (eg, employed, retired, unemployed), and couple status (in a couple vs not). All analyses were conducted in Stata V.12 (StataCorp, College Station, Texas, USA).

RESULTS

From a sample of 26 344 participants, there were 586 new diagnoses of T2DM by the follow-up survey (table 1). The prevalence of psychological distress and poor quality of life increased between baseline and follow-up, while the mean count of social contacts decreased across all four indicators. Annual household income shifted upwards for much of the sample over time. Retirement became more common in general, whereas economic inactivity reduced notably.

In fixed effects models adjusted for age (table 2), a modest increase in the odds of experiencing psychological distress was associated with T2DM diagnosis

(OR=1.31), but the 95% CIs spanned unity (0.76 to 2.25). In contrast, a T2DM diagnosis was associated with a fivefold increase in the odds of a participant reporting that their quality of life had become significantly poorer (OR 5.54, 95% CI 1.28 to 24.10). T2DM diagnosis was also associated with a reduction in social contacts across all four types. Further adjustment for time-varying confounders had a negligible impact on the results.

DISCUSSION

The key findings from this study contribute to understandings of T2DM in the following ways: first, the longitudinal fixed effects design afforded insights in to the extent that a recent T2DM diagnosis is implicated in worsening mental health, poorer quality of life, and reduced social contacts while eliminating sources of confounding that typically manifest in prior (mostly cross-sectional) research; second, the evidence for a T2DM diagnosis leading to an experience of psychological distress was found to be not particularly strong; however, third, the decline in quality of life and across all four social contact outcomes as a consequence of T2DM diagnosis was compelling. Taken collectively, this

Table 1 Descriptive statistics at baseline and follow-up

		Baseline (N=26 344)	Follow-up (N=26 344)
Doctor diagnosed diabetes	N (%)	0 (0.0)	586 (2.2)
Psychological distress (K10 \geq 22)	N (%)	1246 (4.7)	1423 (5.4)
Self-rated quality of life (rated as poor)	N (%)	172 (0.7)	400 (1.5)
Number of times in the past week a participant			
(i) spent time with friends or family they did not live with	Mean (SD)	5 (5.6)	4 (4.0)
(ii) talked to someone (friends, relatives, or others) on the telephone	Mean (SD)	7 (10.1)	6 (6.1)
(iii) attended meetings at social clubs or religious groups	Mean (SD)	2 (2.1)	1 (1.7)
How many people outside of home, but within 1 hour travel-time, does a participant feel close to or could they rely on?	Mean (SD)	8 (8.3)	7 (8.7)
Age	Mean (SD)	61 (10.0)	64 (10.1)
Annual household income			
\$0–\$19k	N (%)	3654 (13.9)	2587 (9.8)
\$20k–\$29k	N (%)	2562 (9.7)	2885 (11.0)
\$30k–\$39k	N (%)	2305 (8.8)	2317 (8.8)
\$40k–\$49k	N (%)	2132 (8.1)	1995 (7.6)
\$50k–\$59k	N (%)	3294 (12.5)	1829 (6.9)
\$60k–\$69k	N (%)	8237 (31.3)	1426 (5.4)
\$70k+	N (%)	3694 (14.0)	9980 (37.9)
Not disclosed	N (%)	466 (1.8)	3325 (12.6)
Economic status			
Employed	N (%)	12 393 (47.0)	11 598 (44.0)
Unemployed	N (%)	285 (1.1)	294 (1.1)
Fully retired	N (%)	8276 (31.4)	9992 (37.9)
Partially retired	N (%)	1406 (5.3)	1316 (5.0)
Disabled	N (%)	595 (2.3)	572 (2.2)
Economically inactive	N (%)	2507 (9.5)	1614 (6.1)
Not disclosed	N (%)	882 (3.4)	958 (3.6)
Couple status			
Married / cohabit	N (%)	20 787 (78.9)	20 562 (78.1)
Single / widowed / divorced	N (%)	5490 (20.8)	5665 (21.5)
Not disclosed	N (%)	57 (0.2)	117 (0.4)

Table 2 The odds of experiencing psychological distress and poor self-rated quality of life in association with type 2 diabetes mellitus diagnosis: adjusted ORs and 95% CIs from fixed effects logistic regression models

	Model 1	Model 2
	OR (95% CI)	
Psychological distress (K10 \geq 22)	1.31 (0.76 to 2.25)	1.30 (0.75 to 2.25)
Self-rated quality of life (rated as poor)	5.54 (1.28 to 24.10)	5.49 (1.26 to 23.88)
	Rate ratio (95% CI)	
Number of times in the past week a participant		
(i) spent time with friends or family they did not live with	0.88 (0.82 to 0.95)	0.89 (0.83 to 0.96)
(ii) talked to someone (friends, relatives, or others) on the telephone	0.93 (0.86 to 0.99)	0.95 (0.87 to 1.02)
(iii) attended meetings at social clubs or religious groups	0.82 (0.74 to 0.91)	0.82 (0.73 to 0.91)
How many people outside of home, but within 1 hour travel-time, does a participant feel close to or could they rely on	0.91 (0.85 to 0.97)	0.92 (0.86 to 0.98)

Model 1: adjusted for age only.

Model 2: adjusted for age, household income, economic status, and marital status.

suggests that a T2DM diagnosis does have significant impacts across a range of circumstances that a person may hold important to themselves that are not typically captured by well-known and validated measures of mental health such as the K10. Circumstances such as whether a person feels they can draw on the support of a social network, which prior research has already shown, do play an important role in mental health trajectories as well as all other aspects of life.³¹ These are circumstances that also likely play a role in shaping whether people are able to adhere to lifestyle modification programs, pharmacotherapy regimens, and the regular visits to general practitioners that are staple of T2DM management. Therefore, declining quality of life and increasing social isolation among people who are recently diagnosed with T2DM are scenarios that ought to be monitored closely by general practitioners and the local health sector if devastating and hugely expensive, but preventable comorbidities and complications are to be successfully avoided.

Aside from the study design, the range of outcome variables is a clear strength of the study. The separate indicator of quality of life afforded an insight that would not have been made had the K10 been relied on solely. However, it is important to recognize that there are a range of ways to measure mental health and while the K10 is a validated and widely used tool, others such as the Warwick-Edinburgh Mental Well-being Scale³² and the WHO's 5-Item Well-Being Index,³³ which focus more on positive circumstances could also have provided different insights, were those included in the surveys. Likewise, the four indicators of social contacts provided inroads into understanding the degree to which a T2DM diagnosis may increase a person's risk of becoming socially isolated. However, other indicators such as those relating to trust in other people, feelings of exclusion related to T2DM stigma, and new contacts resulting from participation in networks specifically related to T2DM (eg, a support program coordinated by a general practitioner) would also have been of interest to examine had data been available. Furthermore, it would be important

(if sample sizes and relevant data allow) for future research to consider how impacts of a T2DM diagnosis on mental health, quality of life, and social contacts may vary between different ethnic and racial groups. It is known that there are important variations in each of these factors, as well as access to health-related information and healthcare between ethnic and racial groups in many countries around the world.^{34–37} Those analyses would provide data that could be used to help devise culturally sensitive strategies that aim to eliminate inequity in the impacts of T2DM within society.

This study is limited by the length of follow-up and that there were only two data points available for each participant. An enhanced analytical strategy in future, pending data availability, would be to examine the impact of a T2DM diagnosis on each outcome in the short-term, as was the case in this study, and in the long-term over many successive waves of data collection. This is important as there are contrasting theories on the long-term consequences that a life changing event like a T2DM diagnosis could set in motion. In the best case scenario, it may be that after the initial shock that many people will experience on being diagnosed with T2DM and subsequent life changes and management strategies that they often must (or ought to) implement, these changes may become less burdensome over time as people gradually adapt to new routines.^{38–39} This is described as a best case scenario since for this to occur it is likely that people will need support structures around them—socially and financially—but as this study has reported, social contacts tended to reduce across the board following a T2DM diagnosis. Evidence already shows that T2DM is a disease over-represented among the socioeconomically disadvantaged,⁴⁰ which puts the adaptation hypothesis into some doubt. Drawing on the theory of accumulation within lifecourse epidemiology,⁴¹ in contrast, it is possible that if the reduced social contacts and quality of life observed in this study are sustained, then that may lead to an increased odds of experiencing psychological distress (as well as other unfavorable outcomes) further down the line.⁴²

Long-term follow-up is henceforth desirable for informing decision-makers on what initiatives can help support people to manage their T2DM effectively without negative impacts on their quality of life.

Acknowledgements This research was completed using data collected through the 45 and Up Study (<http://www.saxinstitute.org.au>). The 45 and Up Study is managed by the Sax Institute in collaboration with major partner Cancer Council NSW; and partners: the National Heart Foundation of Australia (NSW Division); NSW Ministry of Health; NSW Government Family & Community Services—Ageing, Carers, and the Disability Council NSW; and the Australian Red Cross Blood Service. We thank the many thousands of people participating in the 45 and Up Study.

Contributors XF conceptualized the research question, led the study design and analysis, interpreted the results, and drafted the manuscript. TA-B supported the conceptualization of the research question and study design, reviewed the analysis, and contributed to the interpretation of the results and redrafting of the manuscript.

Funding This work was supported by a project grant from the National Health and Medical Research Council (grant number #1101065) and a Vanguard grant from the National Heart Foundation of Australia (grant number #101460). Dr Feng's contribution was also supported by a National Heart Foundation of Australia Postdoctoral Fellowship: grant number #100948.

Competing interests None declared.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement Data analyzed in this manuscript was accessed under a licensing agreement with the Sax Institute, to which enquiries regarding data sharing should be made.

Open Access This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

REFERENCES

- Colagiuri S. Optimal management of type 2 diabetes: the evidence. *Diabetes Obes Metab* 2012;14:3–8.
- Shaw J, Tanamas S. *Diabetes: the silent pandemic and its impact on Australia*. Canberra: diabetes Australia, 2012.
- Narayan KV, Echouffo-Tcheugui JB, Mohan V, et al. Global prevention and control of type 2 diabetes will require paradigm shifts in policies within and among countries. *Health Aff (Millwood)* 2012;31:84–92.
- Colagiuri S. Diabetes prevention and care: we know what to do, so why aren't we doing it? *Med J Aust* 2014;201:501–2.
- Ducat L, Philipson LH, Anderson BJ. The mental health comorbidities of diabetes. *JAMA* 2014;312:691–2.
- Ali S, Stone M, Peters J, et al. The prevalence of co-morbid depression in adults with type 2 diabetes: a systematic review and meta-analysis. *Diabet Med* 2006;23:1165–73.
- Katon WJ, Rutter C, Simon G, et al. The association of comorbid depression with mortality in patients with type 2 diabetes. *Diabetes Care* 2005;28:2668–72.
- Gonzalez JS, Safren SA, Cagliero E, et al. Depression, self-care, and medication adherence in type 2 diabetes relationships across the full range of symptom severity. *Diabetes Care* 2007;30:2222–7.
- Semenkovich K, Brown ME, Svrakic DM, et al. Depression in type 2 diabetes mellitus: prevalence, impact, and treatment. *Drugs* 2015;75:577–87.
- Browne JL, Ventura A, Mosely K, et al. 'I call it the blame and shame disease': a qualitative study about perceptions of social stigma surrounding type 2 diabetes. *BMJ Open* 2013;3:e003384.
- Schabert J, Browne JL, Mosely K, et al. Social stigma in diabetes. *Patient* 2013;6:1–10.
- Browne J, Scibilia R, Speight J. The needs, concerns, and characteristics of younger Australian adults with type 2 diabetes. *Diabet Med* 2013;30:620–6.
- Zacks S, Beavers K, Theodore D, et al. Social stigmatization and hepatitis C virus infection. *J Clin Gastroenterol* 2006;40:220–4.
- Room R. Stigma, social inequality and alcohol and drug use. *Drug Alcohol Rev* 2005;24:143–55.
- Johnson JL, Campbell AC, Bowers M, et al. Understanding the social consequences of chronic obstructive pulmonary disease: the effects of stigma and gender. *Proc Am Thorac Soc* 2007;4:680–2.
- Chapple A, Ziebland S, McPherson A. Stigma, shame, and blame experienced by patients with lung cancer: qualitative study. *BMJ* 2004;328:1470.
- Nouwen A, Winkley K, Twisk J, et al. Type 2 diabetes mellitus as a risk factor for the onset of depression: a systematic review and meta-analysis. *Diabetologia* 2010;53:2480–6.
- Mezuk B, Eaton WW, Albrecht S, et al. Depression and type 2 diabetes over the lifespan: a meta-analysis. *Diabetes Care* 2008;31:2383–90.
- Marrero D, Pan Q, Barrett-Connor E, et al. Impact of diagnosis of diabetes on health-related quality of life among high risk individuals: the Diabetes Prevention Program outcomes study. *Qual Life Res* 2014;23:75–88.
- Knol M, Twisk J, Beekman A, et al. Depression as a risk factor for the onset of type 2 diabetes mellitus. A meta-analysis. *Diabetologia* 2006;49:837–45.
- Skaff MM, Mullan JT, Almeida DM, et al. Daily negative mood affects fasting glucose in type 2 diabetes. *Health Psychol* 2009;28:265.
- Speight J. Behavioural innovation is key to improving the health of one million Australians living with type 2 diabetes. *Med J Aust* 2016;205:149.
- Banks E, Redman S, Jorm L, et al. 45 and Up Study Collaborators. Cohort profile: the 45 and up study. *Int J Epidemiol* 2008;37:941–7.
- Chen L, Magliano DJ, Zimmet PZ. The worldwide epidemiology of type 2 diabetes mellitus—present and future perspectives. *Nat Rev Endocrinol* 2012;8:228–36.
- Kessler RC, Andrews G, Colpe LJ, et al. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol Med* 2002;32:959–76.
- Furukawa TA, Kessler RC, Slade T, et al. The performance of the K6 and K10 screening scales for psychological distress in the Australian National Survey of Mental Health and Well-Being. *Psychol Med* 2003;33:357–62.
- Australian Bureau of Statistics. *Information paper: use of the Kessler Psychological Distress Scale in ABS Health Surveys, Australia*. Canberra: Australian Bureau of Statistics, 2003.
- Koenig HG, Westlund RE, George LK, et al. Abbreviating the Duke Social Support Index for use in chronically ill elderly individuals. *Psychosomatics* 1993;34:61–9.
- Allison PD. *Fixed effects regression analysis for longitudinal data using SAS*. Cary, NC: SAS Institute, 2005.
- Gunasekara FI, Richardson K, Carter K, et al. Fixed effects analysis of repeated measures data. *Int J Epidemiol* 2014;43:264–9.
- Kawachi I, Subramanian SV, Kim D. *Social capital and health*. New York: Springer, 2008.
- Stewart-Brown SL, Platt S, Tennant A, et al. The Warwick-Edinburgh Mental Well-being Scale (WEMWBS): a valid and reliable tool for measuring mental well-being in diverse populations and projects. *J Epidemiol Community Health* 2011;65(Suppl 2):A38–9.
- Heun R, Bonsignore M, Barkow K, et al. Validity of the five-item WHO Well-Being Index (WHO-5) in an elderly population. *Eur Arch Psychiatry Clin Neurosci* 2001;251:27–31.
- Feng X, Astell-Burt T, Kolt GS. Ethnic density, social interactions and psychological distress: evidence from 226,487 Australian adults. *BMJ Open* 2013;3:e002713.
- Harris MI, Eastman RC, Cowie CC, et al. Racial and ethnic differences in glycemic control of adults with type 2 diabetes. *Diabetes Care* 1999;22:403–8.
- Jimenez DE, Cook B, Bartels SJ, et al. Disparities in mental health service use of racial and ethnic minority elderly adults. *J Am Geriatr Soc* 2013;61:18–25.
- Jutagir DR, Gudenkauf LM, Stagl JM, et al. Ethnic differences in types of social support from multiple sources after breast cancer surgery. *Ethn Health* 2016;21:411–25.
- Diener E, Lucas RE, Scollon CN. Beyond the hedonic treadmill: revising the adaptation theory of well-being. *Am Psychol* 2006;61:305.
- Rosenbaum M. The role of learned resourcefulness in the self-control of health behavior. In: Rosenbaum M, ed. *Learned resourcefulness: on coping skills, self-control and adaptive behavior*. New York: Springer, 1990:3–30.
- Zimmet PZ, Magliano DJ, Herman WH, et al. Diabetes: a 21st century challenge. *Lancet Diabetes Endocrinol* 2014;2:56–64.
- Kuh D, Ben-Schlomo Y. *A life course approach to chronic disease epidemiology*. New York: Oxford University Press, 2004.
- Everson SA, Maty SC, Lynch JW, et al. Epidemiologic evidence for the relation between socioeconomic status and depression, obesity, and diabetes. *J Psychosom Res* 2002;53:891–5.

Impact of a type 2 diabetes diagnosis on mental health, quality of life, and social contacts: a longitudinal study

Xiaoqi Feng and Thomas Astell-Burt

BMJ Open Diab Res Care 2017 5:
doi: 10.1136/bmjdr-2016-000198

Updated information and services can be found at:
<http://drc.bmj.com/content/5/1/e000198>

These include:

References

This article cites 36 articles, 9 of which you can access for free at:
<http://drc.bmj.com/content/5/1/e000198#BIBL>

Open Access

This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Topic Collections

Articles on similar topics can be found in the following collections

[Epidemiology/health services research](#) (84)

Notes

To request permissions go to:
<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:
<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:
<http://group.bmj.com/subscribe/>