

Lifestyle management for type 2 diabetes

Are family physicians ready and willing?

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ABSTRACT

OBJECTIVE To determine practices and perceptions of family physicians regarding lifestyle interventions to prevent and manage type 2 diabetes (T2D).

DESIGN Confidential mailed survey.

SETTING Canadian family practices.

PARTICIPANTS Random, stratified sample of 1499 respondents to the 2001 National Family Physician Workforce Survey.

MAIN OUTCOME MEASURES Physicians' self-reported practice patterns and perceptions of lifestyle counseling for patients at risk for, and diagnosed with, T2D.

RESULTS Response rate was 53% (749/1410). Respondents frequently asked patients at risk for, or diagnosed with, T2D about physical activity and weight loss, but far fewer provided written advice, particularly about physical activity. Respondents thought counseling with such interventions as generic patient handouts was preferable to more intensive lifestyle management strategies, such as appointments to provide stage-matched counseling on physical activity. Most respondents thought family physicians should perform lifestyle interventions but realized they are confounded by such barriers as patients' lack of interest and limited referral resources.

CONCLUSION Family physicians keen to implement lifestyle interventions for T2D are hampered by barriers and use of ineffective strategies.

RÉSUMÉ

OBJECTIF Déterminer les pratiques et les perceptions des médecins de famille concernant les interventions sur le mode de vie pour prévenir et prendre en charge le diabète de type 2 (DT2).

CONCEPTION Un sondage confidentiel par la poste.

CONTEXTE Des pratiques familiales canadiennes.

PARTICIPANTS Un échantillon randomisé et stratifié de 1499 répondants au Sondage national sur les effectifs médicaux en médecine familiale 2001.

PRINCIPALES MESURES DES RÉSULTATS Les modes de pratique et les perceptions tels que signalés par les médecins concernant le counseling sur le mode de vie chez les patients à risque d'avoir un DT2 ou ayant reçu un tel diagnostic.

RÉSULTATS Le taux de réponse se situait à 53% (749/1410). Les répondants posaient fréquemment des questions aux patients à risque d'avoir un DT2 ou ayant reçu un tel diagnostic concernant l'activité physique et la perte de poids, mais ils étaient moins nombreux à donner des conseils par écrit, en particulier à propos de l'activité physique. Les répondants étaient d'avis que le counseling au moyen d'interventions comme la remise de documents génériques à l'intention des patients était préférable à des stratégies de prise en charge du mode de vie plus intensives comme des rendez-vous pour offrir un counseling sur l'activité physique adapté au cas. La plupart des répondants estimaient que les médecins de famille devraient pratiquer des interventions sur le mode de vie mais ils se rendaient compte qu'ils sont aux prises avec des barrières comme le manque d'intérêt des patients et les ressources limitées en ce qui a trait aux demandes de consultation.

CONCLUSION Les médecins de famille qui sont disposés à intervenir sur le mode de vie pour lutter contre le DT2 sont freinés par des obstacles et par l'utilisation de stratégies inefficaces.

This article has been peer reviewed.

Cet article a fait l'objet d'une évaluation externe.

Can Fam Physician 2004;50:1235-1243.

Type 2 diabetes (T2D) is a serious chronic illness that imposes a substantial social and economic burden in Canada. More than 2.25 million Canadians (>5% of the population) are estimated to have diabetes, 90% of which is T2D.¹ It is likely, however, that the true prevalence of diabetes is dramatically underestimated.²

Diabetes is a strong risk factor for cardiovascular disease and other complications that result in considerable morbidity and mortality.³ Family physicians (who care for 80% to 90% of patients with diabetes⁴ and see patients with T2D up to 9 times yearly⁵) are ideally placed to provide appropriate diabetes care and to implement screening measures to detect undiagnosed T2D and impaired glucose tolerance (IGT)* in patients presenting for routine care.⁶

Numerous studies have demonstrated that physical activity and dietary interventions improve glycemic control in patients diagnosed with T2D.^{7,8} These interventions can also delay and possibly

prevent onset of the disease in patients with identified IGT who are at risk.⁹⁻¹¹ The Diabetes Prevention Program, a large randomized controlled trial,⁹ clearly showed that participants with IGT who followed a program of physical activity and diet reduced their chances of developing T2D by 58% at 3-year follow-up assessment.

To date, few trials have investigated the effectiveness of lifestyle interventions for T2D patients in primary care.¹² While patients perceive family physicians as a trusted and preferred source of lifestyle counseling,¹³ implementing lifestyle interventions in practice is difficult. United States and UK studies of physicians' attitudes toward diabetes care have shown that several factors (such as the complexity of diabetes management, limited clinical resources, pessimism about the effectiveness of lifestyle interventions, and perceived lack of support for their efforts from the health care system and society as a whole) act as barriers to incorporating lifestyle counseling into primary care.^{4,14}

This study was designed to survey and assess the practices and perceptions of Canadian family physicians regarding lifestyle interventions for T2D prevention and management. This is the pivotal first step in creating educational and practice-based initiatives that will facilitate delivery of effective lifestyle interventions in primary care.

METHOD

Population setting and sample

A random sample of College of Family Physicians of Canada (CFPC) members who responded to a question from the 2001 National Family Physician Workforce Survey (NFPWS)¹⁵ about their reported use of "counseling about regular physical activity to patients for whom [it is] indicated." In the 2001 NFPWS, 87% of respondents reported offering this service to their patients frequently or very frequently.¹⁶

Investigators believed this number to overestimate the level of advice offered to patients in daily practice. As a result, our survey was designed to elicit more specific details about lifestyle counseling

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**Impaired glucose tolerance is defined as a "prediabetes" category: 2-hour postprandial glucose measurement is 7.8 to 11.0 mmol/L in response to a 75-g oral glucose tolerance test.²*

from a sample of physicians who responded to the 2001 NFPWS, specifically regarding their T2D patients—both diagnosed and at risk (Figure 1^{2,15}). Only physicians in full-time family practice (ie, $\geq 50\%$ of their practice is traditional family medicine, which would exclude those practising full-time emergency medicine or another specialty) were included in the survey. Results were weighted by geographic region, sex, and practice type.

Survey instrument

The Diabetes Lifestyle Intervention Survey was conducted by the CFPC and funded by Health Canada's Canadian Diabetes Strategy, Prevention and Promotion Contribution Program.

The five basic stages necessary in survey preparation¹⁷⁻²¹ were completed during summer 2002 and included translation of the survey into French. The survey contained four parts: parts 1 and 2 explored practice behaviours with patients at risk for T2D diabetes and patients diagnosed with T2D, respectively; part 3 explored general perceptions about lifestyle counseling in practice, and part 4 assessed sociodemographic characteristics of respondents. A modified version of the Dillman method²² was used for the survey mailing (all surveys had a unique identifier to facilitate repeat mailings to nonrespondents).

The initial sample consisted of 1499 CFPC NFPWS respondents from across all provinces in Canada. First mailing was in September 2002. Follow-up mailings to nonrespondents consisted of a reminder card at 5 weeks, a second survey mailing at 10 weeks, and a third survey mailing at 14 weeks. Eighty-nine of 1499 (59.4%) surveys returned were deemed ineligible, mainly due to practice focus changes by the closing date of January 31, 2003. In total, 749/1410 (53.1%) surveys were returned and available for analysis: 646/749 (86.2%) English and 73/749 (9.7%) French.

The survey had the power to represent those sampled with 80% confidence if at least 500 respondents replied to the survey (5×100 dependent variables = 500). Descriptive univariate and bivariate analysis was performed, noting statistical significance at the $< .05$ level using SPSS version 11.5.0.²³

RESULTS

Practice setting of respondents

Private offices or clinics were reported by 584/749 (78%) of respondents as the main settings in which they cared for patients: 4.5% reported academic teaching units and 4.4% reported community clinics or community health centres. Populations served by respondents' practices are presented in Figure 2: typical patient groups served were adults 19 to 64 y (98%), seniors 65 and older (90.8%), adolescents 13 to 18 y (84.2%) and children 12 y and younger (83.2%). The largest special group of patients served by respondents was geriatric patients (> 65 y) (70.1%), followed by patients with chronic illness (68.8%) and low-income earners (47.4%).

Sociodemographic characteristics of respondents

Median age of respondents was 44 years (mode=46, standard deviation=8.46, minimum=27 y, maximum=65 y). Median year of medical school graduation was 1984 (mode=1996, standard deviation=8.93, minimum=1961, maximum=2000). Just over half the 749 respondents were male (405, or 54.1%); 325 (43.4%) were female; 19 (2.5%) chose not to answer the question.

Respondents' efforts at prevention

Respondents reported higher numbers of patients at risk (median=25%) than diagnosed (median=10%) in their practices. When asked what prevention services *they* provided for patients at risk, most reported providing both physical activity counseling (652/749, or 87%) and diet and nutrition counseling (647/749, or 86.4%).

Respondents reported that they asked their patients at risk about physical activity levels nearly all the time (719/749, or 96%); similar numbers were reported for diagnosed patients (695/749, or 92.8%). When asked whether they "advised with written directions for a physical activity program," however, much lower numbers were reported for

Figure 1. Definitions used in diagnosis of type 2 diabetes: For national T2D lifestyle survey of CFPC members who responded to the 2001 National Family Physician Workforce Survey.¹⁵

Diagnosis of T2D (non-insulin-dependent diabetes)² is based on:

Symptoms of diabetes plus random blood glucose level of ≥ 11.1 mmol/L (two readings)

OR

Blood glucose by FPG of ≥ 7.0 mmol/L or greater (two readings)

OR

Blood glucose by OGTT of ≥ 11.1 mmol/L at 2 hours with a 75-g OGTT

At risk for T2D category is based on:

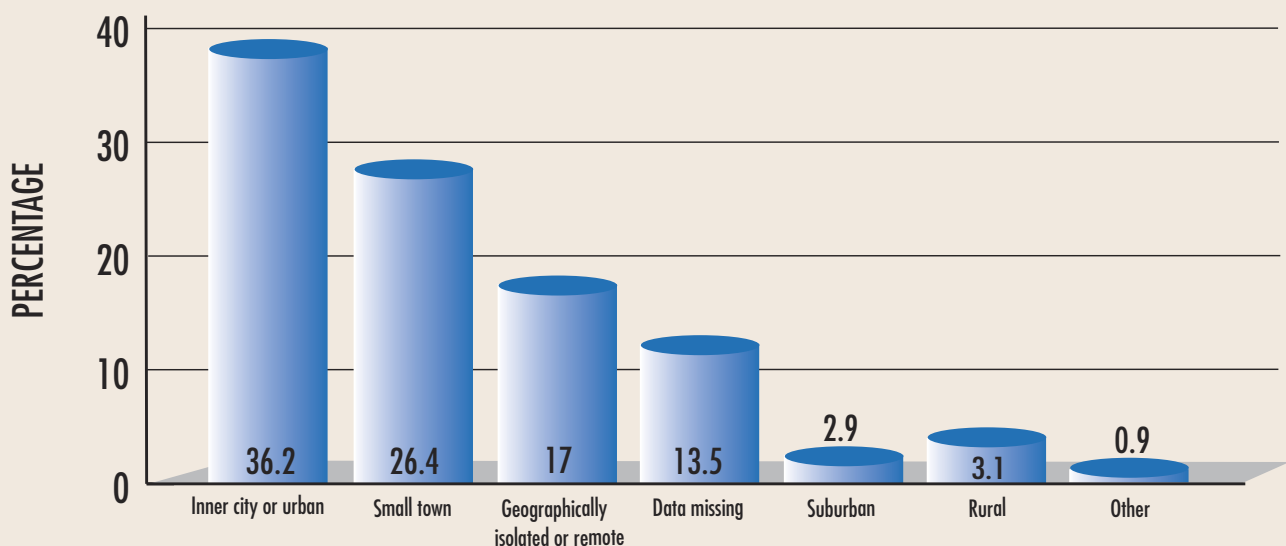
≥ 45 y, first-degree relative with diabetes, member of high-risk ethnic group (of aboriginal/Hispanic/Asian/African descent), obesity, dyslipidemia, history of IGT or IFG, presence of complications associated with diabetes (eg, hypertension), history of gestational diabetes mellitus, birth weight >4 kg, presence of coronary artery disease

OR

FPG in the IFG (6.1-6.9 mmol/L) range or an OGTT in the IGT (7.8-11.0 mmol/L) range

CFPC—College of Family Physicians of Canada, FPG—fasting plasma glucose, IFG—impaired fasting glucose, IGT—impaired glucose tolerance, OGTT—oral glucose tolerance test, T2D—type 2 diabetes.

Figure 2. Population primarily served by respondents' practices (N=749)



both patients at risk (253/749, or 33.8%) and for diagnosed patients (503/749, or 67.2%). Similar differences were seen with regard to weight-loss intervention (Table 1). Only 32.4% of respondents used a reminder system (paper or electronic) for patients at risk, and 53.3% of respondents used a reminder system for diagnosed patients.

Perceptions of prevention management

Respondents thought that lifestyle interventions have a substantial role in preventing (725/749, or 96.8%) and managing (731/749, or 97.6%) T2D. Most respondents thought that family physicians should promote lifestyle change by advising and providing appropriate interventions, such as recommendations and generic patient handouts (711/749, or 94.9%). Fewer respondents (513/749, or 68.5%), however, thought that using behavioural change techniques (eg, scheduling specific appointments to provide stage-matched counseling on diet and physical activity) would be appropriate. Several respondents were unaware of the many tools and programs that facilitate these interventions (Table 2^{13,24-30}).

When asked which nutritional and physical activity interventions they would use, more respondents indicated they would advise both at-risk and diagnosed patients to reduce fat and carbohydrate consumption (652/749, or 87%) and to accumulate 30 to 60 minutes of moderate physical activity on most days of the week (671/749, or 89.6%) (Table 3).

Selecting from a list of barriers that arise when initiating lifestyle modification strategies, more respondents perceived the "patient not being interested in changing physical activity and eating habits" (658/749, or 87.9%) as the strongest impediment (Table 4).

DISCUSSION

This large national survey presents data on the attitudes and practices of Canadian physicians regarding management of at-risk and diagnosed T2D patients. The survey included a large set of eligible, representative respondents (N=1410) and, given the length of the survey, had a good response rate (53.1%) from a variety of Canadian family physicians.

Table 1. Use of lifestyle interventions (N = 749)

INTERVENTION	PATIENTS AT RISK			DIAGNOSED PATIENTS		
	N	%	FISHER'S EXACT TEST	N	%	FISHER'S EXACT TEST
Ask about physical activity levels	719	96.0	0.001	716	95.6	0.000
Advise with written guidance for physical activity program	252	33.6	0.001	503	67.2	0.000
Advise about weight loss when applicable	726	96.9	0.002	702	93.7	0.000
Advise with written guidance to a healthy eating program	480	61.4	0.002	639	85.3	0.000

Table 2. Interventions for diagnosed patients: *How respondents rated interventions for patients with type 2 diabetes.*

HOW DO YOU RATE THE FOLLOWING FAMILY PRACTICE INTERVENTIONS FOR PATIENTS WITH T2D? (N=749)	RESPONDENT UNAWARE OF INTERVENTION OR INTERVENTION INAPPLICABLE TO RESPONDENT	VERY INEFFECTIVE	INEFFECTIVE	NEUTRAL	EFFECTIVE	VERY EFFECTIVE	95% CONFIDENCE INTERVALS
Canada's Food Guide ²⁴	6.1	5.6	14.4	33.4	36.7	2.8	2.89-3.07
Canada's Physical Activity Guide ²⁵	17.2	4.1	10.3	32.7	32.4	2.3	2.55-2.77
Healthy Heart Kit ²⁶	34.7	2.5	4.4	25.2	28.6	3.6	2.08-2.34
PACE Canada ²⁷	68.2	2.1	2.4	18.4	6.8	0.8	0.83-1.05
STEP test exercise prescription ^{13,28}	69.8	2.3	4.4	17.2	4.4	0.5	0.74-0.94
Go for Green Prescription ^{29,30}	69.3	2.4	3.9	17.4	5.2	0.5	0.77-0.97

T2D—type 2 diabetes.

Table 3. Perceptions of lifestyle interventions

INTERVENTIONS "I WOULD USE IN MY PRACTICE" (N=749)	WOULD USE INTERVENTION FOR BOTH "AT RISK" AND "DIAGNOSED" PATIENTS		WOULD NOT USE INTERVENTION	
	N	%	N	%
NUTRITIONAL INTERVENTIONS				
• Advise patient to reduce fat and carbohydrate consumption	652	87.0	21	2.8
• Canada's Food Guide	521	69.6	121	16.2
• Refer patient to diabetes education centre or registered nutritionist or dietitian	463	51.8	6	0.8
• Schedule specific appointments to provide diet or nutrition counseling	348	46.5	226	30.2
PHYSICAL ACTIVITY INTERVENTIONS				
• Advise adults to accumulate 30-60 min of moderate physical activity on most (preferably all) days of the week	671	89.6	24	3.2
• Identify patient behaviours that need to be changed, using Canada's Physical Activity Guide(s)	428	57.1	257	34.3
• Advise patients to go to a fitness specialist	344	45.9	307	41.0
• Schedule specific appointments to provide physical activity counseling	259	34.6	397	53.0

Table 4. Barriers to implementing lifestyle interventions (N = 749)

DIFFICULTIES ENCOUNTERED IN PROMOTING LIFESTYLE CHANGE FOR PATIENTS	N	%
Patient uninterested in changing physical activity and eating habits	658	86.9
Lack of long-term commitment from patient	573	76.5
Lack of time to spend with patients in regular office visit	571	76.2
Patients have comorbidity	540	72.1
Limited access to community-based referrals (eg, nutritionist or dietitian, activity programs, weight-loss centres)	402	53.7

Survey respondents agreed that lifestyle interventions are an important component of strategies to prevent and treat T2D. They believed that family physicians should have an active role in delivering them. These attitudes appeared to translate into practice, with most respondents asking their patients with T2D about physical activity and weight loss, when appropriate.

When asked to be more specific about the interventions they provide in practice, however, respondents reported they were far more likely to counsel about lifestyle behaviours (eg, advising and providing generic patient handouts) than to use more aggressive lifestyle management techniques (eg, scheduling specific appointments to provide stage-matched interventions). Underscoring this finding was respondents' relative lack of awareness of appropriate programs and tools to support behaviour change.

Barriers

The ability to provide more effective and intensive lifestyle management is hampered by several barriers identified by respondents, including patients' lack of interest and long-term commitment, comorbidity, limited provider time, and inadequate access to community-based referrals. Other studies have cited similar barriers, as well as lack of remuneration and insufficient training for physicians.^{4,31-34}

Addressing these barriers is critical, given that an intensive management strategy is more likely to achieve lasting behaviour change. Kreuter et al³⁵ found that linking physicians' lifestyle advice (on smoking, diet, and exercise) with personalized written materials was more likely to achieve intermediate outcomes (recall, interest, and perceived relevance) that are "important precursors to behaviour change."³⁵ For sedentary patients in primary care, written prescriptions and verbal advice were more effective than advice alone in increasing physical activity.²⁹ A recent study demonstrated that oral and written advice with follow-up support was better than usual care in increasing physical activity and improving quality of life over 12 months.³⁶ Among older patients, targeted prescriptions of exercise training to improve heart rate given by family physicians was superior to usual care in improving fitness and self-efficacy.³⁷

Why intervention is important

More intensive interventions (incorporating written materials, behavioural change strategies, and physician training) might further improve the effect of physical activity interventions in the general patient population.³⁸ The US Preventive Services Task Force³⁹ states that “multicomponent interventions combining provider advice with behavioural interventions ... appear the most promising” for promoting physical activity in primary care. As there are few studies on lifestyle interventions for T2D patients based in primary care,¹² however, further research is needed to fully support such interventions.

For weight loss and nutrition counseling, the intensity of the intervention is strongly associated with the degree of change.⁴⁰ Ockene et al⁴¹ found that, among patients with hyperlipidemia, nutritional counseling plus an office-support program produced beneficial changes in diet (10.3% decrease in energy from saturated fat), weight (2.3-kg reduction) and blood lipids (decrease of 0.10 mmol/L [3.8 mg/dL] in low-density lipoprotein cholesterol levels).

According to the obesity and weight-loss literature, physicians can provide effective, adequate dietary counseling by providing brief advice and individualized written patient material,⁴² although consultation with a dietitian improves outcomes.⁴³ More intensive behavioural strategies, such as patient self-monitoring, stimulus control, and social support, appear to improve long-term weight loss in the T2D population.⁷ These findings reflect primary care patients' attitudes about weight management. While some obese and overweight patients want to be advised by their physicians to lose weight, many others prefer a more comprehensive approach (eg, dietary and exercise advice, goal setting).⁴⁴

Finally, evidence shows that delivery of appropriate dietary counseling in primary care can be improved with office-level system supports.^{41,45} These supports, however, were not widely used by our respondents—twice as many reported they *do not* use a reminder system for patients at risk.

In general, our survey results appear to confirm the findings of previous studies that primary care

physicians understand the importance of lifestyle management and are enthusiastic about providing it, but perceive many barriers that limit their ability to effect long-term behavioural change in their patients,^{46,47} particularly in the context of T2D.^{4,14,48} As evidence has recently shown, an intensive program of lifestyle intervention can substantially delay or prevent T2D in patients with IGT.⁹⁻¹¹ Strategies that assist physicians promoting these interventions in practice are clearly needed.

Limitations


A shorter survey could have yielded a much larger response rate; yet, given the numerous demands on clinicians' time, a response rate of 53% is impressive. Further, as our results are based on self-reported data, it is difficult to determine whether respondents practised what they reported; research shows that respondents tend to overestimate what are considered positive behaviours.⁴⁹

This survey sampled only CFPC members, who (as a criterion of membership) must commit to continuing education. As a result, our sample potentially overrepresents physicians who are up-to-date on current recommendations. Finally, our survey did not differentiate between dietary strategies (eg, reduce fat and carbohydrate intake) and weight loss in general.

Conclusion

Recent literature clearly demonstrates the benefits of lifestyle intervention for prevention of T2D. Our findings indicate that family physicians not only understand the importance of lifestyle interventions for preventing and managing T2D, but are eager to deliver them. Family physicians do not, however, use effective strategies to bring about lifestyle behaviour change. What is more, there is strikingly little evidence evaluating these initiatives in primary health care.

There is an urgent need to develop and evaluate strategies to help physicians overcome identified barriers and effect long-term behaviour change in their patients. Failure to do so will severely

compromise family physicians' efforts to battle the T2D epidemic. 

Acknowledgment

We thank the other members of the Type 2 Diabetes Education Committee, Ms Donna Lillie of the Canadian Diabetes Association and Ms Dyane Bourgeois of Dietitians of Canada; The College of Family Physicians of Canada; and Ms Patricia Marturano, Project Coordinator at the College of Family Physicians of Canada. We thank consultants to the Type 2 Diabetes Education Committee, Dr Ann C. Macaulay of the Department of Family Medicine and Dr Jacqueline McClaran of the Health Centre, both at McGill University in Montreal, Que. We also thank the physicians who took the time to respond to this survey.

Contributors

Dr Harris, as Principal Investigator, was central to hypothesis development, design, implementation, and analysis of the study and to conception, writing, and editing of the manuscript. Dr Petrella, as Co-Principal Investigator, was integral to study planning, survey design and interpretation, analysis, and manuscript writing and review. Ms Lambert-Lanning, as a Co-Investigator, assisted in survey and hypothesis development and was in charge of data collection, management, entry, and analysis, and wrote the Results section. Ms Leadbetter, as a Co-Investigator, was integral to initial survey development and to manuscript review. Ms Cranston, as medical writer, actively participated in writing and revising the manuscript.

Competing interests

This work is supported by a grant from Health Canada's Canadian Diabetes Strategy Prevention and Promotion Contribution Program.

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References

1. Health Canada. *Diabetes facts and figures*. Ottawa, Ont: Health Canada; 2003. Available from: http://www.hc-sc.gc.ca/pphb-dgsp/cccpc-cpcmc/ndss-snsd/english/facts_figures_e.html. Accessed 2004 July 27.

EDITOR'S KEY POINTS

- Canadian family physicians appear to be aware of the need for lifestyle modification in type 2 diabetes (T2D); 85% to 90% advise their patients about physical activity and diet.
- Written directions for physical activity or reminder systems, however, were less often used. Many family doctors were unaware of several proven lifestyle interventions, such as PACE Canada or Go for Green prescriptions.
- The main barriers to wider lifestyle interventions were patients' lack of interest and limited time.

POINTS DE REPÈRE DU RÉDACTEUR

- Les médecins de famille canadiens semblent conscients de la nécessité de modifier le mode de vie dans les cas de diabète de type 2 (DT2); de 85% à 90% conseillent leurs patients concernant l'activité physique et le régime alimentaire.
- Par ailleurs, ils utilisaient moins souvent des instructions ou des systèmes de rappel par écrit. Plusieurs médecins de famille n'étaient pas au courant de diverses interventions éprouvées sur le mode de vie comme PACE Canada ou les ordonnances «Vert» l'action!
- Les principaux obstacles à des interventions plus élaborées en matière de mode de vie étaient le manque d'intérêt des patients et le temps limité.

2. Canadian Diabetes Association Clinical Practice Guidelines Expert Committee. Canadian Diabetes Association 2003 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada. *Can J Diabetes* 2003;27(Suppl 2).
3. Gerstein HC, Meltzer S. Preventive medicine in people at high risk for chronic disease: the value of identifying and treating diabetes. *CMAJ* 1999;160:1593-5.
4. Larne AC, Pugh JA. Attitudes of primary care providers towards diabetes. Barriers to guideline implementation. *Diabetes Care* 1998;21:1391-6.
5. Harris SB, Stewart M, Brown JB, Wetmore S, Faulds C, Webster-Bogaert S, et al. Type 2 diabetes in family practice: room for improvement. *Can Fam Physician* 2003;49:778-85.
6. Leiter LA, Barr A, Belanger A, Lubin S, Ross SA, Tildesley HD, et al. Diabetes screening in Canada (DIASCAN) study. *Diabetes Care* 2001;24:1038-43.
7. Wing RR. Weight loss in the management of type 2 diabetes. In: Gerstein HC, Haynes RB, editors. *Evidence-based diabetes care*. Hamilton, Ont: BC Decker Inc; 2001. p. 252-76.
8. Boule NG, Haddad E, Kenny GP, Wells GA, Sigal RJ. Effects of exercise on glycemic control and body mass in type 2 diabetes mellitus: a meta-analysis of controlled clinical trials. *JAMA* 2001;286(10):1218-27.
9. Diabetes Prevention Program Research Group. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 2002;346(6):393-403.
10. Tuomilehto J, Lindstrom J, Eriksson JG, Valle TT, Hamalainen H, Ilanne-Parikka P, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med* 2001;344(18):1343-50.
11. Pan XR, Li GW, Hu YH, Wang JX, Yang WY, An ZX, et al. Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance. The Da Qing IGT and Diabetes Study. *Diabetes Care* 1997;20:537-44.
12. Harris SB, Petrella RJ, Leadbetter W. Lifestyle interventions for type 2 diabetes: relevance for clinical practice. *Can Fam Physician* 2003;49:1618-25.
13. Petrella RJ, Wight D. An office-based instrument for exercise counseling and prescription in primary care. The Step Test Exercise Prescription (STEP). *Arch Fam Med* 2000;9:339-44.
14. Wylie G, Hungin APS, Neely J. Impaired glucose tolerance: qualitative and quantitative study of general practitioners' knowledge and perceptions. *BMJ* 2002;321:1190.
15. College of Family Physicians of Canada. 2001 CFPC National Family Physician Workforce Survey [Part of the Janus Project: Family physicians meeting the needs of tomorrow's society]. Mississauga, Ont: College of Family Physicians of Canada; 2001. Available from: <http://www.cfpc.ca/english/cfpc/research/janus%20project/default.asp?s=1>. Accessed 2004 July 8.
16. College of Family Physicians of Canada. *Physical Activity Report—Results of the 2001 National Family Physician Workforce Survey*. Mississauga, Ont: College of Family Physicians of Canada; 2002. Available from: <http://www.cfpc.ca/english/cfpc/programs/patient%20care/physical%20activity/research/default.asp?s=1>. Accessed 2004 July 8.
17. Del Greco L, Walop W. Questionnaire development: 1. Formulation. *CMAJ* 1987;136:583-5.

18. Del Greco L, Walop W, McCarthy RH. Questionnaire development: 2. Validity and reliability. *CMAJ* 1987;136:699-70.
19. Del Greco L, Walop W, Eastridge L. Questionnaire development: 3. Translation. *CMAJ* 1987;136:817-8.
20. Walop W, Del Greco L, Eastridge L, Marchand B, Szentveri K. Questionnaire development: 4. Preparation for analysis. *CMAJ* 1987;136:927-8.
21. Del Greco L, Walop W. Questionnaire development: 5. The pretest. *CMAJ* 1987;136:1025-6.
22. Dillman D. *Mail and Internet surveys: the tailored designed method*. 2nd ed. Toronto, Ont: John Wiley & Sons; 2000.
23. SPSS Inc. *Statistical Program for the Social Sciences. SPSS for Windows, version 11.5.0*. Chicago, Ill: SPSS Inc; 2002.
24. Health Canada. *Canada's food guide to healthy eating*. Ottawa, Ont: Minister of Public Works and Government Services Canada; 1997. Available from: http://www.hc-sc.gc.ca/hpfb-dgpsa/onpp-bppn/food_guide_rainbow_e.pdf. Accessed 2004 July 27.
25. Health Canada, Canadian Society for Exercise Physiology. *Canada's physical activity guide to healthy active living*. Ottawa, Ont: Health Canada, Canadian Society of Exercise Physiology; 1998. Available from: <http://www.hc-sc.gc.ca/hppb/fitness/pdf/guideEng.pdf>. Accessed 2004 July 27.
26. Health Canada, Heart and Stroke Foundation of Canada. *The Healthy Heart Kit*. Ottawa, Ont: Public Works and Government Services Canada; 1999. Available from: www.healthy-heartkit.com. Accessed 2004 July 27.
27. Canadian Fitness and Lifestyle Research Institute. *PACE Canada tool kit and counseling guide*. Ottawa, Ont: Pace Canada. Available from: <http://www.pace-canada.org/whatis.htm>. Accessed 2004 July 27.
28. Petrella R. *Step test exercise prescription (STEP)*. London, Ont: Canadian Centre for Activity and Aging; Available from: <http://www.cfpc.ca/English/cfpc/programs/patient%20care/physical%20activity/interventions/step/default.asp?s=1>. Accessed 2004 July 27.
29. Swinburn BA, Walter LG, Arroll B, Tilyard MW, Russell DG. The green prescription study: a randomized controlled trial of written exercise advice provided by general practitioners. *Am J Public Health* 1998;88(2):288-91.
30. College of Family Physicians of Canada. *Go for Green, Health Canada. Go for Green Prescription*. Mississauga, Ont: College of Family Physicians of Canada; 2001. Available from: http://www.goforgreen.ca/goforgreen_prescription/index.htm. Accessed 2004 July 8.
31. Drass J, Kell S, Osborn M, Bausell B, Corcoran J, Moskowitz A, et al. Diabetes care for Medicare beneficiaries. Attitudes and behaviors of primary care physicians. *Diabetes Care* 1998;21:1282-7.
32. Larme AC, Pugh JA. Evidence-based guidelines meet the real world. The case of diabetes care. *Diabetes Care* 2001;24:1728-33.
33. Brown JB, Harris SB, Webster-Bogaert S, Wetmore S, Faulds C, Stewart M. The role of patient, physician and systemic factors in the management of type 2 diabetes mellitus. *Fam Pract* 2002;19(4):344-9.
34. Agarwal G, Pierce M, Ridout D, on behalf of Primary Care Diabetes (the Primary Care Section of the British Diabetic Association). The GP perspective: problems experienced in providing diabetes care in the UK general practice. *Diabet Med* 2002;19(Suppl 4):13-20.
35. Kreuter MW, Chheda SG, Bull FC. How does physician advice influence patient behavior? Evidence for a priming effect. *Arch Fam Med* 2000;9:426-33.
36. Elley CR, Kerse N, Arroll B, Robinson E. Effectiveness of counselling patients on physical activity in general practice: cluster randomised trial. *BMJ* 2003;326:793-8.
37. Petrella RJ, Koval JJ, Cunningham DA, Paterson DH. Can family doctors prescribe exercise to improve fitness? The Step Test Exercise Prescription (STEP) project. *Am J Prev Med* 2003;24:316-22.
38. Petrella RJ, Lattanzio CN. Does counseling help patients get active? Systematic review of the literature. *Can Fam Physician* 2002;48:72-80.
39. Eden KB, Orleans T, Mulrow CD, Pender NJ, Teutsch SM. Does counseling by clinicians improve physical activity? A summary of the evidence for the U.S. Preventive Services Task Force. *Ann Intern Med* 2002;137:208-15.
40. Pignone MP, Ammerman A, Fernandez L, Orleans CT, Pender N, Woolf S, et al. Counseling to promote a healthy diet in adults. A summary of the evidence for the U.S. Preventive Services Task Force. *Am J Prev Med* 2003;24(1):75-92.
41. Ockene IS, Herbert JR, Ockene JK, Saperia GM, Stanek E, Nicolosi R, et al. Effect of physician-delivered nutrition counseling training and an office-support program on saturated fat intake, weight, and serum lipid measurements in a hyperlipidemic population: Worcester Area Trial for Counseling in Hyperlipidemia (WATCH). *Arch Intern Med* 1999;159(7):725-31.
42. Mant D. Effectiveness of dietary intervention in general practice. *Am J Clin Nutr* 1997;65(6 Suppl):1933-8S.
43. Pritchard DA, Hyndman J, Taba F. Nutritional counselling in general practice: a cost effective analysis. *J Epidemiol Community Health* 1999;53(5):311-6.
44. Potter MB, Vu JD, Crougham-Minihane M. Weight management: what patients want from their primary care physicians. *J Fam Pract* 2001;50(6):513-8.
45. Ockene IS, Hebert JR, Ockene JK, Merriam PA, Hurley TG, Saperia GM. Effect of training and a structured office practice on physician-delivered counseling: the Worcester-Area Trial for Counseling in Hyperlipidemia (WATCH). *Am J Prev Med* 1996;12(4):252-8.
46. Coulter A, Schofield T. Prevention in general practice: the views of doctors in the Oxford region. *Br J Gen Pract* 1994;41(345):140-3.
47. McAvoy BR, Kaner EF, Lock CA, Heather N, Gilvarry E. Our healthier nation: are general practitioners willing and able to deliver? A survey of attitudes to and involvement in health promotion and lifestyle counselling. *Br J Gen Pract* 1999;49(440):187-90.
48. Pill R, Stott NCH, Rollnick SR, Rees M. A randomized controlled trial of an intervention designed to improve the care given in general practice to type II diabetic patients: patient outcomes and professional ability to change behaviour. *Fam Pract* 1998;15(3):229-35.
49. Adams AS, Soumerai SB, Lomas J, Ross-Degnan D. Evidence of self-report bias in assessing adherence to guidelines. *Int J Qual Health Care* 1999;11(3):187-92.

