Diabetes Management in Canada: Baseline Results of the Group Practice Diabetes Management Study

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ABSTRACT

BACKGROUND

There exists a considerable gap between best practice as recommended by diabetes guidelines and actual practice. The objective of this study was to determine the level of care being provided to patients with type 2 diabetes by family physicians in group practices in 4 regions of Canada.

METHODS

Baseline characteristics from a cluster-randomized trial using chart audits were recorded to assess glycemic control and rates of physician adherence to guidelines-recommended practice. Intracluster correlation coefficients (ICCs) were calculated using the physician practice as the cluster.

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RÉSUMÉ

GÉNÉRALITÉS

Il existe un écart considérable entre les meilleures pratiques selon les lignes directrices pour la prévention et le traitement du diabète et les pratiques réelles. L'objectif de cette étude était de déterminer le niveau des soins prodigués aux patients atteints de diabète de type 2 par des médecins de famille en exercice collectif dans 4 régions du Canada.

PLAN ET MÉTHODES

Dans le cadre d'un essai randomisé par grappes, on a examiné des dossiers médicaux pour évaluer le contrôle de la glycémie et le degré d'adhésion des médecins aux pratiques recommandées dans les lignes directrices. Pour le calcul des coefficients de corrélation intragrappe (CCI), la grappe était l'exercice de chaque médecin.

RÉSULTATS

Cinquante-six médecins de 16 exercices collectifs ont fourni 549 dossiers. L'hémoglobine glycosylée (HbA1c) avait été mesurée chez 71,8 % des patients (moyenne : 7,7 %). Un total de 82,3 % des patients avaient reçu des antihyperglycémiants, mais l'HbA_{1c} n'avait baissé sous 7,0 % que chez 35,3 % d'entre eux. La pression sanguine avait été notée dans 92,7 % des dossiers (moyenne : 139/79 mm Hg). Des antihypertenseurs avaient été prescrits à 58,1 % des patients, mais la pression sanguine était inférieure à 130/85 mm Hg chez seulement 20,0 % d'entre eux. Un bilan lipidique avait été effectué chez 62,3 % des patients. Le pourcentage des patients qui avaient atteint l'objectif était de 83,9 % pour le cholestérol des lipoprotéines de basse densité, de 38,3 % pour les triglycérides et de 76,2 % pour le rapport

RESULTS

Fifty-six physicians in 16 group practices provided 549 charts. Glycosylated hemoglobin (A1C) was measured in 71.8% of patients (mean: 7.7%). A total of 82.3% received antihyperglycemic medication, but only 35.3% achieved an A1C <7.0%. Blood pressure (BP) results were documented in 92.7% of charts (mean: 139/79 mm Hg). While 58.1% of patients received antihypertensive medications, only 20.0% had BP <130/85 mm Hg. Lipid profiles were documented in 62.3% of patients. The percentage of patients achieving lipid targets was 83.9% for low-density lipoprotein cholesterol, 38.3% for triglycerides and 76.2% for total cholesterol to high-density lipoprotein cholesterol ratio. Lipid-lowering agents and acetylsalicylic acid were prescribed for 19.7% and 22.4% of patients, respectively. Only 17.5% of patients had a 24-hour urine/albumin to creatinine ratio, 32.1% had a dilated eye exam, 20.0% had a peripheral neuropathy exam and 25.9% had a foot exam. Patient outcome ICCs ranged from 0 to 0.14, while physician process ICCs ranged from 0 to 0.57.

INTERPRETATION

Despite high rates of screening for glycemia and macrovascular complications, treatment was not sufficiently intensive for most patients. Family physicians performed poorly in microvascular complication screening.

cholestérol total:cholestérol des lipoprotéines de haute densité. Des hypolipidémiants et l'AAS avaient été prescrits à 19,7 % et 22,4 % des patients, respectivement. Le rapport albumine:créatinine fondé sur des échantillons d'urine recueillis sur 24 heures n'avait été établi que chez 17,5 % des patients, 32,1 % des patients avaient subi un examen par les pupilles dilatées, 20,0%, un dépistage de la neuropathie périphérique et 25,9 %, un examen des pieds. Les CCI pour le devenir des patients étaient de 0 à 0,14 et les CCI pour les pratiques des médecins étaient de 0 à 0,57.

INTERPRÉTATION

Même si les épreuves de glycémie et les examens de dépistage des complications macrovasculaires avaient été courants, le traitement n'avait pas été assez énergique chez la plupart des patients. Les médecins de famille n'avaient pas fait suffisamment d'examens de dépistage des complications microvasculaires.

INTRODUCTION

The vast majority of patients with type 2 diabetes in Canada are followed exclusively by their family physicians (FPs) (1). Three sets of Canadian diabetes clinical practice guidelines have been published since 1992, the most recent 2 sets being evidence-based (2-4). Research, however, has demonstrated relatively poor adherence to guidelines in family practice settings (5,6). In addition, many patients are not achieving the clinical targets recommended by these guidelines (6-10).

This paper reports on the baseline chart audit findings of a large cluster-randomized, controlled trial that investigated the effect of an innovative continuing medical education intervention on FP management of type 2 diabetes in 4 distinct and geographically disparate regions of Canada, comprising both urban and rural practices. While previous diabetes audit data have, for the most part, been derived from small or regional studies, these baseline results provide a "snapshot" of care being provided in a number of practice locations and settings across the country. The results of the randomized, controlled trial will be reported separately.

METHODS

Participants

The study was carried out in St. John's, Newfoundland; Montreal, Quebec; London, Ontario; and Calgary, Alberta. Within each region, eligible FP group practices (non-academic, with 3 to 6 eligible physicians) were identified using physician resource databases, telephone directories, local academies of medicine or the provincial licensing authority. Eligible practices were listed and randomized. The FP site investigator contacted eligible practices according to the order of the randomized list and peer-recruited the first 4 group practices that agreed to participate. In order for a group practice to be eligible, the majority of the physician members of the group had to be eligible and consent to participate. Physician eligibility criteria included the following: 1) being a member of an eligible group practice; 2) practicing ≥20 hours per week; and 3) treating patients with type 2 diabetes.

Each physician in the selected practices generated a billing list of all active patients with International Classification of Disease 1989 billing code 250 (identifying patients with type 2 diabetes) seen in the previous 12-month period. Physicians reviewed the lists for eligible patients. Patient eligibility criteria included the following: 1) diagnosis of type 2 diabetes with a duration of at least 2 years; 2) seen at least once by their physician from 1998 to 1999; 3) ≥18 years of age; 4) no pregnancy within the preceding 2 years; and 5) competent to consent. Ineligible patients or those who had moved or died were removed from the list. A maximum of 30 eligible patients per physician were then randomly selected by the researchers. Physicians were asked to confirm that each selected patient

was still active in the practice and met the eligibility criteria. Eligible patients were sent a letter signed by the physician describing the project and requesting consent for a chart audit. Consenting patients were listed, and of these, 10 patient charts per physician were randomly selected. Physicians were blinded to consenting and participating patients.

Measures

The primary measure was glycemic control as measured by glycosylated hemoglobin (A1C). Secondary variables were rates of adherence to diabetes management behaviours (screening for microvascular and macrovascular complications) as recommended by Canadian guidelines (3). Other extracted variables were comorbidity as diagnosed and documented by the physician (hypertension, dyslipidemia, retinopathy, nephropathy and neuropathy); most recent blood pressure (BP) and lipid values (based on local laboratory standards); medications for diabetes, hypertension and dyslipidemia; number of office visits; diabetes education since diagnosis; specialist visits; use of flow sheet in chart; patient date of birth, sex and date of type 2 diabetes diagnosis. Physician variables captured included practice location/setting, gender, years in practice and certificant status with the College of Family Physicians of Canada (CFPC).

Data collection and analysis

The baseline time frame was defined as February 1, 1998, to February 1, 1999. In each region, a trained research associate abstracted charts and entered data directly onto a laptop computer at practice locations. Adherence to a given clinical practice guideline recommendation was documented only when a supporting notation was in the chart.

This paper reports on the baseline characteristics from a cluster-randomized trial involving 56 family practices and 10 patient charts per physician. Physician demographic data were summarized using proportions and means. Patient demographic and audit data were also summarized using proportions and means, as well as intraclass (intracluster) correlation coefficients (ICC), with the physician's practice as the cluster. As the ICC is a measure of "the degree of similarity among responses within a cluster" (11), these values measure the similarity of responses within the physician's practice. ICC values computed as negative are reported as zero on the grounds that negative values are not considered plausible in cluster-randomized trials, and that these observed negative values were thought to be attributable to chance. Data were analyzed using SAS® software, version 8.2, Toronto, Ontario, Canada).

RESULTS

Participants

Of 98 identified eligible group practices, 16 were recruited (16%)—4 in Newfoundland, 3 in Quebec, 5 in Ontario and 4 in Alberta—with a total of 56 individual physicians. The mean patient consent rate per physician was 56.5%. A total of 549 charts were audited, with a mean of 9.8 charts per physician. Tables 1 and 2 provide group practice, physician and patient characteristics.

Chart audit

The mean number of patient visits per physician over the 1-year time period was 8.3 (ICC: 0.16), of which 47% had documentation for diabetes care (median: 3.0; mean: 3.9; ICC: 0.25). Since diagnosis, 64.8% (ICC: 0.15) had received some diabetes education, and 46.6% (ICC: 0.077) had at least 1 referral to a diabetes specialist (internist or endocrinologist). During the baseline audit period, 21.1% (ICC: 0.086) had visited a specialist at least once. A diabetes flow sheet was used in 1.1% (ICC: 0.026) of charts.

Table 1. Group practice and physician characteristics

Characteristic	*Value*
Group practice (N=16)	
Mean number of consenting physician partners (median; range)	3.5 (3; 3–5)
Mean time group established with current partners, years (median; range)	9.2 (8.5; 2–22)
Practice location, number (%)	
Rural	5 (31.3)
Semi-urban	2 (12.5)
Urban	9 (56.3)
Physician (N=56)	
Female, %	35.7
Certified with CFPC*, %	60.0
Mean age*, years (median; range)	45.4 (46; 30–80)
Mean time since graduation*, years (median; range)	17.3 (17; 2–56)
Mean time as physician partner, years (median; range)	11.9 (11; 1–29)

*As 1 physician did not complete the demographic questionnaire, the calculations for certificant status, mean age and mean time since graduation were performed on a sample size of 55.

CFPC = College of Family Physicians of Canada

Table 2. Patient characteristics

Characteristic (N=435)	*Value*
Female, %	51.7
Mean age at diagnosis, years (median; range)	54.1 (53.7; 21–86)
Mean age at audit, years (median; range)	64.2 (65; 27–92)
Mean duration of diabetes, years (median; range)	9.4 (7.3; 2–39.3)

Table 3 summarizes glycemic control measures and management strategies. A1C was measured in 71.8% of patients, with a mean value of 7.7%. Fasting plasma glucose was measured in 39.0% of patients, with a mean value of 9.1 mmol/L. A minority of patients (17.7%) were being treated with lifestyle only. Of the remaining patients, 67.6% were on oral agents only, while 10.9% were prescribed insulin alone and 3.8% took insulin in combination with an oral agent(s). In terms of counselling, documentation for diet was noted in 44.1% of charts, exercise in 28.4%, hypoglycemia in 10.7% and treatment plan in 60.3%.

Secondary analysis revealed that, when categorized according to Canadian 1998 clinical practice guideline glycemic targets (3), 35.3% (ICC: 0.030) of patients were identified as having ideal/optimal control (A1C <7.0%), 38.9% (ICC: 0.00026) as having suboptimal control (A1C 7.0 to 8.4%) and 25.8% (ICC: 0.022) as having inadequate control (A1C >8.4%).

Table 3. Glycemic control, monitoring and management

Measure	*Value*	*ICC*
Glycemic screening and control		
A1C tested once, % of patients	71.8	0.22
Mean A1C, %	7.7	0.036
FPG tested, % of patients	39.0	0.21
Mean FPG, mmol/L	9.1	0.066
Glycemic management strategies		
Lifestyle only, % of patients	17.7	0.57
Oral agents only, % of patients	67.6	0.023
Of patients on oral agents*:		
1 oral agent, % of patients	55.3	0.013
2 oral agents, % of patients	43.2	0.0018
3 oral agents, % of patients	1.5	0
Insulin only, % of patients	10.9	0.046
Insulin + oral agent(s), % of patients	3.8	0.01
Counselling		
Diet, % of patients	44.1	0.15
Exercise, % of patients	28.4	0.18
Hypoglycemia, % of patients	10.7	0.08
Treatment plan, % of patients	60.3	0.36

*392 patients were prescribed oral agents; however, there were missing data in the charts of 3 patients. Analysis was therefore performed on n=389

A1C = glycosylated hemoglobin
FPG = fasting plasma glucose
ICC = intracluster correlation coefficient

Table 4 summarizes the diagnosis of diabetes-related comorbidities and complications in the patient sample. Almost two-thirds of patients had hypertension (64.3%), and 38.1% had dyslipidemia. In terms of microvascular complications, 7.7% had retinopathy, 2.7% had nephropathy and 9.7% had neuropathy.

Table 5 summarizes results for screening and management of risk factors for complications of diabetes. In terms of macrovascular complications, the vast majority (92.7%) of charts had documentation for BP measurement, with a mean value of 139/79 mm Hg; 20.0% (ICC: 0.014) met the BP target of <130/85 mm Hg. Antihypertensive medications were prescribed for 58.1% (ICC: 0.01) of patients. A lipid profile was ordered for 62.3% of patients. The 1998 lipid targets varied according to the number of major cardiovascular risk factors present in addition to diabetes (3). Of the total, 83.9% (ICC: 0) met the low-density lipoprotein cholesterol (LDL-C) target of <4.0 mmol/L, 38.3% (ICC: 0.041) achieved the triglyceride (TG) target of <2.0 mmol/L and 76.2% (ICC: 0.014) achieved the total cholesterol (TC):high-density lipoprotein cholesterol (HDL-C) target of <6.0. Lipid-lowering agents and acetylsalicylic acid (ASA) were prescribed for 19.7% (ICC: 0.02) and 22.4% (ICC: 0.084) of patients (without contraindications), respectively.

In terms of microvascular screening rates, 17.5% of patients were tested for microalbuminuria, 32.1% had a dilated eye exam and 25.9% had a foot exam.

INTERPRETATION

This large Canadian study examined diabetes care in primary care settings in 4 geographically distinct and disparate regions of the country. Patients visited their FP on average 8 times in a 12-month period, confirming earlier reports that FPs have numerous opportunities to perform the monitoring and screening recommended by diabetes guidelines (6,7). However, screening recommendations were inconsistently implemented, and management strategies fell short of optimal care. While smaller regional studies have also indicated that there is room for improvement (6,7), this study has provided evidence that suboptimal diabetes management is a

Table 4. Prevalence of diabetes-related comorbidities and complications

Diagnosis	*% of patients*	*ICC*
Hypertension	64.3	0.035
Dyslipidemia	38.1	0.16
Retinopathy	7.7	0.016
Nephropathy	2.7	0.025
Neuropathy	9.7	0.006

ICC = intracluster correlation coefficient

problem that is national in scope. While access to FPs and specialists varies widely, this study indicates that improvements to care are indicated regardless of geographic setting.

Glycemic control

Evaluation and treatment of hyperglycemia

Of the total number of patients, 71.8% had at least 1 documented A1C test during the audit period. Similar findings were reported by Beaton (10), who found that in a 2-year period, 77% of patients had 1 or more A1C tests, and Harris (6), who reported that 84% had 1 A1C test within a 1-year period. Patients had a mean A1C of 7.7%, consistent with other Canadian studies of patients with type 2 diabetes in family practice settings (6,12,13). Only 35.3% of patients in this study achieved an "ideal/optimal" A1C <7.0%. Recent guidelines (4) encourage early and aggressive use of combination therapy to achieve glycemic targets. Most patients (82.3%) were receiving oral agents for their diabetes, but few of these patients were on combination therapy (43.2% were prescribed 2 oral agents, 1.5% were prescribed 3). Insulin was infrequently prescribed, with 10.9% of patients using insulin alone and only 3.8% using insulin in combination with oral agent(s). Treatment intensification would be indicated in the majority of these patients.

Table 5. Screening for risk factors for complications

Clinical activity	*Value*	*ICC*
BP results documented, %	92.7	0.084
Mean BP, mm Hg		
Systolic:	139	0.061
Diastolic:	79	0.017
Lipid profile obtained, %	62.3	0.11
Mean triglycerides, mmol/L (n=264)	2.7	0.013
Mean total cholesterol, mmol/L (n=306)	5.3	0
Mean HDL-C, mmol/L (n=235)	1.1	0.14
Mean LDL-C, mmol/L (n=211)	3.0	0
Dipstick urine or urinalysis obtained, %	35.7	0.17
24-hour urine or ACR obtained, %	17.5	0.24
Examination of fundi via dilated pupils by expert within past 2 years, %	32.1	0.069
Type of eye expert, %		
Ophthalmologist:	0.4	0.23
Optometrist:	92.5	0.15
Exam for peripheral neuropathy, %	20.0	0.18
Foot exam, %	25.9	0.12

ACR = albumin-to-creatinine ratio
BP = blood pressure
ICC = intracluster correlation coefficient
HDL-C = high-density lipoprotein cholesterol
LDL-C = low-density lipoprotein cholesterol

Macrovascular complication screening

BP measurement and treatment

Physicians did an excellent job of measuring BP (92.7% of patients had documented BP measurements). Indeed, other studies confirm that BP measurement appears to have been systematically incorporated into routine care (6,7,10). Patients had a mean BP of 139/79 mm Hg—close to the 1998 recommended target of ≤130/85 mm Hg—yet only 20.0% of patients actually achieved that target. The majority (58.1%) was receiving antihypertensive medications, but the intensity of management was frequently insufficient. The results are echoed by Toth (8), who found 46% achieved the BP target <130/85 mm Hg; Beaton, who reported that only 29% achieved the BP target of <130/80 mm Hg (10); and del Cañizo-Gómez (14), who found that 72% achieved target diastolic BP <80 mm Hg, but only 27% achieved target systolic BP <130 mm Hg.

Lipid measurement and treatment

Lipid screening was ordered in the majority of patients (62.3%). With the exception of TGs, lipids were well managed. In terms of achieving the 1998 guideline lipid targets, 83.9% achieved the LDL-C target of <4.0 mmol/L, 76.2% achieved the TC:HDL-C target of <6.0, but only 38.3% achieved the TG target of <2.0 mmol/L (3). Recent lipid targets are much lower (4), and evidence suggests that these stringent targets are much more difficult to achieve. For example, in Beaton's study, only 23% of patients achieved the LDL-C target of <2.6 mmol/L (10), while both Toth and del Cañizo-Gómez reported that only 41% achieved that target (8,14).

Antiplatelet therapy

Despite guideline recommendations that ASA be prescribed as a primary prevention measure for all high-risk patients with diabetes and as a secondary prevention strategy in patients with diabetes and large-vessel disease (3,4), it was prescribed for a mere 22.4% of patients without contraindications—similar to findings reported by other authors (8,10).

Microvascular complications screening

FPs did not perform as well in microvascular screening. This is disconcerting, in that renal disease, retinopathy, neuropathy and foot problems impact negatively on quality of life. The finding that these manoeuvres have not yet been incorporated into routine diabetes care in the FP setting is

surprising, given that screening for these complications involves relatively simple and quick physical exams or routine laboratory work.

Nephropathy screening

The finding that only 17.5% had documentation of a 24-hour urine or albumin -to -creatinine ratio test suggests that FPs may not fully appreciate the importance of microalbuminuria as a potent predictor of nephropathy, an independent risk factor for cardiovascular disease and a powerful predictor of mortality (4). Other studies in primary settings have documented nephropathy screening rates that range from 2 to 28% (6,15).

Retinopathy screening

The low rates of documentation for dilated eye exam (32.1%) may reflect poor access to specialists, or it may be that patients sought care without consultation and results were not communicated to FPs. However, if this rate is accurate, it falls well short of optimal. It is also considerably lower than the rate of 47% (within the preceding 2 years) seen in a Canadian study (6), and 52% and 63% (within the preceding 1 year) in 2 American population-based cross-sectional surveys (16,17).

Neuropathy screening

A simple foot exam has been shown to significantly reduce the rate of amputation (4), yet with only 25.9% of FPs reporting foot exams and only 20.0% examining for peripheral neuropathy, many patients are vulnerable to the development foot of ulcerations and their sequelae.

ICC values

One of the unique contributions of the study is the inclusion of ICC values—the statistical measure of a clustering effect. Cluster-randomized designs are being increasingly used in healthcare research, and researchers need an understanding of the implications of these designs. This is especially true in guideline implementation studies, where the issue of ensuring adequate power is critical (18). While researchers in primary care require published data on ICCs, they are rarely reported (18). An ICC value for a given outcome reflects the amount of variation in the data that can be explained by variability between clusters (18). An ICC of 1 indicates complete agreement between the responses within a given cluster (11). Published process variables in primary care have ranged from 0.05 to 0.15, while ICCs for patient outcomes are <0.05 (18). Patient outcome ICCs in this study ranged from 0 (TC, mean LDL-C) to 0.14 (HDL-C), while physician process ICCs ranged from 0 (prescription of 3 oral agents) to 0.57 (documentation of lifestyle counselling). ICCs were generally higher for variables most affected by physician practice style (i.e. screening for microvascular and macrovascular complications and management strategies).

This variation may be explained by the greater biologic variability related to patient outcomes than to physician behaviours. For example, although physicians may be consistent in the way they manage a particular problem, patients are likely to vary in their responses to that management (18). Interestingly, the low ICC value of 0.026 for use of a flow sheet indicates that individual FPs were inconsistent in their use of flow sheets from one patient to another. This reflects the challenges involved in introducing even simple organizational systems like flow sheets in the busy family practice setting.

Strengths and weaknesses

A strength of this study is that data were collected from 4 widespread regions of Canada, comprising both rural and urban practices. The findings expand the diabetes audit literature, especially in Canada, which for the most part is limited to small or regional studies. In addition, the random selection of both physician group practice and patients adds to the generalizability of the findings. The group practice participation rate of 16% is primarily due to the exclusion of numerous groups based on the stringent eligibility criterion that consent was required from the majority of the group practice members in order for that group to participate. In addition, one region experienced more difficulty in recruitment than the others, which lowered the overall recruitment rate (Calgary 8% vs. Montreal 21.4%, Newfoundland 16.8% and London 50%). The participating physicians were comparable to the CFPC database with respect to age and gender (19); however, fewer physicians held CFPC certificant status (60% in this study vs. 82% in the CFPC database). While participants were randomly recruited, their consent represents a participation bias that could indicate a special interest in diabetes, potentially affecting the results. Chart audit may not reflect care provided by previous or other physicians involved in a patient's care and underestimate some aspects of practice, especially physical examination and counselling behaviours (20), the use of over-the-counter medications such as ASA and eye examination by optometrists.

CONCLUSION

This large Canadian study is one of the first to offer a "national" perspective on diabetes management. While the existing Canada audit literature has offered snapshots of care at local and regional levels, this large study is the first to confirm that the gap between optimal and ideal care is consistent across regions and provinces, and in urban vs. rural settings. The FPs in this study performed relatively well in terms of screening for macrovascular disease, but there were significant gaps in their screening for microvascular disease. They also performed relatively well in screening for risk factors of the macrovascular complications of diabetes, but fell short of appropriately managing hypertension and dyslipidemia. In addition, antiplatelet therapy was under-prescribed in this high-risk population.

There is evidence that treatment needs to be intensified in many patients to achieve guideline-recommended targets for blood glucose, BP and lipids, and to prevent future complications. These results highlight the fact that screening and management practices are often not related; high rates of screening do not necessarily mean that the condition will be adequately managed. While screening remains a crucial part of diabetes care, it is the optimal management of risk factors that will lead to a reduction in complications.

The results of this baseline chart audit help to clarify areas of practice and physician behaviours that should be targeted by continuing medical education to help FPs better apply clinical practice guidelines in practice. Innovative strategies to overcome documented barriers (6) to implementation of guideline recommendations are required to effect the changes in physician behaviour needed to improve patient outcomes.

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ETHICS APPROVAL

The study protocol was approved by the University of Western Ontario Research Ethics Board for the Review of Health Sciences Research Involving Human Subjects and Ethics Review Boards at each provincial site.

AUTHOR DISCLOSURES

Drs. Harris and Macaulay received speaker's honoraria from Bayer Canada Inc., a co-sponsor of this study.

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