# Quality indicators for the prevention of cardiovascular disease in primary care

Jessica Hopkins MD MHSc CCFP    Gina Agarwal MB BS MRCGP CCFP PhD    Lisa Dolovich PharmD MSc

## ABSTRACT

**OBJECTIVE** To determine the feasibility and usefulness of collecting 9 previously described quality indicators of cardiovascular disease (CVD) prevention in primary care.

**DESIGN** Retrospective chart audit.

**SETTING** Family health team in Hamilton, Ont, comprising approximately 30 000 patients and 25 physicians over 2 sites.

**PARTICIPANTS** A random sample of community-dwelling men who were 40 to 80 years of age and women who were 50 to 80 years of age on January 1, 2003, and who had complete physical examinations in 2003.

**MAIN OUTCOME MEASURES** The frequency with which quality indicators were collected during the complete physical examination, whether the collection of these indicators predicted subsequent collection of the same indicators, and physician or patient behavioural changes to reduce the risk of CVD.

**RESULTS** Of the 237 patient charts reviewed, 142 were of men and 95 were of women. Collection of most of the quality indicators was high (>50%). Results were adjusted for age, sex, and family health team site. Measurements to check for obesity were collected more frequently in women, while blood pressure measurements and follow-up when required were completed more frequently in men. The relationship between the collection of an indicator and the subsequent times the same indicator was collected was not significant for any of the variables except excess alcohol consumption, in that collection of the excess alcohol consumption indicator led to a significant increase in subsequent collection of that same indicator ($P=.0091$). Age significantly predicted the number of times cholesterol and blood pressure were repeatedly checked ($P=.0074$ and $P=.0077$, respectively). The collection of these indicators was significantly associated with behavioural changes related to CVD prevention on the part of the patient or physician, with collection of the alcohol consumption indicator being the most likely to encourage subsequent behavioural changes. The only indicator to not reach statistical significance for subsequent changes was the cholesterol indicator ($P=.08$).

**CONCLUSION** The collection of previously described quality indicators for the primary prevention of CVD in Canada is feasible. Collection of the indicators does not generally predict short-term outcomes; however, collection of most indicators increased the odds of patient or physician behavioural changes for the primary prevention of CVD.

## EDITOR'S KEY POINTS

- This retrospective chart audit examines whether collection of 9 quality indicators of cardiovascular disease (CVD) prevention (obesity, alcohol consumption, smoking status, smoking cessation, type 2 diabetes, cholesterol, blood pressure, global risk, and follow-up for elevated blood pressure) predicts subsequent collection of the same indicators and patient or physician behavioural changes to reduce the risk of CVD.

- Most of the indicators were collected for more than 50% of the patients, but collection of an indicator did not consistently ensure future collection of the same indicator. For most indicators, however, collection increased the odds that patients made changes or physicians advised changes relating to that risk factor.

- This study demonstrates that it is feasible for physicians to collect these indicators during annual health examinations and that testing for some or all CVD risk factors can lead to relevant physician discussion and patient change.

- Further studies should compare the collection of these indicators with their effects on CVD morbidity and mortality.

# Indicateurs de qualité pour la prévention des maladies cardiovasculaires en soins primaires

**Jessica Hopkins** MD MHSc CCFP    **Gina Agarwal** MB BS MRCGP CCFP PhD    **Lisa Dolovich** PharmD MSc

## RÉSUMÉ

**OBJECTIF** Déterminer s'il est faisable et utile de recueillir 9 indicateurs de qualité reconnus pour les maladies cardiovasculaires (MCV) dans un contexte de soins primaires.

**TYPE D'ÉTUDE** Vérification rétrospective de dossiers.

**CONTEXTE** Une équipe de santé familiale d'Hamilton, Ontario, composée d'environ 30 000 patients et de 25 médecins répartis sur 2 sites.

**PARTICIPANTS** Un échantillon aléatoire d'hommes âgés de 40 à 80 ans et de femmes âgées de 50 à 80 ans au premier janvier 2003, vivant dans le milieu naturel et ayant eu un examen physique complet en 2003.

**PRINCIPAUX PARAMÈTRES À L'ÉTUDE** La fréquence à laquelle les indicateurs de qualité ont été recueillis au cours de l'examen physique complet, si la collecte de ces indicateurs permettait de prévoir une collecte subséquente des mêmes indicateurs, et les changements comportementaux du médecin et du patient pour réduire le risque de MCV.

**RÉSULTATS** Sur les 237 dossiers examinés, 142 appartenaient à des hommes et 95 à des femmes. On a recueilli la plupart des indicateurs de qualité dans plus de 50% des cas. Les résultats ont été ajustés selon l'âge, le sexe et le site de l'équipe de santé familiale. Le degré d'obésité a été mesuré plus souvent chez les femmes tandis que la mesure de la tension artérielle et son suivi ont été effectués plus fréquemment chez les hommes. Il n'y avait pas de relation significative entre la cueillette d'un indicateur donné et le nombre de fois qu'on l'a ensuite vérifié, sauf pour l'excès de consommation d'alcool: dans ce cas, la collecte de l'indicateur de consommation éthylique excessive entraînait une augmentation significative de la collecte subséquente du même indicateur (*P*=,0091). L'âge permettait de prédire le nombre de fois que la cholestérolémie et la tension artérielle seraient à nouveau vérifiées (*P*=,0074 et *P*=,0077, respectivement). La collecte de ces indicateurs était associée de façon significative à des changements de comportement liés à la prévention des MCV, l'indicateur de consommation d'alcool étant le plus susceptible de promouvoir des changements comportementaux ultérieurs. Le seul indicateur qui n'entraînait pas de changements ultérieurs significatifs sur le plan statistique était celui de la cholestérolémie (*P*=,08).

**CONCLUSION** Au Canada, il est possible de recueillir les indicateurs de qualité ci-dessus pour la prévention primaire des MCV. De façon générale, la collecte de ces indicateurs ne permettait pas de prédire les issues à court terme; toutefois, dans la plupart des cas, elle augmentait la probabilité de changements comportementaux favorables à la prévention primaire des MCV chez le médecin ou le patient.

## POINTS DE REPÈRE DU RÉDACTEUR

- Cette vérification rétrospective de dossiers voulait déterminer si la cueillette de 9 indicateurs de qualité pour la prévention des maladies cardiovasculaires (MCV) (obésité, consommation d'alcool, tabagisme, arrêt du tabagisme, diabète de type 2, cholestérolémie, tension artérielle, risque global et surveillance d'une tension élevée) permettait de prédire qu'il y aurait une cueillette subséquente des mêmes indicateurs et des changements comportementaux du patient ou du médecin pour réduire le risque de MCV.

- On a obtenu la plupart des indicateurs chez plus de 50% des patients, mais le fait d'en avoir obtenu un ne garantissait pas toujours qu'on puisse l'obtenir plus tard. Dans la plupart des cas, toutefois, le fait d'obtenir un indicateur donné augmentait la probabilité que le patient ait modifié des habitudes ou que le médecin ait suggéré des changements en lien avec ce facteur de risque.

- Cette étude montre qu'il est possible pour le médecin de recueillir ces indicateurs lors de l'examen médical annuel, et que le fait de vérifier certains ou tous les facteurs de risque de MCV peut susciter des conseils pertinents de la part du médecin et des changements de comportement chez le patient.

- Les effets de la collecte de ces indicateurs sur la morbidité et la mortalité par MCV devraient faire l'objet d'autres études.

Cardiovascular disease (CVD) is a leading cause of mortality and accounts for approximately 40% of deaths in Canada.[1] It has substantial social and economic costs,[2] and is of increasing concern as the population ages. The individual risk of developing CVD increases with a growing number of modifiable risk factors, including hypertension, diabetes, smoking, alcohol consumption, hyperlipidemia, physical inactivity, being overweight, and obesity.[1,3-6]

Cardiovascular disease is one of the main areas of chronic disease management in primary care. Burge and colleagues[7] used a Delphi panel approach to develop 9 primary prevention quality indicators for CVD in primary care (**Table 1**[6,7]). They defined CVD as ischemic heart disease, hypertension, hyperlipidemia, and heart failure.[7] Primary care is well positioned to screen patients and make treatment recommendations for modifiable risk factors for CVD. For example, a potential opportunity for upstream intervention occurs during the annual health examination. Our study expands on the work of Burge and colleagues by 1) investigating the feasibility of collecting these quality indicators in primary care and 2) determining the ability of these quality indicators to predict short- and medium-term outcomes for CVD.

## METHODS

### Study design

We conducted a structured retrospective chart audit. Patient charts were obtained from an urban, academic family health team (FHT) in Hamilton, Ont, which comprised approximately 30 000 patients and 25 physicians over 2 sites.

Community-dwelling men and women who were 40 to 80 years of age and 50 to 80 years of age, respectively, on January 1, 2003, were included. In order to minimize the return of ineligible patients, only those patients who were still enrolled in the FHT on December 31, 2007, and who had a provincial billing code for a complete physical examination in 2003 were considered eligible.

We excluded patients with serious barriers to office visits, specifically those not living independently in the community, such as residents of long-term care facilities and those with disabilities that prevented office visits. We also excluded patients with previously diagnosed CVD, as defined by Burge and colleagues,[7] using provincial billing diagnostic codes.

In order to capture all indicators, we abstracted data from the FHT's electronic medical record (EMR) over a 5-year time period (January 1, 2003, through December 31, 2007). We identified eligible patients using a query involving the relevant dates, billing, and diagnostic codes through the EMR. Patients were randomly selected for inclusion in the study via a computerized randomization procedure (using SAS, version 9.1).

Owing to limitations of the EMR, a single investigator (J.H.) examined individual patient records to determine FHT enrolment status on January 1, 2007, and to exclude patients with previously diagnosed CVD.

### Data collection

Data were collected using a standardized data abstraction form.

Because of the lack of guidance from the literature on the frequency of collection of these indicators in primary care, our sample size was guided by our planned data analysis using logistic regression. A previous study demonstrated a meaningful bias in regression coefficients derived from data with fewer than 10 events per variable.[8] Given that our study used 9 important variables (ie, the 9 quality indicators), and each indicator required a minimum of 10 events for analysis by logistic regression, we calculated our minimum sample size to be 90. In order to make the analysis more robust and to account for patients without events or with missing data, the target sample was increased to 200 patients.

Our outcomes of interest were as follows: 1) the presence of quality indicators (**Table 1**[6,7]); 2) the likelihood of having the same quality indicator repeated after it had been measured once, as an indication of continued follow-up and monitoring (short-term outcome); and 3) the odds of having a health care provider– or patient-motivated discussion or behavioural change should any indicator be recorded (medium-term outcome [**Table 1**[6,7]]).

### Data analysis

We collected demographic data, including FHT site, date of birth, sex, physician with whom the patient was enrolled, and occupation class according to the government of Canada's National Occupational Classification matrix.[9,10] Health status information collected included smoking status, excess weight (body mass index >25 kg/m² or waist circumference >102 cm in men or >88 cm in women[11]), excess alcohol consumption (more than 2 standard drinks per day[3,6]), abnormal fasting glucose (fasting glucose >6.0 mmol/L[12]), elevated lipid levels (low-density lipoprotein cholesterol >4.5 mmol/L or total cholesterol to high density lipoprotein ratio >6.0 mmol/L[13]), elevated risk according to global risk assessment (global risk assessment higher than lowest level of risk), and elevated blood pressure (BP) at complete physical in 2003 (systolic BP 140 to 159 mm Hg or diastolic BP 90 to 99 mm Hg[7]). Information on indicators and their repeat measurements were collected for obesity, alcohol consumption, smoking status, smoking cessation, type 2 diabetes mellitus (T2DM), cholesterol, BP, and global risk assessment. Information on behavioural changes were collected for the obesity, alcohol consumption, smoking cessation, T2DM, cholesterol, and BP indicators. All statistical analyses were performed using SAS, version 9.1. Descriptive

**Table 1.** Definitions of quality indicators and medium-term outcomes for the primary prevention of CVD in primary care

| QUALITY INDICATOR | DEFINITION | MEDIUM-TERM OUTCOMES* | |
| --- | --- | --- | --- |
| | | PATIENTS | PHYSICIANS |
| Obesity | Percentage of patients who had weight and height or waist circumference recorded on their charts | Have attempted to lose weight through diet, physical activity, or consultation with a dietitian or physical activity expert | Have discussed healthy weight loss through diet, physical activity, consultation with a dietitian, medication, or bariatric surgery |
| Alcohol consumption | Percentage of patients who had alcohol consumption recorded on their charts | Have decreased alcohol consumption to no more than 1 to 2 standard drinks/d[6] Have attended an alcohol treatment program | Have discussed decreasing alcohol consumption to not exceed recommended daily intake Have prescribed medication for alcohol cessation Have referred the patient to alcohol treatment programs or resources |
| Smoking status | Percentage of patients who had smoking status recorded on their charts | NA | NA |
| Smoking cessation | Percentage of patients who are current smokers and had smoking cessation counseling or a referral for counseling recorded on their charts | Have quit smoking or attempted to quit smoking | Have discussed smoking cessation Have prescribed smoking cessation medication Have referred the patient to a behavioural program for smoking cessation |
| T2DM | Percentage of patients who had a fasting plasma glucose level recorded on their charts in the past 3 y[†] | Have attempted to improve diet or lose weight through increased physical activity Have seen a dietitian or physical activity expert | Have discussed diet or increased physical activity Have referred the patient to a dietitian Have prescribed hypoglycemic medication |
| Cholesterol | Percentage of patients who had lipid testing at least every 5 y recorded on their charts | Have attempted to improve diet or increase physical activity Have seen a dietitian or physical activity expert | Have discussed diet or increased physical activity Have referred the patient to a dietitian Have prescribed lipid-lowering medication |
| BP | Percentage of adult patients in the previous 3 y[†] whose BP measurements were recorded on their charts | Have checked BP at home Have improved diet or increased physical activity Have seen a dietitian or physical activity expert | Have discussed diet or increased physical activity Have referred the patient to a dietitian or physical activity expert |
| Follow-up for elevated BP | Percentage of patients with a systolic BP of 140 mm Hg to 159 mm Hg or diastolic BP of 90 mm Hg to 99 mm Hg who had follow-up visits within 6 mo of elevated BP measurement | NA | NA |
| Global risk | Percentage of patients for whom global risk assessments were recorded on their charts | NA | NA |

Adapted from Burge et al.[7]
BP—blood pressure, CVD—cardiovascular disease, NA—not applicable, T2DM—type 2 diabetes mellitus.
*Any positive response to a patient or physician outcome listed in the chart was treated as a positive result for medium-term outcomes.
[†]From January 1, 2005, to December 31, 2007, inclusive.

statistics included measures of proportion or centre, along with appropriate measures of error. Analytical statistics included logistic regression for medium-term outcomes and logistic and Poisson regression for short-term outcomes. The Hosmer-Lemeshow goodness-of-fit test and deviance statistic were used to determine if the logistic and Poisson models, respectively, were an appropriate fit for the data. The variance inflation factor was used to determine whether or not multicollinearity was a problem.

Ethics approval for the study was obtained from the McMaster Faculty of Health Sciences Research Ethics Board at McMaster University in Hamilton, Ont.

## RESULTS

There were 237 patients included in this study (**Figure 1**). It should be noted that 81 charts were excluded from the second site, as sample size was met before the paper charts were retrieved. The median age of patients was 54.75 years (range 40.02 to 79.11). Male patients outnumbered female patients 142 (59.9%) to 95 (40.1%). Just more than half of the patients had an occupation recorded (53.6%). A summary of the frequency of indicator variables present and subsequent outcomes is presented in **Table 2.** Smoking status was the most frequently recorded variable (85.2%) and follow-up for elevated BP was the least frequently recorded variable (25.0%).

We compared the frequency of indicators by sex. Measurements to check for obesity were collected more frequently from women than from men (2-sided Fisher exact test, $P = .015$). Conversely, BP measurements within the past 3 years and follow-up when required were collected more frequently from men than from women (2-sided Fisher exact test, $P = .023$ and $P = .032$, respectively). Collection of the other indicators did not differ by sex. We compared the frequency of collection of each indicator by FHT site.

**Figure 1.** Selection of patients included in the study
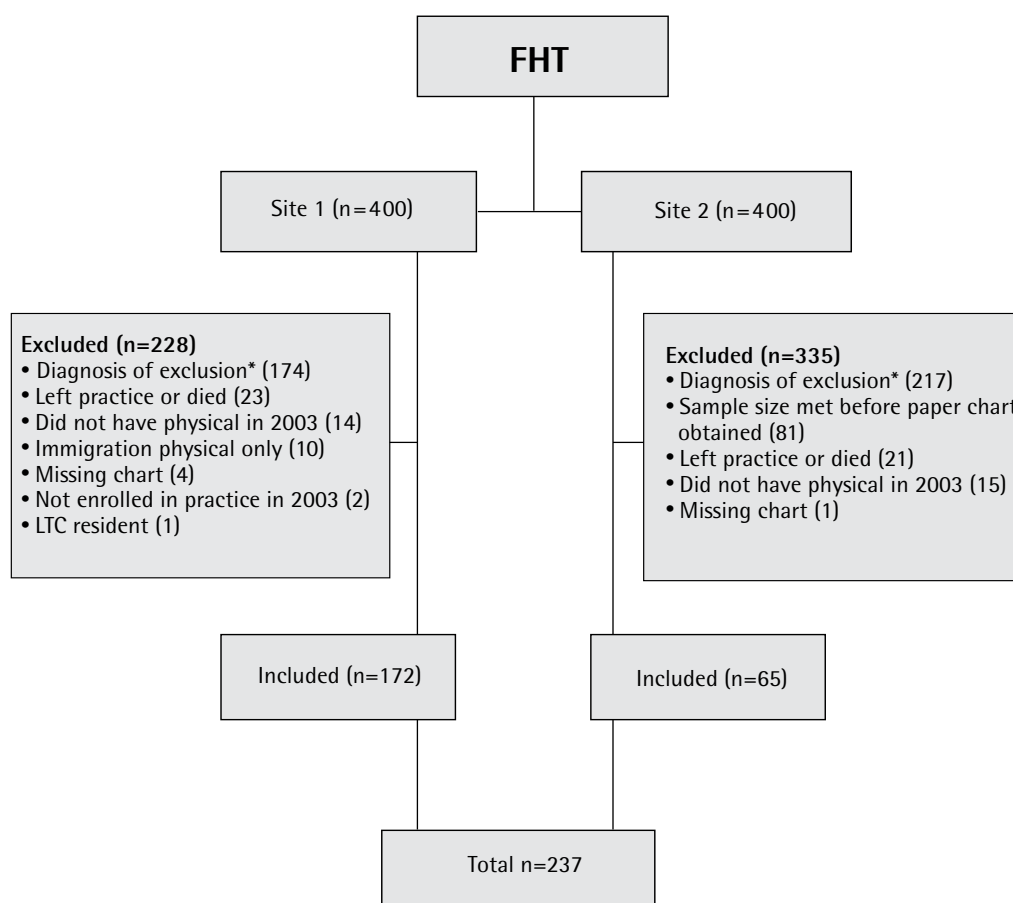


CVD—cardiovascular disease, FHT—family health team, LTC—long-term care.
*Those with disabilities preventing office visits or those previously diagnosed with CVD.

**Table 2.** Frequency of indicator variables and subsequent outcomes on patient charts: *N=237.*

| VARIABLE | ABSENT, N (%) | PRESENT, N (%) | MISSING, N (%) |
|---|---|---|---|
| Obesity indicator | 98 (41.35) | 139 (58.65) | NA |
| • Overweight or obese | 46 (19.41) | 93 (39.24) | 98 (41.35) |
| • Repeat measurements of the obesity indicator | 163 (68.78) | 74 (31.22) | NA |
| • Medium-term outcomes for the obesity indicator* | 144 (60.76) | 93 (39.24) | NA |
| Alcohol consumption indicator | 58 (24.47) | 179 (75.53) | NA |
| • Elevated alcohol intake | 146 (61.60) | 33 (13.92) | 58 (24.47) |
| • Repeat measurements of the alcohol consumption indicator | 152 (64.14) | 85 (35.86) | NA |
| • Medium-term outcomes for the alcohol consumption indicator* | 212 (90.45) | 25 (10.55) | NA |
| Smoking status indicator[†] | 35 (14.77) | 202 (85.23) | NA |
| • Repeat measurements of the smoking status indicator | 119 (50.21) | 118 (49.79) | NA |
| Smoking cessation indicator[‡] | 10 (25.64) | 29 (74.36) | NA |
| • Repeat measurements for the smoking cessation indicator[‡] | 24 (61.54) | 15 (38.46) | NA |
| • Medium-term outcomes for the smoking cessation indicator*[‡] | 9 (23.08) | 30 (76.92) | NA |
| T2DM indicator | 87 (36.71) | 150 (63.29) | NA |
| • Abnormal fasting plasma glucose | 139 (58.65) | 11 (4.64) | 87 (36.71) |
| • Repeat measurements for the T2DM indicator | 153 (64.56) | 84 (35.44) | NA |
| • Medium-term outcomes for the T2DM indicator* | 143 (60.34) | 94 (39.66) | NA |
| Cholesterol indicator | 41 (17.30) | 196 (82.70) | NA |
| • Abnormal serum cholesterol levels | 174 (73.42) | 22 (9.28) | 41 (17.30) |
| • Repeat measurements of the cholesterol indicator | 102 (43.04) | 135 (56.96) | NA |
| • Medium-term outcomes for the cholesterol indicator* | 138 (58.23) | 99 (41.77) | NA |
| BP indicator | 51 (21.52) | 186 (78.48) | NA |
| • Repeat measurements of the BP indicator | 91 (38.40) | 146 (61.60) | NA |
| • Medium-term outcomes for the BP indicator* | 141 (59.49) | 96 (40.51) | NA |
| Elevated BP at the 2003 annual physical examination | 184 (77.64) | 40 (16.88) | 13 (5.49) |
| • Follow-up of elevated BP indicator | 30 (75.00) | 10 (25.00) | NA |
| Global risk indicator | 175 (73.84) | 62 (26.16) | NA |
| • Elevated global risk assessment | 39 (16.46) | 23 (9.70) | 175 (73.84) |
| • Repeat measurements of the global risk indicator | 215 (90.72) | 22 (9.28) | NA |

BP—blood pressure, NA—not applicable, T2DM—type 2 diabetes mellitus.
*Positive behavioural change on the part of patients or physicians after indicator was initially collected.
[†]Of the 237 participants, 163 were non- or ex-smokers, 39 were current smokers, and 35 did not have the data available on their charts.
[‡]Current smokers only.

Measurement of obesity differed significantly by site (2-sided Fisher exact test, *P*<.0001). Additionally, the sites also differed in the same direction when using global risk assessment tools (2-sided Fisher exact test, *P*=.012). None of the other indicators showed statistically significant differences by site.

## Short-term outcomes (repeated measure of indicators)

**Table 3** shows the relationship between the collection of an indicator and the number of subsequent times the same indicator was collected. Only collection of the excess alcohol consumption variable significantly predicted subsequent collection (*P*=.0091)—if the excess alcohol consumption variable was collected once, the mean number of times it was collected thereafter increased by 52%. The analysis was adjusted for patient age, sex, and FHT site. Age significantly predicted the number of times cholesterol and blood pressure were repeatedly checked (*P*=.0074 and *P*=.0077, respectively). An "indicator" variable that would predict the subsequent collection of any variable did not emerge. The models were not overdispersed, suggesting the Poisson model was appropriate for these data. Low variance inflation factors suggested that multicollinearity was not a problem.

**Table 3. Association between presence of an indicator variable and repeat measurements of the same indicator**

| VARIABLE | N* | ADJUSTED REGRESSION† PARAMETER ESTIMATE (95% CI)† | P VALUE |
|---|---|---|---|
| Obesity | 35 | 1.46 (1.33–2.85) | .27 |
| Excess alcohol consumption | 35 | 0.48 (0.28–0.84) | .0091 |
| Smoking status | 35 | 0.64 (0.36–1.14) | .1382 |
| Elevated fasting glucose | 35 | 1.27 (0.34–4.76) | .7275 |
| Elevated cholesterol§ | 35 | 0.84 (0.46–1.49) | .5427 |
| Elevated BP‖ | 35 | 0.97 (0.55–1.73) | .9280 |
| Elevated global risk | 35 | 0.49 (0.10–2.53) | .3689 |

BP—blood pressure, CI—confidence interval.
*Includes only those patients for whom an indicator was ever measured.
†Poisson regression adjusted for age, sex, and family health team site.
‡Parameter estimates are the ratio of the mean number of times the variable was collected if it had been initially collected to the mean number of times when it was not initially collected.
§Age was a significant predictor (1.46 [1.01 to 1.06], P=.0074).
‖Age was a significant predictor (1.03 [1.01 to 1.07], P=.0077).

## Medium–term outcomes (behavioural changes in health care providers and patients)

Table 4 shows the relationship between the collection of an indicator and whether or not patients made behavioural changes or physicians made recommendations related to CVD prevention. Analyses were adjusted for age, sex, and FHT site. Initially, we attempted to adjust for abnormality of the indicator. However, collinearity was a substantial problem. The smoking cessation indicator was excluded from the analysis owing to an insufficient sample size (n=39). Generally, the collection of these indicators was significantly associated with behavioural changes related to CVD prevention on the part of the patients or physicians. Collection of the alcohol consumption indicator showed the highest odds ratio (9.51, 95% confidence interval [CI] 1.25 to 72.46) for subsequent behavioural change on the part of either the patient or the physician to encourage a decrease in alcohol consumption. The only indicator to not reach statistical significance was the cholesterol indicator (odds ratio 2.71, 95% CI

1.23 to 5.96, P=.08). Low variance inflation factors suggested that multicollinearity was not a problem with these data.

## DISCUSSION

This study demonstrates that it is feasible to collect the 9 quality indicators for the primary prevention of CVD in an urban family practice that uses an EMR. With the exception of the global risk indicator and the follow-up for elevated BP indicator, all of the indicators were noted in the EMRs for more than 50% of the study population. Disappointingly, the presence of a quality indicator did not consistently predict the repeated collection of the same quality indicator. However, it was very encouraging that the collection of the obesity, alcohol consumption, T2DM, and BP indicators predicted documented behavioural change or advice on the part of the patient or physician to prevent CVD.

This is the first published study looking at the feasibility and usefulness of the quality indicators described by Burge and colleagues.[7] We hypothesized that collecting an indicator once would prompt providers to remeasure the same indicator, especially in the setting of an abnormal measurement. We also hypothesized that the collection of indicators, especially if measurements were abnormal, would prompt physicians to recommend behavioural changes to patients or prompt patients to undertake relevant measures to lower their risk of CVD. Our findings suggest that the collection of some of these indicators encouraged patients to make or physicians to suggest behavioural changes to improve cardiovascular health. Possible explanations for the lack of some observed associations include the following: the possibility that these were not valid quality indicators for CVD prevention; the short-term outcome we aimed to measure (ie, subsequent indicator collection) was not a valid surrogate outcome for CVD morbidity and mortality; inadequate documentation of outcomes by health care providers meant that patients might not have returned for appropriate follow-up care, making the subsequent collection of indicators impossible; or the primary care teams were not functioning proactively to integrate

**Table 4. Odds of patient or physician behavioural change if an indicator was collected**

| VARIABLE | QUALITY INDICATOR | | | ADJUSTED ANALYSIS* | | |
|---|---|---|---|---|---|---|
| | N | OR (95% CI) | P VALUE | N | OR (95% CI) | P VALUE |
| Obesity indicator | 237 | 2.58 (1.47–4.50) | .0009 | 139 | 2.62 (1.39–4.93) | .0185 |
| Alcohol consumption indicator | 237 | 8.83 (1.17–66.75) | .0349 | 179 | 9.51 (1.25–72.46) | .0117 |
| T2DM indicator | 237 | 2.50 (1.41–4.44) | .0018 | 150 | 2.60 (1.45–4.68) | .0082 |
| Cholesterol indicator | 237 | 2.58 (1.20–5.55) | .0154 | 196 | 2.71 (1.23–5.96) | .0817 |
| BP indicator | 237 | 3.06 (1.48–6.33) | .0026 | 224 | 3.09 (1.45–6.57) | .0082 |

BP—blood pressure, CI—confidence interval, OR—odds ratio, T2DM—type 2 diabetes mellitus.
*Adjusted for age, sex, and family health team site

measurement and follow-up of CVD quality indicators as part of routine clinical practice.

This study has important implications for primary care. The results show that physicians incorporate Canadian guidelines into annual health examinations, and that some of these indicators prompt changes in behaviour on the part of both physicians and patients with respect to primary prevention of CVD. Lack of behavioural change with the cholesterol indicator could be due to patient, practice, or physician factors. However, this study is unable to identify which factors are the main contributors to the problem. As physicians continue to perform annual health examinations, it is essential to develop evidence-informed practices that result in positive outcomes.

## Strengths and limitations

Strengths of this study include the use of quality indicators that are in keeping with clinical practice guidelines for primary care used by physicians in Canada. Most of the indicators described are items routinely collected during annual health examinations. Therefore, large changes to practice would not be required to leverage these indicators. We used a large, 2-site, urban, group family practice in Ontario for this study. With an increasing number of FHTs in Ontario, and other similar groups in Canada, this study is generalizable to many primary care practices. Limitations of the study include the use of a single EMR—the feasibility of collecting these indicators in paper-based offices was not determined. Unfortunately, we were unable to adjust for abnormality of the indicators owing to collinearity problems. We suspect that if indicators were abnormal, this might have prompted physicians to alter their practices. We also had difficulties in obtaining paper charts from site 2, which were stored off-site. Thus, our sample has more charts from site 1. While it is possible that bias might have been introduced by having more charts from site 1 than site 2, we believe this is unlikely, as the 2 sites are in the same academic family medicine department, colleagues between the sites frequently interact, and the EMR and many other processes between the sites are similar.

## Conclusion

Future research should look at comparing the collection of these quality indicators with long-term CVD morbidity and mortality. Further study should also verify the feasibility of collecting these indicators in settings with paper-based patient records. Finally, standardized forms and reminder systems might increase the collection of quality indicators in primary care practice. ✿

**Dr Hopkins** is a fifth-year resident in the Community Medicine Residency Program at McMaster University in Hamilton, Ont. **Dr Agarwal** is an Assistant Professor in the Department of Family Medicine at McMaster University. **Dr Dolovich** is Research Director and an Associate Professor in the Department of Family Medicine at McMaster University and a scientist and Associate Director at the Centre for Evaluation of Medicines of St Joseph's Healthcare in Hamilton.

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