One-year survival and admission to hospital for cardiovascular events among older residents of long-term care facilities who were prescribed intensive- and moderate-dose statins

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Cite as: *CMAJ* 2019 January 14;191:E32-9. doi: 10.1503/cmaj.180853

See related article at www.cmaj.ca/lookup/doi/10.1503/cmaj.181671

ABSTRACT

BACKGROUND: Guidance from randomized clinical trials about the ongoing benefits of statin therapies in residents of long-term care facilities is lacking. We sought to examine the effect of statin dose on 1-year survival and admission to hospital for cardiovascular events in this setting.

METHODS: We conducted a retrospective cohort study using population-based administrative data from Ontario, Canada. We identified 21 808 residents in long-term care facilities who were 76 years of age and older and were prevalent statin users on the date of a full clinical assessment between April 2013 and March 2014, and categorized residents as intensive- or moderate-dose users. Treatment groups were matched on age, sex, admission to hospital for atherosclerotic cardiovascular disease, resident frailty and propensity score. Differences in 1-year survival and admission to hospital for cardiovascular events were measured using Cox proportional and subdistribution hazard models, respectively.

RESULTS: Using propensity-score matching, we included 4577 well-balanced pairs of residents who were taking intensive- and moderate-dose statins. After 1 year, there were 1210 (26.4%) deaths and 524 (11.5%) admissions to hospital for cardiovascular events among residents using moderate-dose statins compared with 1173 (25.6%) deaths and 522 (11.4%) admissions to hospital for cardiovascular events among those taking intensive-dose statins. We found no significant association between prevalent use of intensive-dose statins and 1-year survival (hazard ratio [HR] 0.97, 95% confidence interval [CI] 0.90 to 1.05) or 1-year admission to hospital for cardiovascular events (HR 0.99, 95% CI 0.88 to 1.12) compared with use of moderate-dose statins.

INTERPRETATION: The rates of mortality and admission to hospital for cardiovascular events at 1 year were similar between residents in long-term care taking intensive-dose statins compared with those taking moderate-dose statins. This lack of benefit should be considered when prescribing statins to vulnerable residents of long-term care facilities who are at potentially increased risk of statin-related adverse events.

Statins (hydroxymethylglutaryl-CoA reductase inhibitors) are used widely in persons of advanced age and in those living in long-term care facilities.[1,2] In Ontario, Canada, over one-third of all residents of long-term care facilities are prevalent statin users, including 28% of frail residents who have a limited likelihood of 1-year survival; nearly one-quarter of prevalent users received high doses.[2] Historically, however, randomized clinical trials studying the efficacy and safety of statins rarely include adults aged 75 years and older,[3] and most have not included residents of long-term care facilities.[4] This leaves clinicians with little guidance when making ongoing decisions about treatment with statins, such as the appropriate dosing of statin medications, for patients in long-term care facilities and other populations of older adults. An observed threefold difference in the median proportion of residents in long-term care facilities receiving statins between high- and low-rate prescribers highlights the uncertainty faced by clinicians when making treatment decisions.[2]

Recent findings from a large observational cohort study suggested that prevalent use of high-intensity statins is associated with a greater reduction in 1-year mortality than moderate-intensity statins, even among patients aged 76 years or older with atherosclerotic cardiovascular disease.[5] However, residents of long-term care facilities are more likely to be frail and to have multiple physical and psychiatric comorbidities, resulting in a shorter life expectancy compared with community-dwelling older adults, which may alter the potential benefits of high-intensity statin therapy. The Choosing Wisely campaign, which aims to reduce unnecessary medical treatments and intensity of therapy, states that, as individuals age, the adverse effects of using statins — including muscle symptoms, liver and kidney damage, falls and increased confusion — can potentially outweigh the benefits, particularly in those with no history of heart disease.[6] An additional recommendation by Choosing Wisely Canada specific to the setting of long-term care is to stop long-term medications, such as high-dose statins, unless there is an appropriate indication and a reasonable expectation of benefit for the resident.[7] Therefore, the objective of our study was to examine the rates of 1-year survival and admission to hospital for cardiovascular events among older residents of long-term care facilities who were prescribed intensive-dose statins compared with those receiving moderate-dose statins.

Methods

Study design and setting

We conducted a population-based retrospective cohort study involving residents of long-term care facilities in Ontario, Canada. The study used several health administrative and clinical assessment databases, which were linked using unique encoded identifiers and analyzed at ICES (Supplemental Table 1, Appendix 1, available at www.cmaj.ca/lookup/suppl/doi:10.1503/cmaj.180853/-/DC1). Most of the cost of care in long-term care facilities is covered by the provincial health system, and all residents have access to physician services, hospital care and prescription medications.

Study population

The cohort creation, which has been described in detail elsewhere,[2] used clinical data collected with the validated Resident Assessment Instrument–Minimum Data set version 2.0 (RAI-MDS 2.0) tool[8] linked with health administrative data.

The cohort comprised 76 266 residents of long-term care facilities in Ontario who received a full clinical assessment between Apr. 1, 2013, and Mar. 31, 2014. We included those aged 76 years and older with recorded statin therapy (date dispensed plus days supplied) that overlapped or included the clinical assessment date. We extracted prescription medication claims for statins from the Ontario Drug Benefit database. We chose the restriction of 76 years and older because clinical trial evidence for statin use becomes sparse in this age category.[9] The clinical assessment date served as the study index date.

Statin intensity was the exposure of interest. We used information on the statin drug claim overlapping the index date, including type of statin prescribed, quantity of pills provided and days of medication supplied, to calculate a resident's daily statin dose. We categorized residents who were prescribed atorvastatin (40 mg or more per day), rosuvastatin (20 mg or more per day) or simvastatin (80 mg or more per day) as intensive-dose recipients.[9] These dosage thresholds were selected because they were anticipated to achieve a 50% or more reduction in low-density lipoprotein cholesterol (LDL-C).[9–11] All remaining statin users were categorized as moderate-dose recipients, including the small proportion (< 5%) receiving low-dose formulations, to be consistent with previous work.[11]

Outcomes

We followed all residents for 1 year after the index date for all-cause mortality and admission to hospital for cardiovascular events. Date of death was ascertained using the Ontario Registered Persons Database, which contains vital statistics information for all Ontario residents enrolled in the provincial health system. We used the Canadian Institute for Health Information's Discharge Abstract Database, which compiles data on all inpatient admissions to acute care hospitals in Ontario, to ascertain admission to hospital for cardiovascular events (International Statistical Classification of Diseases and Related Health Problems, 10th revision code I00-I99 as an admitting cause for the visit).

Statistical analysis

We identified important baseline characteristics associated with mortality and admission to hospital for cardiovascular events based on previous work by our team and others.[2,12,13] Assessment items from the RAI-MDS 2.0 provided measures of clinical diagnoses, functional status and cognitive performance; they were also used to calculate a validated measure of resident frailty.[14,15] This index of frailty covers many domains of health and is calculated as the proportion of accumulated to potential health deficits (from 72 RAI-MDS items) whereby those with greater than 30% of potential deficits are defined as frail. We used the Johns Hopkins Adjusted Clinical Groups® case-mix system (version 10.0) to compute the number of Aggregated Diagnosis Groups in the past 2 years as a general measure of comorbidity.[16] We looked back 20 years from the index date to capture residents with a history of hospital admissions for atherosclerotic cardiovascular disease (admission for at least 1 of myocardial infarction, stroke, ischemic heart disease without infarction and peripheral arterial disease).[9] History of hospital and emergency department use, overall and specifically for cardiovascular diagnoses, was captured in the year before the index date. Concurrent use of cardiovascular and other medications on the index date was obtained using the Ontario Drug Benefit database.

We compared residents with similar observed characteristics through propensity-score matching. We used a multivariable logistic regression model, including all resident characteristics and incorporating a random intercept specific to each long-term care facility to account for residents clustered within facilities, to compute an individual-level propensity score for receiving intensive-dose statins compared with moderate-dose statins (Supplemental Table 2, Appendix 1). Residents taking intensive-dose statins were

matched to those taking moderate doses based on propensity score (± within 0.2 SDs of the score), age (± within 1 yr), sex, previous admission to hospital for atherosclerotic cardiovascular disease and our indicator of resident frailty.[14] We used standardized differences to compare resident characteristics before and after propensity-score matching, with a standardized difference of 10% or less representing adequate balance.[17]

In our analysis of all-cause mortality, we examined 1-year survival differences between the treatment groups by using Kaplan–Meier product-limit survival estimates and Cox proportional hazard modelling. For the outcome of admission to hospital for cardiovascular events, we compared the cumulative incidence of the first admission to hospital between treatment groups and used subdistribution hazard models to account for the competing risk of death because of the high mortality rate in the long-term care setting.[18] All models used robust sandwich-type estimators to account for the matched nature of the data.[19] Our analysis had 80% statistical power to detect an 11% relative difference in 1-year survival and a 16% relative difference in 1-year admission to hospital for cardiovascular events. In secondary analyses, the matched cohort was stratified by sex, previous admission to hospital for atherosclerotic cardiovascular disease and frailty status.

Independent of our cohort, we explored the proportion of residents in long-term care facilities aged 76 years and older who were prescribed a statin at some point between Apr. 1, 2013, and Mar. 31, 2014, and who were incident users (using a 1-yr look back to distinguish "new" use).

We conducted these analyses with SAS version 9.4. All statistical tests were 2-tailed, and we defined $p < 0.05$ as the level of statistical significance.

Ethics approval

The use of data in this project was authorized under section 45 of Ontario's Personal Health Information Protection Act, which does not require review by a research ethics board.

Results

We identified 67 208 residents of long-term care facilities aged 76 years and older between Apr. 1, 2013, and Mar. 31, 2014; 21 808 were statin users on their index date, of which 4762 (21.8%) received intensive-dose statins and 17 046 (78.2%) received moderate-dose statins. Atorvastatin was the most commonly prescribed statin medication among those taking intensive-dose (72.2%) and moderate-dose (55.5%) statins at the index date, and most (> 99.5%) had used statins the previous year, typically at the same dosage (Supplemental Table 3, Appendix 1). Of all the residents who were prescribed a statin at some point between Apr. 1, 2013, and Mar. 31, 2014, only 4.0% were considered incident users of the medication.

Before matching, residents taking intensive doses of statins were more likely to be younger, male, have a history of admission to hospital for atherosclerotic cardiovascular disease, 1 or more emergency department or hospital visits in the past year, and were concurrently using other cardiovascular medications, such as β-blockers and angiotensin-converting enzyme inhibitors, compared with those taking moderate doses (Table 1).

Propensity-score matching produced 4577 analytical pairs of residents taking intensive- and moderate-dose statins. The treatment groups were well-balanced as indicated by standardized differences that were less than 10% across all resident characteristics. After 1 year, there were 1210 (26.4%) deaths and 524 (11.4%) admissions to hospital for cardiovascular events among matched residents taking moderate doses compared with 1173 (25.6%) deaths and 522 (11.4%) admissions to hospital for cardiovascular events among those taking intensive doses.

One-year survival for matched residents taking intensive-and moderate-dose statins was 74.37% and 73.56%, respectively (Table 2). The risk difference in 1-year survival between the treatment groups was not significant (0.81%, 95% confidence interval [CI] −0.99% to 2.61%). We found no significant association between 1-year survival and receiving intensive-dose versus moderate-dose statins (hazard ratio [HR] 0.97, 95% CI 0.90 to 1.05) using Cox proportional hazard modelling. Hazard ratios for mortality among males and females, residents with and without a previous admission to hospital for atherosclerotic cardiovascular disease, and residents who were frail and either prefrail or not frail were not significant.

The 1-year cumulative incidence of admission to hospital for cardiovascular events was 11.41% in residents taking intensive-dose statins and 11.45% in those taking moderate doses, with a risk difference in outcomes of −0.04% (95% CI −1.34% to 1.26%; Table 3). We found no significant association between 1-year admission to hospital for cardiovascular events and use of intensive-dose statins compared with moderate-dose statins (HR 0.99, 95% CI 0.88 to 1.12). We also observed nonsignificant associations in strata defined by sex, previous admission to hospital for atherosclerotic cardiovascular disease and frailty status.

Interpretation

In our population-based study of older residents of long-term care facilities in Ontario, just over 20% of all prevalent statin users were receiving intensive doses. After propensity-score matching, there was no significant association between the prescribed statin dose and 1-year survival or admission to hospital for cardiovascular events. This finding was consistent across subgroups of residents, including those with and without a previous admission to hospital for atherosclerotic cardiovascular disease, and among more robust residents with a lower baseline mortality rate.

For individuals with atherosclerotic cardiovascular disease who are 75 years of age and older, the guideline from the American College of Cardiology/American Heart Association Task Force on Practice Guidelines recommends moderate-intensity statins.[9] Our findings are consistent with the guideline recommendations as most statin users were taking moderate doses, and the nonsignificant association between use of intensive-dose statins and our study outcomes highlights the possibility that the recommendation could be extended to older residents of long-term care facilities with and without atherosclerotic cardiovascular

disease. However, a recent large observational study involving patients in the Veterans Affairs health care system in the United States found prevalent use of high-intensity statins to be associated with a statistically significant 9% decrease in 1-year mortality compared with moderate doses among adults older than 75 years with atherosclerotic cardiovascular disease.[5] This result is contrary to our findings, and the discrepancy in results may be due to differences in the underlying study populations. Although the Veterans Affairs study followed all patients who were older than 75 years, we exclusively examined a cohort of residents of

Table 1 (part 1 of 2): Baseline characteristics of older Ontario residents living in long-term care facilities who were prescribed intensive- and moderate-dose statins between Apr. 1, 2013, and Mar. 31, 2014

	Unmatched residents			Propensity-score matched residents		
Characteristic	No. (%) taking intensive-dose statins *n* = 4762	No. (%) taking moderate-dose statins *n* = 17 046	Standardized difference	No. (%) taking intensive-dose statins *n* = 4577	No. (%) taking moderate-dose statins *n* = 4577	Standardized difference
Demographic						
Age group, yr						
76–85	2624 (55.1)	7892 (46.3)	0.18	2505 (54.7)	2504 (54.7)	0
≥ 86	2138 (44.9)	9154 (53.7)	0.18	2072 (45.3)	2073 (45.3)	0
Sex, male	1903 (40.0)	5282 (31.0)	0.19	1801 (39.3)	1801 (39.3)	0
Time in long-term care facility, yr						
< 1	1656 (34.8)	4973 (29.2)	0.12	1552 (33.9)	1630 (35.6)	0.04
1–4	2443 (51.3)	8891 (52.2)	0.02	2376 (51.9)	2350 (51.3)	0.01
5–9	582 (12.2)	2798 (16.4)	0.12	568 (12.4)	518 (11.3)	0.03
≥ 10	81 (1.7)	384 (2.3)	0.04	81 (1.8)	79 (1.7)	0
General health status						
Aggregated Diagnosis Groups in past 2 years						
0–5	2653 (55.7)	11 016 (64.6)	0.18	2596 (56.7)	2515 (54.9)	0.04
6–10	1514 (31.8)	4521 (26.5)	0.12	1428 (31.2)	1482 (32.4)	0.02
≥ 11	595 (12.5)	1509 (8.9)	0.12	553 (12.1)	580 (12.7)	0.03
Performance of activities of daily living						
Independent with or without supervision	472 (9.9)	1833 (10.8)	0.03	446 (9.7)	477 (10.4)	0.02
Limited	536 (11.3)	1982 (11.6)	0.01	521 (11.4)	513 (11.2)	0.01
Extensive	2476 (52.0)	8437 (49.5)	0.05	2378 (52.0)	2356 (51.5)	0.01
Dependent	1278 (26.8)	4794 (28.1)	0.03	1232 (26.9)	1231 (26.9)	0
Cognitive performance scale						
Intact or borderline intact	1199 (25.2)	3977 (23.3)	0.04	1136 (24.8)	1161 (25.4)	0.01
Mild impairment	965 (20.3)	3322 (19.5)	0.02	920 (20.1)	983 (21.5)	0.03
Moderate impairment	2047 (43.0)	7272 (42.7)	0.01	1983 (43.3)	1931 (42.2)	0.02
Severe impairment	551 (11.6)	2475 (14.5)	0.09	538 (11.8)	502 (11.0)	0.02
Frail participant*	2543 (53.4)	9125 (53.5)	0	2458 (53.7)	2458 (53.7)	0
Clinical diagnosis						
Diabetes	2018 (42.4)	6516 (38.2)	0.08	1915 (41.8)	1915 (41.8)	0
Congestive heart failure	911 (19.1)	2604 (15.3)	0.1	852 (18.6)	855 (18.7)	0
Hypertension	3573 (75.0)	12 693 (74.5)	0.01	3433 (75.0)	3450 (75.4)	0.01
Arteriosclerotic heart disease	1267 (26.6)	3516 (20.6)	0.14	1181 (25.8)	1257 (27.5)	0.04
Peripheral vascular disease	497 (10.4)	1245 (7.3)	0.11	457 (10.0)	451 (9.9)	0
Deep vein thrombosis	50 (1.0)	223 (1.3)	0.02	49 (1.1)	46 (1.0)	0.01
Cardiac dysrhythmia disorders	457 (9.6)	1493 (8.8)	0.03	438 (9.6)	432 (9.4)	0

Table 1 (part 2 of 2): Baseline characteristics of older Ontario residents living in long-term care facilities who were prescribed intensive- and moderate-dose statins between Apr. 1, 2013, and Mar. 31, 2014

	Unmatched residents			Propensity-score matched residents		
Characteristic	No. (%) taking intensive-dose statins *n* = 4762	No. (%) taking moderate-dose statins *n* = 17 046	Standardized difference	No. (%) taking intensive-dose statins *n* = 4577	No. (%) taking moderate-dose statins *n* = 4577	Standardized difference
Alzheimer disease and related dementias	2751 (57.8)	10 542 (61.8)	0.08	2667 (58.3)	2631 (57.5)	0.02
Cancer	468 (9.8)	1486 (8.7)	0.04	438 (9.6)	439 (9.6)	0
Emphysema/COPD/asthma	994 (20.9)	3212 (18.8)	0.05	942 (20.6)	974 (21.3)	0.02
Depression	1544 (32.4)	5475 (32.1)	0.01	1492 (32.6)	1459 (31.9)	0.02
Arthritis	58 (1.2)	226 (1.3)	0.01	57 (1.2)	52 (1.1)	0.01
Parkinson disease	281 (5.9)	1146 (6.7)	0.03	271 (5.9)	239 (5.2)	0.03
History of atherosclerotic-related admission to hospital						
Myocardial infarction	1409 (29.6)	2549 (15.0)	0.36	1254 (27.4)	1381 (30.2)	0.06
Ischemic heart disease without infarction	1631 (34.3)	3713 (21.8)	0.28	1494 (32.6)	1562 (34.1)	0.03
Stroke	1569 (32.9)	3682 (21.6)	0.26	1464 (32.0)	1521 (33.2)	0.03
Peripheral arterial disease	253 (5.3)	502 (2.9)	0.12	217 (4.7)	245 (5.4)	0.03
Any of the above*	3185 (66.9)	7603 (44.6)	0.46	3017 (65.9)	3017 (65.9)	0
Emergency department and hospital use in past year						
Any ED visit	2609 (54.8)	8142 (47.8)	0.14	2461 (53.8)	2535 (55.4)	0.03
Any inpatient admission to hospital	1860 (39.1)	5303 (31.1)	0.17	1734 (37.9)	1794 (39.2)	0.03
Any ED visit with a cardiovascular diagnosis	612 (12.9)	1260 (7.4)	0.18	542 (11.8)	574 (12.5)	0.02
Any inpatient admission to hospital with a cardiovascular diagnosis	985 (20.7)	2154 (12.6)	0.22	878 (19.2)	953 (20.8)	0.04
Concurrent drug therapy use						
No. of unique drug therapies						
0–5	881 (18.5)	4035 (23.7)	0.13	862 (18.8)	849 (18.5)	0.01
6–10	2426 (50.9)	8797 (51.6)	0.01	2349 (51.3)	2310 (50.5)	0.02
≥ 11	1455 (30.6)	4214 (24.7)	0.13	1366 (29.8)	1418 (31.0)	0.02
Angiotensin-converting enzyme inhibitor	1946 (40.9)	5941 (34.9)	0.12	1851 (40.4)	1877 (41.0)	0.01
Angiotensin receptor blocker	714 (15.0)	2733 (16.0)	0.03	685 (15.0)	667 (14.6)	0.01
β-Blocker	2273 (47.7)	6244 (36.6)	0.23	2137 (46.7)	2270 (49.6)	0.06
Calcium-channel blocker	1572 (33.0)	5478 (32.1)	0.02	1498 (32.7)	1520 (33.2)	0.01
Oral antiglycemic	1227 (25.8)	3962 (23.2)	0.06	1158 (25.3)	1159 (25.3)	0
Antipsychotic	1223 (25.7)	4634 (27.2)	0.03	1182 (25.8)	1148 (25.1)	0.02
Benzodiazepine	557 (11.7)	1985 (11.6)	0	539 (11.8)	543 (11.9)	0
Antibiotic	380 (8.0)	1220 (7.2)	0.03	354 (7.7)	353 (7.7)	0
Opioid	922 (19.4)	3289 (19.3)	0	888 (19.4)	946 (20.7)	0.03
Antidepressant	2431 (51.0)	8389 (49.2)	0.04	2339 (51.1)	2345 (51.2)	0
Cholinesterase inhibitor	1324 (27.8)	5285 (31.0)	0.07	1296 (28.3)	1271 (27.8)	0.01

Note: COPD = chronic obstructive pulmonary disease, ED = emergency department.
*Characteristics used to hard match and not included in the propensity-score model.

Table 2: Association between statin dose and 1-year mortality in older Ontario residents living in long-term care facilities who were prescribed statins, overall and by subgroup*

Analysis	No. of matched pairs analyzed	One-year survival in residents taking intensive-dose statins, %	One-year survival in residents taking moderate-dose statins, %	Risk difference in 1-year survival, % (95% CI)	HR† (95% CI)
Primary analysis, all matched pairs	4577	74.37	73.56	0.81 (−0.99 to 2.61)	0.97 (0.90 to 1.05)
Stratified analysis					
Sex					
Female	2776	77.70	76.08	1.62 (−0.60 to 3.84)	0.93 (0.83 to 1.03)
Male	1801	69.24	69.68	−0.44 (−3.45 to 2.57)	1.02 (0.91 to 1.15)
History of atherosclerotic-related admission to hospital					
No	1560	78.72	76.67	2.05 (−0.88 to 4.97)	0.91 (0.79 to 1.05)
Yes	3017	72.12	71.96	0.16 (−2.11 to 2.43)	1.00 (0.91 to 1.09)
Frailty status					
Prefrail or not frail	2119	82.77	83.48	−0.71 (−2.97 to 1.55)	1.05 (0.91 to 1.21)
Frail	2458	67.13	65.01	2.12 (−0.53 to 4.77)	0.93 (0.85 to 1.03)

Note: CI = confidence interval, HR = hazard ratio.
*Statins prescribed between Apr. 1, 2013, and Mar. 31, 2014.
†Residents taking moderate-dose statins served as the reference category.

Table 3: Association between statin dose and 1-year admission to hospital for cardiovascular events in older Ontario residents living in long-term care facilities who were prescribed statins, overall and by subgroup*

Analysis	No. of matched pairs analyzed	One-year cumulative incidence of admission to hospital for cardiovascular events, %		Risk difference in 1-yr cumulative incidence, % (95% CI)	HR† (95% CI)
		Residents taking intensive-dose statins	Residents taking moderate-dose statins		
Primary analysis, all matched pairs	4577	11.41	11.45	−0.04 (−1.34 to 1.26)	0.99 (0.88 to 1.12)
Stratified analysis					
Sex					
Female	2776	10.34	10.77	−0.43 (−2.05 to 1.19)	0.96 (0.82 to 1.12)
Male	1801	13.05	12.49	0.56 (−1.62 to 2.74)	1.04 (0.87 to 1.25)
History of atherosclerotic-related admission to hospital					
No	1560	8.08	8.21	−0.13 (−2.06 to 1.80)	0.98 (0.77 to 1.25)
Yes	3017	13.13	13.13	0.00 (−1.69 to 1.69)	1.00 (0.87 to 1.15)
Frailty status					
Prefrail or not frail	2119	12.13	12.41	−0.28 (−2.26 to 1.70)	0.98 (0.82 to 1.16)
Frail	2458	10.78	10.62	0.16 (−1.57 to 1.89)	1.01 (0.85 to 1.20)

Note: CI = confidence interval, HR = hazard ratio.
*Statins prescribed between Apr. 1, 2013, and Mar. 31, 2014.
†Residents taking moderate-dose statins served as the reference category.

long-term care facilities with a high prevalence of frailty, functional limitations and cognitive impairment. Recent data suggest that traditional cardiovascular risk factors, such as LDL-C, are not significantly associated with mortality among individuals aged 80 years and older who are frail.[20] Therefore, the use of intensive-dose statins to drive greater decreases in LDL-C may not have an effect on overall mortality for residents of long-term care facilities who frequently experience frailty and have a shorter life expectancy.

Intensive statin therapy is typically well-tolerated in older patients.[21] However, the risks of statin-associated muscle symptoms, acute kidney injury and moderate or serious liver dysfunction are all heightened by increased statin doses.[22–24] Also, clinically significant drug–drug interactions with statins are more common when a higher dose statin is used.[25] While the incidence of serious adverse events from high-intensity statins has been reported to be low in community-dwelling older adults, these studies have typically not included residents of long-term care facilities who are at a higher risk for adverse drug effects and drug interactions because of their vulnerability and high rate of polypharmacy.[26] This is an area in need of further research.

Our study mainly examined prevalent users of intensive- and moderate-dose statins rather than employing an incident-user design.[27] However, we found that only 4.0% of residents in long-term care facilities who were prescribed a statin at some point during the study year represented incident users. Therefore, in this setting, it may be especially relevant to examine the benefits and risks of ongoing statin use. For this vulnerable older population with relatively high levels of frailty, cognitive and functional impairment, and limited life expectancy, special considerations are required to ensure that decisions regarding continued pharmacotherapy follow the principles of resident-centred care, which aim to maximize quality of life and reduce nonbeneficial treatments.[28–30]

Given the lack of benefit we observed for ongoing use of intensive-dose statins compared with moderate-dose statins, a reduction in dose may be warranted among residents of long-term care facilities, particularly in those where the risk of statin-related adverse events would be expected to be relatively higher. However, these results may not be applicable to community-dwelling older adults who are taking statins. A recent primary care database study involving adults without atherosclerotic cardiovascular disease who were aged 75 years and older showed that new statin use was only associated with a significant reduction in atherosclerotic cardiovascular disease incidence and all-cause mortality among people aged 75–84 years with diabetes; this benefit disappeared among those aged 85 years and older.[31] In our study, given the care setting and focus toward ongoing use, we hypothesized that residents nearing death would be preferentially discontinued from statins, thus creating intractable bias in a comparison of residents currently taking statins and those not taking statins.

Limitations

Given the observational study design and use of administrative data, we cannot rule out residual confounding as an explanation for our results. To account for confounding bias, we used propensity-score matching to compare similar treatment groups and used rich, clinical assessment data to measure characteristics, such as physical and cognitive functioning, which are not typically available in traditional studies using administrative data. However, laboratory measures of cholesterol and other subclinical measures of cardiovascular functioning were not available. In addition, we lacked the necessary data for a comprehensive assessment of statin-related harms between different dosages. Finally, our study only provides evidence for the use of intensive-dose statins compared with moderate-dose statins in long-term care facilities, and we made no comparisons to a group of residents who were not taking statins.

Conclusion

There was no significant difference in 1-year outcomes among residents of long-term care facilities who were taking intensive-dose statins compared with those taking moderate-dose statins in our population-based cohort. It may be prudent to reduce statin doses for specific vulnerable residents who are at increased risk of statin-related adverse events. Future research and clinical trials should focus on evaluating the efficacy and safety of statin use and dosing, as well as stopping the use of statins, in residents of long-term care facilities to help inform clinical practice.

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Competing interests: None declared.

This article has been peer reviewed.

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Contributors: Michael Campitelli, Susan Bronskill, Dennis Ko and Colleen Maxwell conceived and designed the study. Michael Campitelli carried out the statistical analysis. Michael Campitelli, Susan Bronskill and Colleen Maxwell drafted the manuscript. All of the authors contributed to the interpretation of data, critical revisions of the manuscript for important intellectual content, gave final approval of the version to be published and agreed to be accountable for all aspects of the work.

Funding: This research was funded in part by the Canadian Frailty Network, supported by the Government of Canada through the Networks of Centres of Excellence Program (grant no. SIG2014-M1) and also the Canadian Institutes of Health Research through operating grants MOP-136854). Dennis Ko is supported by a Mid-Career Investigator Award from the Heart and Stoke Foundation of Canada. The study sponsors provided the operating costs and infrastructure to support the research. No funding bodies had any role in the study design, data collection, analysis, decision to publish or preparation of the manuscript.

Data sharing: The data set from this study is held securely in coded form at ICES. While data-sharing agreements prohibit ICES from making the data set publicly available, access may be granted to those who meet prespecified criteria for confidential access, available at www.ices.on.ca/DAS. The full data set creation plan and underlying analytic code are available from the authors upon request, understanding that the programs may rely upon coding templates and macros that are unique to ICES.

Acknowledgements: The authors thank Leah Edwards for her support in preparing the manuscript. They also thank IMS Brogan Inc. for use of their Drug Information Database.

Disclaimer: This study was supported by ICES, which is funded by an annual grant from the Ontario Ministry of Health and Long-Term Care (MOHLTC). The opinions, results and conclusions reported in this paper are those of the authors and are independent from the funding sources. No endorsement by ICES or the Ontario MOHLTC is intended or should be inferred. Parts of this material are based on data and information compiled and provided by the Canadian Institute for Health Information (CIHI). However, the analyses, conclusions, opinions and statements expressed herein are those of the author, and not necessarily those of CIHI.

Accepted: Nov. 27, 2018

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