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Cardiovascular medications in primary care: treatment gaps and targeting by absolute risk

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Abstract

Aim To measure the use of three major types of cardiovascular medications (antiplatelet, blood pressure lowering, and cholesterol lowering) in primary care, and their level of targeting to individuals at high absolute risk of a cardiovascular event.

Methods Demographic, risk factor, and prescribing data from the Dunedin Royal New Zealand College of General Practitioners Research Unit database were analysed. The data set consisted of 25,384 individuals, men aged at least 45 years and women at least 55 years, who consulted a doctor in 2000 in a practice which supplied electronic clinical notes. People with congestive heart failure were excluded. Five-year risk of a cardiovascular event was estimated using a history of vascular disease or the Framingham risk equation, and correlated with prescribed medications.

Results Cardiovascular risk could be estimated for only one-third of the study population due to missing risk factor information. Data were largely unavailable on antiplatelet agents and so lipid lowering and blood pressure lowering medications were used to assess the "treatment gap". This combination was prescribed to only 28% of those with documented cardiovascular disease. For the remainder without a history of disease and for whom 5-year absolute risk of cardiovascular disease could be estimated, prescription of combination therapy ranged from 8% in the lowest risk group (<5% 5-year risk) to 14-16% in the other risk categories.

Conclusions Among this primary care population, more than two-thirds of people with vascular disease were not receiving guideline-recommended medications and there was little evidence of targeting by absolute risk for those without disease. However limited conclusions can be made for the latter group because of lack of documented risk factor information. While these treatment gaps may be less now, for example due to increased access to statins, it is probable that substantial gaps remain.

Recent national and international guidelines recommend that individuals with a past history of cardiovascular disease receive three classes of cardiovascular medication (antiplatelet, blood pressure lowering, and cholesterol lowering), largely irrespective of risk factor levels.[1,2] For those with no vascular history but who have a calculated 5-year cardiovascular risk of 15% or more individualised lifestyle interventions and treatment to lower all their modifiable risk factors is advised.[1]

However significant treatment gaps have been shown in New Zealand and overseas studies examining single modality therapy.[3,4] In addition, targeting by absolute risk rather than by risk factor thresholds represents a shift in paradigm for many doctors (and patients), potentially resulting in even greater gaps.

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The objective of this paper was to measure the use of cardiovascular medications in primary care and establish whether prescribing is targeted to those at high absolute risk of an event.

Methods

Study population—Demographic, risk factor, and prescribing data from the Dunedin Royal New Zealand College of General Practitioners (RNZCGP) Research Unit were analysed. Their database comprises a non-random sample of general practices that contribute non-identifiable clinical data including demographic, consultation and prescription information. The study population was men aged at least 45 years and women at least 55 years, who were recorded in the RNZCGP network as consulting a general practitioner during 2000 (1 January to 31 December inclusive), and whose practice provided full computerised clinical notes.

For each patient the RNZCGP provided a unique identifier, demographics (age, sex, NZDep2001,[5] community services card (CSC, entitles families on low to modest incomes to a subsidy on GP visits and prescriptions), high user health card (HUHC, entitles the bearer to the same subsidies as the CSC and can be applied for if a person has visited the GP 12 or more times in the previous 12 months), cardiovascular risk factor information (blood pressure and cholesterol measurements in 2000, diabetes, smoking status), past history of cardiovascular disease or congestive heart failure, and prescriptions of cardiovascular medication during 2000.

Patients were classified as having diabetes if they had a prescription for oral hypoglycaemics or insulin or a Read code diagnosis of diabetes; and as cigarette smokers if there was evidence from free text searching or Read codes of regular daily smoking or cessation within the last 12 months. The mean of the latest two systolic blood pressure, total cholesterol and high density lipoprotein (HDL) measurements in 2000 were obtained from free text searching, laboratory results and patient measurements tables. Unaggregated data could not be provided due to privacy concerns.

Identification of cardiovascular history—A cardiovascular history was defined as a history of angina, myocardial infarction, angioplasty, coronary artery bypass graft, transient ischaemic attack, ischaemic stroke, or peripheral vascular disease.[1] Congestive heart failure was not included because of its specialised management and patients with congestive heart failure were excluded from the study population.[6]

Evidence of a history of cardiovascular and/or congestive heart failure was obtained from primary and secondary care data over a five-year period (1996-2000 inclusive). The RNZCGP primary care data set was searched using Read codes and free text queries of clinical notes. Public hospital diagnoses in the form of International Classification of Disease (ICD-9) codes were obtained from the National Minimum Data Set (NMDS) using an encrypted National Health Index number to link the study population with the NMDS. Cardiovascular history as identified by diagnostic coding (Read and ICD-9) was used in the main analyses and the free text search results were included in the sensitivity analyses.

The ICD-9 codes used in the NMDS search for cardiovascular history were: ischaemic heart disease (410-414, 429.0-429.2, 429.71, 429.72, 429.9), ischaemic cerebrovascular events (433-438), and peripheral vascular disease (440-444); and for congestive heart failure history: congestive heart failure (428.0), left heart failure (428.1) and heart failure unspecified (428.9). These codes were matched to Read codes to query consultation notes in the RNZCGP data set. Free text searching was necessary because many patient records in the RNZCGP data set did not contain any Read coding. The patient notes ensuing from the free text search were scanned for prescription of a nitrate medication at any time in the previous five years and where present it was assumed that there was a positive history of cardiovascular disease. The remainder, without a nitrate prescription, were then visually scanned to determine whether cardiovascular disease was present. All of the search results for heart failure were visually scanned.

Calculating cardiovascular risk—Individuals with a cardiovascular history were classified at greater than 20% risk of a cardiovascular event over the next five years.[1] Five-year absolute risk of a cardiovascular event was calculated only for individuals without a past history of cardiovascular disease and with blood pressure and cholesterol measurements by means of the Framingham-based (Anderson[7]) risk equation, as currently used in New Zealand.[1,8] Variables included in the equation are sex, age, systolic blood pressure, smoking, total cholesterol, HDL, diabetes, ECG left ventricular hypertrophy (LVH). The variable ECG LVH was set to zero. Estimated five-year risk was grouped into

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categories: < 5%, 5 - 10%, 10 - 15%, 15 - 20%, and ≥ 20%. Demographics of those with and without estimated cardiovascular risks were compared using t-tests for continuous variables and chi-squared for categorical. Analyses were performed using SAS version 8.02 software.[9]

Medication groups–Cardiovascular medicines were grouped as follows:

- Antiplatelet agents—aspirin, clopidogrel, dipyramidole.
- Blood pressure lowering agents—angiotensin converting enzyme inhibitors, alpha adrenoceptor blockers, angiotensin II antagonists, beta adrenoceptor blockers, centrally acting agents, dihydropyridine calcium channel blockers, other calcium channel blockers, potassium-sparing diuretics, thiazides and related diuretics, vasodilators.
- Cholesterol lowering agents – HMG CoA reductase inhibitors (statins), fibrates, resins, nicotinic acid.

In sensitivity analyses medicines with blood pressure lowering effects (e.g. loop diuretics, long acting nitrates, and antiarrhythmics) but other primary indications were included in the blood pressure lowering group.

Assessing the treatment gap—Cross-tabulations were performed of absolute risk categories and use of one, two, or three medication types. Predictors of the simultaneous use of medications from both classes (lipid lowering and blood pressure lowering) were determined using multivariate logistic regression models. Explanatory variables included were sex, age, systolic blood pressure, smoking, cholesterol, diabetes, cardiovascular history, absolute five-year cardiovascular risk, NZDep2001, HUHC and CSC status.

Results

Twenty practices were eligible and 99,796 patients consulted these practices during the study year. Date of birth or sex was missing from the records of 865 (0.9%) patients. From the remainder, 27,184 fitted the age criteria. After excluding those with history of congestive heart failure (1,800 or 6.7%), the study population consisted of 25,384 individuals. Approximately 28% had documented cholesterol measurements (7,231 had total cholesterol and 6,937 had HDL) and 64% (16,191) had a systolic blood pressure. A quarter (5,994) of the sample population had all three of these risk factor levels documented.

Cardiovascular risk—A history of cardiovascular disease based on ICD-9 or Read codes was present in 3,855 individuals (15%). In the more sensitive strategy, which included free text searching and nitrate prescriptions, this increased to 22% (n=5,615). Absolute risk category could be calculated for 8,434 (33%) individuals, consisting of the 3,855 with a cardiovascular history and 4,579 without a history but with data on risk factors levels. Cardiovascular risk could not be calculated for 16,950 individuals (67%). Those with a cardiovascular risk score were more likely to be older, smokers, have diabetes, and be holders of CSC or HUHC (Table 1).

Medication use by absolute risk—Data were provided on cardiovascular prescriptions for 11,293 individuals. Prescriptions for one or more antiplatelet agents, blood pressure or cholesterol lowering drugs were recorded for 5%, 34%, and 10% of the study population respectively. However since many patients purchase aspirin over-the-counter it is likely that the data set did not fully capture actual antiplatelet use. Hence the main analyses are performed for prescription of blood pressure and lipid lowering medicines only.

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Table 1. Demographics of those with and without a cardiovascular (CV) risk estimate

Demographics	CV risk not calculated (n=16,950)	CV risk calculated (n=8,434)
% Female	43.9	44.5
Mean age (years)	63.6	66.3*
% CSC holders	45.8	58.5*
% HUHC holders	2.8	5.7*
% Smoker	7.5	14.1*
% Diabetes	6.4	17.2*

*p<0.0001; CSC=Community Services Card, HUHC=High User Health Card—subsidised health and medicines.

The correlation between absolute cardiovascular risk and treatment is shown in Table 2 below. Overall 72-84% of those potentially eligible under current guidelines were not receiving both blood pressure and lipid lowering medications, with the lowest gap in those with a past history of cardiovascular disease. Prescribing of combination therapy was predominantly influenced by vascular history with little evidence of targeting by absolute risk. Only blood pressure medication prescribing showed an upward trend with increasing absolute risk levels. Use of combination therapy was very low for the group in whom risk was unable to be estimated.

Table 2. Proportion in each 5-year absolute cardiovascular (CV) risk group prescribed at least one medicine from each class of medication

Variable	CV history	No CV history					
5-yr CV risk (Number in group)	≥20% (n=3855)	≥20% (n=570)	15–20% (n=515)	10–15% (n=1005)	5–10% (n=1507)	<5% (n=979)	Risk not estimable (n=16,950)
BP-lowering medication	67%	62%	58%	53%	44%	30%	23%
Lipid-lowering medication	33%	21%	23%	20%	21%	15%	2%
Combination (BP & lipid lowering)	28%	16%	16%	14%	14%	8%	1%

Sensitivity analyses that included additional cardiovascular medicines with blood pressure lowering capability or excluded potassium-sparing diuretics showed similar results. Using the more sensitive definition of cardiovascular history, i.e. including free text searching as well as ICD-9 and Read codes, indicated only 23% with a past cardiovascular history were receiving combination therapy.

Imputing missing values using age and sex means from the data set increased the treatment gap in those without a past history of cardiovascular disease. Individuals

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with missing cardiovascular risk calculations had lower prescribing of lipid lowering and blood pressure lowering medication.

A past history of vascular disease was the strongest predictor of combination therapy; those with a history were three times more likely to be prescribed the combination compared to those with less than 7.5% 5-year risk (Table 3). There was no trend of increasing odds between the high risk (≥ 15%) and moderate risk (≥ 7.5-< 15%) groups when compared with the lowest risk group in those without a past history (odds ratios 1.6 and 1.5 respectively). Having a high user health card was associated with greater provision of combination therapy. People living in the most deprived areas (NZDep2001 groups 8-10) were less likely to be on the combination than those in less deprived areas.

Table 3. Predictors of combination therapy use

Variable	Odds ratio	95% confidence interval
Cardiovascular risk		
- Past history of vascular disease	3.2	(2.7–3.8)
- 5-year CV risk ≥ 15% (no past history)	1.6	(1.3–2.0)
- 5-year CV risk 7.5%–15%	1.5	(1.2–1.8)
- 5-year CV risk < 7.5%	1.0	
Community Services Card holder		
- Yes	1.1	(1.0–1.3)
- No	1.0	
High User Health Card holder		
- Yes	1.4	(1.1–1.7)
- No	1.0	
NZDep2001		
- Deciles 1–4	1.3	(1.1–1.5)
- Deciles 5–7	1.4	(1.2–1.6)
- Deciles 8–10	1.0	

In a separate model increasing blood pressure levels were not predictive of combination therapy but there was a trend for increasing prescription with reducing cholesterol, although these were on treatment values and analysed independent of cardiovascular history. Males were more likely to be on the combination (odds ratio 1.4, 95% confidence interval 1.3–1.6) and there was increasing likelihood of prescription in higher age groups until 75 years and above. Smoking status and diabetes status were not predictive.

Discussion

This research shows there is a significant gap between guideline recommendations and practice in cardiovascular prevention. The large majority of people with vascular disease do not receive recommended medication. There was little evidence of targeting by absolute risk in those without disease. This research also highlights the extent of missing risk factor data in a recent primary care database.

Findings from other research have been similar. During 1999–2000 use of beta-blockers in coronary heart disease patients ranged from 47% to 88% across Europe

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with persistent low use of statins (40-75%).[4] A British survey conducted over two years from 1999 showed that less than half of women with a history of myocardial infarction or stroke were taking antiplatelet medication and only one in five were receiving a statin.[10]

Missing data are a significant concern and highlight the difficulty in retrieving information that is not stored in an easily accessible electronic format and is not routinely extracted. Due to resource constraints risk factor levels in one year only were searched. Cholesterol may be less frequently checked than blood pressure and this will result in selection of people with a recent cholesterol measurement. Smoking is likely to be significantly underestimated due to infrequent documenting in consultation notes and the lack of coding.

More resources and support for the development of accurate and timely primary care data collection are required on a national level in order to increase the utility of these data sets in monitoring treatment gaps. Missing data may also be due to failure to collect and/or document cardiovascular risk factors. Implementation of the New Zealand cardiovascular risk guideline provides an opportunity for consistent documentation of risk factors as part of initiatives to systematically risk assess and manage the eligible population.[1]

This research examined medicines in broad classes. Cardiovascular medications prescribed during 2000 were included regardless of their actual dose and intended use. They were not analysed according to whether prescriptions were ongoing. These factors will tend to underestimate the gap. Aspirin use could not be reliably evaluated and this means the gap will be underestimated for the combination of three treatment modalities.

Further research into this area should explore ways of capturing data on over-the-counter medications. Patients who have a recent diagnosis of cardiovascular disease may be receiving their medication from specialist clinics and hence the treatment gap may be overestimated in this primary care database. The gap may also be affected by incomplete data due to patient migration to non-contributing practices and deaths early in the study year.

We did not differentiate by risk factor level in those at 15-20% 5-year risk without a history of vascular disease. In this group the presence of very low blood pressure or cholesterol levels may mean combination drug treatment aimed at all risk factors is not required. Therefore our analysis may slightly overestimate the gap, although we would expect a low prevalence of such risk factor levels in this population.

During the time period examined, access to statins was under Special Authority (restricting subsidy to individuals with cardiovascular disease and total cholesterol above 4.5-6 mmol/L or, if no history, total cholesterol greater than 9) and statin use has increased since 2000. A 2001 audit in Auckland of 147 patients with coronary artery disease found 71% were receiving statins, however this was a group recently discharged from hospital following an acute event and this high percentage is unlikely to accurately reflect chronic usage in primary care.[3] The Special Authority requirement was removed in early 2002 and in 2003 statin prescribing had increased by 65%.[11] Nonetheless our data suggest a large treatment gap is still likely to exist since the baseline was so low.

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As with any medical records-based research, the Dunedin RNZCGP Research Unit database has limitations. Doctors contributing to the database are a selected subgroup. However an investigation of biases by the Unit found the data collected to have similar patient morbidity and prescribing but reduced rates of laboratory investigation when compared to a random sample of general practitioners.[12]

There are no legal requirements in New Zealand to maintain patient records on paper in addition to those recorded on practice computers and this means that if computers are used to store practice records at all, they store more comprehensive patient data than in other countries.[13] The Research Unit recently showed that key demographic variables such as patient age, National Health Index, sex, and health card status were very well recorded, but only 23% of consultations were Read coded and ethnicity recorded for 35%.[14]

In conclusion, there are large treatment gaps for cardiovascular disease. This has implications for the successful implementation of the recent New Zealand Guidelines Group guideline on management of cardiovascular risk.[1] Many different strategies, ranging from district wide programmes of risk assessment to individual education of doctors and patients about absolute risk, and initiatives to enhance primary care access and support for chronic care management out of hospital, are likely to be required to achieve widespread identification and management of those at high cardiovascular risk.

Primary health organisations may be ideally positioned to monitor these gaps through systematic approaches to risk assessment and the development of risk registers and methods of evaluating appropriate management.

Competing interests: Anthony Rodgers, Natasha Rafter, Jennie Connor, Rod Jackson, and Stephen Vander Hoorn are investigators on a randomised controlled trial of combination cardiovascular medication.

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