Hospital admissions for cardiovascular complications of people with or without diabetes, Victoria, 2004–2016

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Intensive metabolic control reduces the incidence and progression of diabetes-related micro- and macrovascular complications.[1,2] Nevertheless, the risk of developing cardiovascular disease is higher for people with diabetes,[3] although cardiovascular disease incidence rates are generally declining more rapidly for people with diabetes than for other people.[4,5]

We analysed hospital discharge data from the Victorian Admitted Episode Dataset[6] for 1 January 1999 – 31 December 2016. We identified incident cases of three cardiovascular disease complications (acute myocardial infarction [AMI], stroke, and heart failure) by International Statistical Classification of Diseases, tenth revision, Australian modification (ICD-10-AM) codes. Data for 1999−2003 were examined to ensure that admissions during the observation period (2004−2016) were index admissions for the specific complication, but were not included in our main analysis. Admission rates were separately calculated for people with type 1 or type 2 diabetes (numbers of people with diagnosed diabetes, by year, were obtained from the National Diabetes Services Scheme, which captures 80–90% of diabetes diagnoses[7]) and for people without diabetes (derived from Australian Bureau of Statistics census data[8]).

We analysed changes in admission rates by Joinpoint regression (https://surveillance.cancer.gov/joinpoint); points at which changes in the direction or magnitude of linear trends were statistically significant ($P < 0.05$) were determined with permutation tests. Each trend segment was described by an annual percentage change (APC), and the change for the entire study period as the mean APC (further details: online Supporting Information). The study was approved by the St Vincent's Hospital Melbourne Human Research Ethics Committee (HREC/18/SVHM/146).

A total of 382 107 patients were admitted to Victorian hospitals during 2004–2016 with cardiovascular complications: 278 991 without diabetes (73%), 3645 with type 1 diabetes (1%), and 99 471 with type 2 diabetes (26%). AMI admission rates declined during this period for people with type 1 (mean APC, –7.7%; 95% confidence interval [CI], –13.4% to –1.5%) or type 2 diabetes (mean APC, –11.4%; 95% CI, –13.0% to –9.9%), as well as for people without diabetes (mean APC, –5.0%; 95% CI, –6.7% to –3.4%) (Box 1, Box 2).

Stroke admission rates declined significantly during 2004–2016 for people with type 1 diabetes (mean APC, –7.2%; 95% CI, –12.2% to –1.9%); for people with type 2 diabetes, rates declined during 2005–2011 and 2014–2016, but not during 2011–2014 (overall change: –11.9%; 95% CI, –17.0% to –6.5%). For patients without diabetes, the decline during 2005–2014 was significant (mean APC, –4.1%; 95% CI, –5.8% to –2.3%), but not during 2015–2016 (Box 1, Box 2).

Admissions for heart failure declined during 2004–2016 for people with type 1 diabetes (mean APC, –10.3%; 95% CI, –14.1%

1 Age- and sex-adjusted admission rates for cardiovascular complications (with 95% confidence intervals), Victoria, 2004–2016, by diabetes status of patients

A. No diabetes

B. Type 1 diabetes

C. Type 2 diabetes

Legend: Acute myocardial infarction; Heart failure; Stroke
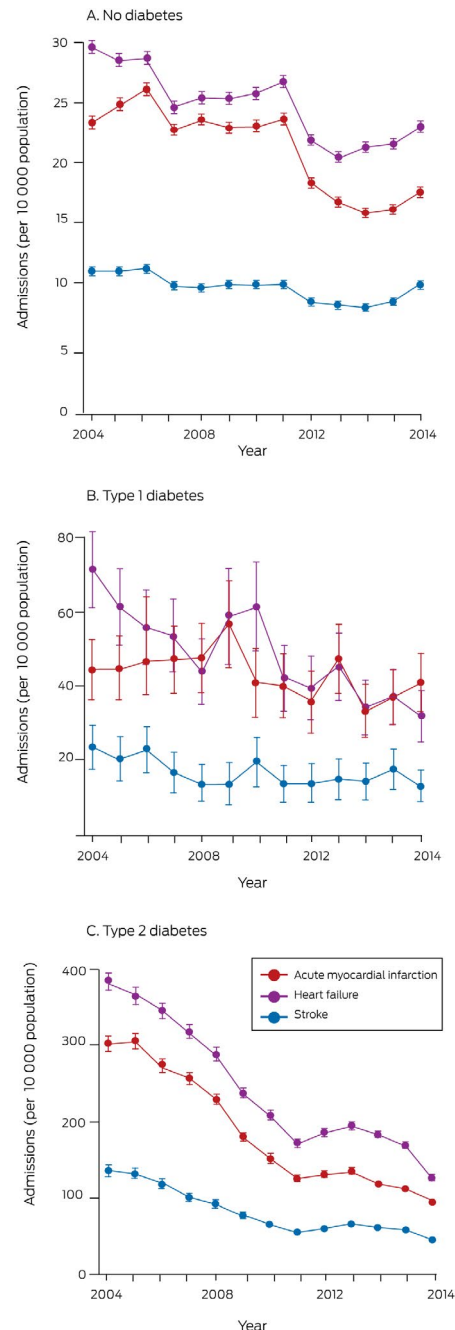
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2 Annual percentage change (APC) in admissions for cardiovascular complications, Victoria, 2004–2016, by diabetes status

Cardiovascular complication and diabetes status	Admissions	Change in event rate, 2004–2016*		Change in event rate, by period*
		Overall change (95% CI)	Mean APC (95% CI)	Mean APC (95% CI)
Acute myocardial infarction				
No diabetes	114 965	–24.8% (–24.9% to –24.7%)	–5.0% (–6.7% to –3.4%)	—
Type 1 diabetes	1272	–7.7% (–8.8% to –6.7%)	–7.7% (–13.4% to –1.5%)	1. 2005–2009: +7.0% (–9.7% to +22.8%) 2. 2009–2016: –15.1% (–21.3% to –8.7%)
Type 2 diabetes	15 278	–69.0% (–69.0% to –68.8%)	–11.4% (–13.0% to –9.9%)	—
Stroke				
No diabetes	52 320	–10.9% (–13.6% to –10.6%)	–1.7% (–4.9% to +1.5%)	1. 2005–2014: –4.1% (–5.8% to –2.3%) 2. 2014–2016: +9.6% (–10.2% to +33.8%)
Type 1 diabetes	504	–44.4% (–50.0% to –41.4%)	–7.2% (–12.2% to –1.9%)	—
Type 2 diabetes	17 440	–68.0% (–68.0% to –67.9%)	–11.9% (–17.0% to –6.5%)	1. 2005–2011: –14.7% (–17.6% to –11.7%) 2. 2011–2014: +5.8% (–19.0% to +38.2%) 3. 2014–2016: –26.1% (–39.8% to –9.2%)
Heart failure				
No diabetes	135 524	–22.2% (–22.3% to –22.2%)	–2.8% (–4.1% to –1.5%)	—
Type 1 diabetes	1393	–55.1% (–58.6% to –52.4%)	–10.3% (–14.1% to –6.4%)	—
Type 2 diabetes	52 831	–67.3% (–67.4% to –67.3%)	–9.2% (–11.0% to –7.3%)	—

CI = confidence interval.
* Adjusted for age and sex. Event rates for 2004 and 2016 are included in the expanded version of this table in the online Supporting Information. ◆

to –6.4%) or type 2 diabetes (mean APC, –9.2%; 95% CI, –11.0% to –7.3%), and also for people without diabetes (mean APC, –2.8%; 95% CI, –4.1% to –1.5%) (Box 1, Box 2).

As hospital discharge coding data do not provide information on metabolic control or medication use, we could not assess whether cardiovascular risk factor modification and use of specific medications were associated with changes in admission rates. We also lacked information on disease duration for patients with hospital-coded diabetes. Further, we have counted admissions of any patients who had presented with complications before 1998 (ie, outside our 5-year clearance period) as incident admissions; these patients would be at very high risk of further admissions, and their inclusion may have inflated the admission rates we report for the observation period of our study.

Few recent studies have assessed outcomes for all three cardiovascular complications in a single investigation. Cardiovascular complication-related admissions to Victorian hospitals declined during 2004–2016 more rapidly for people with diabetes than for those without diabetes. The relatively greater absolute decline in the numbers of admissions of people with diabetes may be related to the fact that they are considered to be at high risk for cardiovascular disease and are therefore treated more aggressively; the scope for reducing risk with multifactorial target-driven interventions is greater in these patients. Nevertheless, admission rates for cardiovascular complications of people with diabetes remain relatively high.

[Corrections added on 18 June 2021 after first online publication: In Box 2, the values under the "Overall change (95% CI)" column were amended.]

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