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Chapter 3 – Section 3.5: The case for spending to improve chronic disease management

Technical Report

Prepared by Ontario Health Quality Council

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Overview:

To make the case for investing in QI for chronic disease management, we estimate the number of these complications which could be avoided through optimal use of six interventions recommended for patients with diabetes or coronary artery disease (CAD).

Some general principles were applied in this analysis:

- We used Ontario data where possible. If unavailable, our second choice was data from elsewhere in Canada, and our third choice, international data.

- Wherever there were multiple estimates for any particular variable in our analysis, we chose the estimate which would lead to a conservative estimate of the benefits of optimal chronic disease management.

Step 1: Calculating # of patients with CAD, diabetes or both

A national survey estimates that 4.0% of the population over age 12 has coronary artery disease.[1] Statistics Canada data for 2006 show the over age 12 population was 11 303 674. Therefore,

people with CAD = 384,649

A study from the Institute for Clinical Evaluative Sciences in Ontario, based on administrative data (hospital, drugs, and physician billings), estimates that among those aged 20 and over, the prevalence of diabetes is 8.8%.[2] Statistics Canada data for 2006 show the population for ages 20 and over was 9 647 968. Therefore,

people with diabetes = 802,240

Next, we obtained data from the Saskatchewan Health Quality Council's Chronic Disease Management Collaborative, which had information from patients with either diabetes or coronary artery disease confirmed by the patient's family physician. This was based on a a 28% sample of family practices. This data showed that of those people with diabetes, 19% also had CAD concurrently. A near-identical figure was also obtained using data in chapter 3. Therefore,

people with diabetes and CAD = 19% x 849,021 = 152,426
people with diabetes alone = 649,815
people with CAD alone = 232,224

Step 2: Estimating how many people are currently getting an intervention

Patients with diabetes or CAD should receive either specific drugs, or ensure that certain tests (blood pressure, A1C) fall within a particular range. Table 1 lists these interventions. In particular:

- Beta-blockers are recommended in patients with CAD (with or without diabetes). Ontario data in 2000 for CAD in the age 65 and over population show a rate of 63%.[3] There are three limitations with these data: they are relatively old and the situation may have improved since; they omit those under age 65; and they address acute myocardial infarction, not other forms of CAD. More current 2006 data from Saskatchewan's Chronic Disease Collaborative suggest that beta-blocker prescribing rates for all ages and all types of CAD are only 54%.[4] We chose the higher figure of 63% as this will yield a more conservative estimate of benefits of optimal chronic disease management.

- ACE inhibitors or angiotension receptor blockers (ARBs) are recommended in both CAD and diabetes. Prescribing rates for Ontario have been reported to be 59% for patients with CAD and 37% for patients with diabetes.[5] (The same limitations regarding exclusion of those under age 65 apply for these studies.) For patients with both CAD and diabetes, we assumed they had the higher rate (59%).

- Aspirin is also recommended for both CAD and diabetes. For CAD, the data from chapter 3 of the report show a 76% rate of recommendation. (We are reassured that this figure is almost identical to 2006 Saskatchewan data - 73%.[4]) For diabetes, we could not find any published figures for aspirin use in Ontario. Thus, we used the Saskatchewan estimate of 52%.[4]

- Statins are recommended for both CAD and diabetes. Chapter 3 date from the report show a rate of 64%. (We are reassured that this is similar to 2006 Saskatchewan data - 59%.[4]) We could not find data for statins in diabetes and thus, used the Saskatchewan figure of 43%.

- Blood pressure should be under 130/80 for diabetes patients (with or without CAD) under 140/90 for patients with CAD only. Data from chapter 3 show compliance with this target at 28% and 78% respectively.

- Patients with diabetes should have an A1C < 7.0. According to chapter 3, 47% hit this goal.

Step 3: Targets for Good Control

We used three references for targets for good control of diabetes and CAD:

1. The Canadian Cardiovascular Society[6] recommends that among CAD patients, 85% should be on beta-blockers, 85% on ACEI/ARBs, 70% on statins and 90% on ASA.

2. For diabetes outcomes, there are no Ontario targets yet, and no consensus nationally on what the targets should be. However, targets set in British Columbia's Quality Improvement Collaboratives for A1c and BP were 65% and 70% respectively[7]; for Saskatchewan, they were 75% and 75%[4]. To err on the conservative side, we chose targets of 70% for each measure.

3. For diabetes, we could not find a published target for ASA and statins, and thus, chose to set the same target as for CAD (90% and 70% respectively).

4. All diabetes patients with blood pressure over 130/80 or who have microalbumin in the urine should be on an ACE/ARB. We set a target of 75% for use of ACEI/ARBs in diabetes patients. In the absence of any published targets, we chose a figure that was lower than the CAD targets to err on the conservative side.

Based on figures in step 1, 2 and 3, we calculate, for each intervention and each disease, the number of persons with suboptimal care as follows:

with suboptimal care = # with disease x {target rate of use – actual rate}

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Table 1: Estimated persons in Ontario receiving suboptimal chronic disease care

Disease	# with condition	Intervention	estimated % getting intervention	Target %	# with suboptimal care
CAD alone	232,224	b-blocker	62%	85%	53,411
		ACEI/ARB	59%	85%	60,378
		ASA	76%	90%	32,511
		BP < 140/90	78%	75%	*
		statin	64%	70%	13,933
Diabetes alone	649,815	ASA	52%	90%	246,930
		ACEI/ARB	53%	75%	142,959
		A1C <7	47%	70%	149,457
		BP < 130/80	47%	75%	181,948
		statin	43%	70%	175,450
CAD and diabetes	152,426	b-blocker	62%	85%	35,058
		ACEI/ARB	59%	85%	39,631
		ASA	76%	90%	21,340
		A1C <7	47%	70%	35,058
		BP<130/80	28%	75%	71,640
		statin	43%	70%	41,155

* Number with suboptimal care is above target.

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Step 4: Number Needed to Treat

Next, we looked at the complications that could be avoided through use of each intervention, for each disease. Such complications include reduced mortality, strokes, AMIs, etc. For each recommended intervention, we found the number needed to treat (NNT) for each complication prevented in a one year time span, based on the original clinical trials supporting the intervention (Table 2). (Most studies reported an NNT over a five year follow-up period. For simplicity, we multiplied 5-year NNTs by 5 to estimate a 1-year NNT.)

Table 2: Number of persons needed to treat over one year to prevent complications using selected intervention

Disease	Intervention	AMI	CABG	PCI	amputation, foot	stroke	death
CAD alone	b-blocker [1]	111					84
	ACEI/ARB [2]	208	434	434		333	278
	ASA [3]	268				453	306
	BP < 140/90 [4]	160				136	205
	Statin [5]	96	160	182		323	133
DM alone	ASA [6]	769					
	ACEI/ARB [2]	208	434	434		333	277
	A1C <7 [7]	109			1111		343
	BP < 130/80 [8]	169			1250	238	224
	Statin [9]	96				98	52
CAD + DM	b-blocker [1]	111					111
	ACEI/ARB [2]	208	434	434		333	278
	ASA [3]	268				453	306
	A1C <7 [7]	109			1111		343
	BP<130/80 [8]	169			1250	238	224
	Statin [9]	96				98	52

[1] Freemantle N et al. B Blockade after myocardial infarction: systematic review and meta regression analysis, *BMJ*. 1999; 318: 1730-1736.

[2] The Heart Outcomes Prevention Evaluation Study Investigation. Effects of an angiotensin-converting-enzyme inhibitor, ramipril, on cardiovascular events in high-risk patients. 2000; 342: 145-153.

We assumed that the benefits from ACE inhibitors were the same for CAD and diabetes.

[3] Collaborative overview of randomised trials of antiplatelet therapy-I: Prevention of death, myocardial infarction, and stroke by prolonged antiplatelet therapy in various categories of patients. Antiplatelet Trialists' Collaboration. *BMJ*. 1994; 308(6921): 81-106.

The NNT for one year for prevention of a vascular event (AMI, stroke or vascular death) is 80 for post-AMI, 120 for post-stroke, and 100 for other history of CAD (e.g. angina, previous angioplasty; see abstract). Thus, we assumed the NNT at one year is 100. The approximate number of vascular events prevented among approximately 66,000 high-risk "adjusted" patients is as follows: AMI, 1437-975=462; stroke, 969-696=273; vascular death, 3035-2534=501; see Figure 4). Using relative percentages for each category (37%, 22% and 41%), we estimate averting .37 AMIs, .22 strokes and .41 vascular deaths per 100 persons, yielding NNTs of 268, 453 and 247.

Gum, PA, Thamilarasan M, Watanabe, J et al. Aspirin use and all-cause mortality among patients being evaluated for known or suspected coronary artery disease, *JAMA*. 2001; 286: 10: 1187-1194.

This comparable study suggests a one-year NNT for death of 251, which is consistent with the preceding approach.

[4] Staessen J, Gasowski J, Wang J, Thijs L, Hond E, et al. Risks of untreated and treated isolated systolic hypertension in the elderly: meta-analysis of outcome trials. *The Lancet* : 355; 9207: 865-872.

Dickerson L, Gibson MV. Management of hypertension in older persons. *Am Fam Physician* 2005; 71: 469-76.

In this meta-analysis of 8 trials of hypertension, there is a sub-group analysis of results for patients with a previous complication of cardiovascular disease. We assume that this group best approximates patients with coronary artery disease. NNTs are listed in Table 5, third row from bottom. 5-year NNTs are converted to 1 year values by multiplying by 5.

[5] Ross SD, Allen IE, Connelly JE, Korenblat BM et al. Clinical outcomes of statin treatment trials. Arch Intern Med. 1999; 159: 1793-1801

Goldberg RB et al. Cardiovascular events and their reduction with pravastatin in diabetic and glucose-intolerant myocardial infarction survivors with average cholesterol levels: CARE trial. *Circulation*. 1998; 98: 2513-2519.

Plehn JF et al. Reduction of stroke incidence after myocardial infarction with pravastatin: CARE study. *Circulation*. 1999; 99: 216-223.

Pyorala K, Ballantine CM, Gumbinger B, Lee MW, Shah A et al. Reduction of cardiovascular events by simvastatin in nondiabetic coronary heart disease patients with and without the metabolic syndrome. Subgroup analyses of the Scandinavian Simvastatin Survival Study. Diabetes care 2004; 27: 1735-1740

Data for NNTs was pooled from the above four studies.

[6] Hansson L, Zanchetti A, Carruthers SG, Dahlof B, Elmfeldt D, Julius S, Menard J, Rahn KH, Wedel H & Westerling S. Effects of intensive blood-pressure lowering and low dose aspirin on patients with hypertension: principal results of the Hypertension Optimal Treatment (HOT) randomized trial. *The Lancet*. 1998; 351:1755–1762.

This trial examined both hypertension and ASA in patients with and without diabetes. ASA was found to reduce AMIs by 3.6 – 2.3 = 1.3 events per 1000 patient-years (see Table 6 in article). This translates to an NNT of 769.

[7] Stratton, IM et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. *BMJ*. 2000; 321: 405-411.

Table 2 of this study lists rates of complications (AMI, death, and amputation) per person-years for patients with different levels of A1C control. We compared differences between patients with A1C between <7 versus those with values >7.

[8] Adler, AI et al. Association of systolic blood pressure with microvascualr and macrovascular complications of type 2 diabetes (UKPDS 36): prospective observational study. *BMJ*. 2000; 321: 412-419.

Table 2 of this study lists complication rates per person-years for patients with different levels of blood pressure control. We compared patients with SBP 120-129 vs those with SBP 140-149. NNTs were calculated based on differences in rates of complication per 1000 person years.

[9] Pyorala, K, Pedersen TR et al. Cholesterol lowering with simvastatin improves prognosis of diabetic patients with coronary heart disease. A subgroup analysis of the Scandinavian Simvastatin Survival Study (4s). Diabetes Care; 1997:20 (4).

This study reports a decrease among those with diabetes in rate of stroke from 10.3% to 4.8% with median treatment time over 5.4 years (see Table 3). This yields an NNT of 98. Similarly, mortality decreased from 24.7% to 14.3%.

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Step 5: Calculation of complications avoided from optimal management

The number of complications avoided, for any given intervention for a disease, is as follows:

# of complications avoided = # of people with suboptimal care / NNT

Disease	Intervention	AMI	CABG	PCI	amputation, foot	stroke	death
CAD alone	b-blocker	481					636
	ACEI/ARB	290	139	139		181	217
	ASA	121				72	106
	BP < 140/90	0				0	0
	statin	145	87	77		43	105
Diabetes alone	ASA	321					
	ACEI/ARB	687	329	329		429	516
	A1C <7	1371			135		436
	BP < 130/80	1077			146	764	812
	statin	1828				1790	3374
CAD & diabetes	b-blocker	316					316
	ACEI/ARB	191	91	91		119	143
	ASA	80				47	70
	A1C <7	322			32		102
	BP<130/80	424			57	301	320
	statin	429				420	791
Total		8,022	647	636	369	4167	7944

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Endnotes

[1] Chow C-M, L Donovan L, Manuel D, Johansen H, Tu JV, for the Canadian Cardiovascular Outcomes Research Team. Regional variation in self-reported heart disease prevalence in Canada. *Can J Cardiol* 2005; 21(14):1265-1271.

[2] Lipscombe, LL. The Growing Prevalence of Diabetes in Ontario: Are we prepared? *Healthcare Quarterly*. 2007: Vol 10; No3: 23-25.

[3] Pilote L, Beck CA, Karp I, et al. Secondary prevention after acute myocardial infarction in four Canadian provinces, 1997–2000. *Can J Cardiol* 2004; 20(1):61-67.

[4] Health Quality Council, Saskatchewan's Chronic Disease Management Collaborative – Turning the Tide on Chronic Disease Progress Report – Found at : www.hqc.sk.ca/download.jsp?K39AONVKHoqLVXivCoM+KzBIzBf0QfLQkUwK4QBZaJvelmpnmFRWog==

[5] Shah BR, Mamdani and Kopp A. Chapter 3: Drug Use in Older People with Diabetes. Diabetes in Ontario – An ICES Practice Atlas, June 2003.

[6] Tran CTT, Lee DS, Flintoft VF, et al. CCORT/CCS quality indicators for acute myocardial infarction care. A Canadian Cardiovascular Society consensus panel has recommended these targets for optimal drug use. *Can J Cardiol* 2003; 19(1):38-45.

[7] Vancouver Island Health Authority - Collaboratives Program for Services Integration. Found at: http://www.viha.ca/phc_cdm/phc_cdm_prog/cpsi.htm; Health Heart Society of British Colombia – Congestive Heart Failure Collaborative. Found at - http://www.heartbc.ca/pro/collaboratives/chf/chfindex.htm; and Healthy Heart Society of British Colombia, The BC Diabetes Collaborative – Found at: http://www.heartbc.ca/pro/collaboratives/dm/dmindex.htm.