

OBSERVATIONS

What Is the Sensitivity and Specificity of Self-Report for Retinopathy Screening?

A wide range in screening rates for diabetic retinopathy by dilated ophthalmic examination has been reported in studies over the last decade (1–4). Comparisons of these rates should take into account the measure used to assess the condition (i.e., screened versus unscreened). Examples of measures include self-report by the individual, claims data for the service, or medical record abstraction of the desired information. Because goals for improvement of diabetes care (5) are based on studies using these reported rates, the sources of these data must be considered and described. Self-report by an individual relies on memory, correct discernment of a dilated versus undilated exam, and accurate identification of the screening behavior within the time frame in question. Claims data, on the other hand, can overestimate the rate of dilated exams under the code for a comprehensive ophthalmic examination. Furthermore, depending on the patient's health care coverage plan, the retinopathy screening may be a service that does not require a separate claim. Finally, abstraction of medical records may be a sensitive measure for a dilated ophthalmic examination; however, its specificity is dependent on a record system that captures and organizes the medical reports for retrieval and evaluation.

A recently published study by Basch et al. (6) reported that a telephone-based health education intervention was associated with a doubling in the rate of dilated ophthalmic examinations (54.7% screened in the intervention group vs. 27.3% in the standard care group) in a sample of African-American adults with diabetes. The main outcome for that randomized controlled trial was documentation from the medical record of receipt of a dilated eye examination. In addition,

staff conducted telephone interviews to ascertain self-report of a dilated eye examination. The cross-classification of documented and self-reported screening status from that study is presented here in order to describe the accuracy (7) of self-report of a dilated eye examination.

Eligibility for the randomized trial specified that participants had not had a dilated eye examination in the previous 14 months. The current standard of diabetes care is for an annual dilated eye examination (8). A total of 280 African-Americans with diabetes from five New York City metropolitan area medical centers consented to be randomized and completed the study. Documentation of a dilated eye examination consisted of medical record abstraction by an auditor masked to group assignment. If in the telephone interview the subject reported having gone to an outside eye care provider and signed a medical release, then a form for provider documentation of the date of the most recent dilated eye examination was obtained. Because the documented outcome from the medical record would have superseded the patients' self-report as the primary outcome for this study, completion of the telephone interview was not a prerequisite for inclusion in the published report. There was no self-report for 32 subjects because of the staff's inability to contact the subjects by telephone, even after repeated attempts. Each of the remaining 248 subjects included in this current report had both self-report and accessible medical record documentation for eye examination status. Inaccessible medical records for seven subjects (three intervention subjects and four control subjects) were conservatively treated as a negative for the dichotomous categories of screened versus unscreened.

The telephone interviewer, masked to group assignment, asked, "When was the last time you had an eye exam in which the pupils were dilated?" Response options were: "less than 1 month," "1–12 months," "13–24 months," "more than 2 years," and "never." We allowed plus or minus 1 month for error in recall. Thus, if a person reported having an exam in the past 1–12 months, and documentation indicated an exam 13 months ago, the self-report was considered verified. Similarly, the self-report was allowed to underestimate the time since last exam.

Rates of self-reported and docu-

mented dilated eye examinations for the entire sample ($n = 248$) and for the intervention ($n = 119$) and control ($n = 129$) groups separately are as follows: self-report was 58.5% for total sample, with 75.6 vs. 42.6% for intervention and control groups, respectively; documentation of exam was 44.0% for total sample, with 60.5 and 28.7%, respectively, for intervention and control groups. The apparent overestimation due to self-report was 33% in the total sample (58.5 vs. 44%), 48% in the control group (42.6 vs. 28.7%), and 25% in the intervention group (75.6 vs. 60.5%). The sensitivity of self-report for the total sample was 94.5, with intervention subjects showing greater sensitivity in self-report. Specificity overall was 69.8, with intervention subjects at 55.3 and control subjects at 77.2.

Objective 5-13 of Healthy People 2010 (5) is to increase the proportion of adults with diabetes who have an annual dilated eye examination from a 2000 baseline of 47% to a goal of 75%. The baseline was derived from self-report data. The National Health Interview Survey (NHIS) rate for African-Americans was 43%, which is virtually the same as the self-report data for the sample of African-Americans assigned to the control group, where the overestimation compared with documentation was by 48% (5).

These data indicate that self-report of a dilated ophthalmic exam and the documentation from the medical record or provider confirmatory letter are not in complete agreement. In fact, the intervention group had much less difference between the two measures than the control group. This difference could be because of a greater awareness of what constitutes a dilated eye examination, a result of the telephone-based health education and the brief behavioral counseling to improve retinopathy screening rates. Thus, accuracy of self-report data may be improved with greater patient education about what constitutes a dilated eye examination.

Ascertaining the true condition of screened versus unscreened for each subject was beyond the scope of this study and is a limitation of this report. It is possible that a subject's self-report of having had a dilated eye examination was indeed factual, but medical records were misfiled or incomplete; the great majority (>90%) of subjects in this report, however, re-

landers 1.4% [21/1,534], and others 0.4% [2/454]). No women with a twin pregnancy had a stillbirth. Women with a twin pregnancy were older (29 ± 5 vs. 27 ± 6 years, $P = 0.012$), more parous (2 [1–3] vs. 1 [0–2], $P = 0.007$), and weighed more at booking (80.0 ± 21.0 vs. 74.7 ± 16.9 kg, $P = 0.023$) at the same gestation (17 ± 9 weeks) than those with a singleton pregnancy but were otherwise similar.

Of the 2,515 women screened for GDM, 3 twin and 83 singleton pregnancies had no GCT before the OGTT: the proportion with GDM was similar among those having the OGTT (33.3 vs. 37.3%). Women pregnant with twins were more likely to be screened (77.8% [42] vs. 50.6% [2,473], $P < 0.001$), had a higher 1-h glucose challenge results (6.6 ± 1.3 vs. 6.0 ± 1.5 ; $P = 0.004$ before age, weight, and parity adjustment and $P = 0.022$ after), and were nonsignificantly more likely to have a positive screen on GCT (17.9% [7] vs. 12.6% [301], $P = 0.319$) and GDM on OGTT after a positive GCT (50.0% [2/4] vs. 28.3% [66/233], $P = 0.342$) than women with a singleton pregnancy, but numbers were small. Overall incidences of GDM were 11.9 and 5.1% ($P = 0.051$).

Our data confirm that twin pregnancies are associated with greater risk of GDM with relative hyperglycemia. Unfortunately, the numbers of women with a twin pregnancy and an OGTT were too few to show a significantly higher incidence of GDM overall. The greater screening for GDM among women with twin pregnancies should have reduced the difference in GDM risk between the two groups, with the likely lower threshold for screening for GDM in these women (although closed unit versus shared care practice could be a further explanation). It was unfortunate that there were insufficient numbers to look at the risk of GDM within ethnic groups, but the groups were well matched for this. These data support the hypothesis that twin pregnancies are more prone to GDM. If so, women with twin pregnancies should be tested for GDM not only at 24–28 weeks but also later on in pregnancy.

DAVID SIMMONS, FRACP, MD¹
MANISHA YAPA²

From the ¹Department of Rural Health, University of Melbourne, Melbourne, Australia; and the ²University of Otago, Dunedin, New Zealand.

Address correspondence to Professor David Simmons, Department of Rural Health, Faculty Medicine Dentistry and Health Sciences, University of Melbourne, P.O. Box 6500, Shepparton VIC 3632, Australia. E-mail: dsimmons@unimelb.edu.au.

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A Case of Fulminant Type 1 Diabetes With Elevated Rheumatoid Factor and the Temporal Presence of Thyroid-Stimulating Hormone Receptor Antibody

Type 1 diabetes is divided into two subtypes: autoimmune and idiopathic diabetes (1). Recently, fulminant type 1 diabetes was identified as a novel subtype of idiopathic diabetes (2). Imagawa et al. (2), who first identified this subtype, hypothesized that the disorder is caused by nonautoimmune mechanisms, including viral infection of exocrine pancreatic tissue. This hypothesis was generated from the negative test results for diabetes-related antibodies in patients with fulminant type 1 diabetes.

Additional pieces of supporting evidence were the absence of hyperexpression of major histocompatibility complex class I molecules in islets and the presence of lymphocyte infiltration in exocrine pancreatic tissue without insulinitis in biopsy specimens. Consequently, high serum amylase levels were the primary characteristics of patients with fulminant type 1 diabetes. However, the hypothesis mentioned above has not been universally accepted (3). We report a case of fulminant type 1 diabetes in a patient who had a normal level of serum amylase at the time of diagnosis along with increased rheumatoid factor and thyroid-stimulating hormone (TSH) receptor antibody levels.

A 22-year-old woman was admitted to our hospital with diabetic ketoacidosis. She suffered from a sore throat and headache 7 days before admission. Nausea, vomiting, and slight fever started 2 days before admission. She visited the emergency room with epigastric pain and thirst and was found to have a high glucose level. She was transferred to our hospital the next day for admission.

The patient was comatose when she arrived. Her plasma glucose level was 59.6 mmol/l. Her HbA_{1c} was 5.3%, within normal range. Urinary ketone was strongly positive. Arterial pH was 6.922, and bicarbonate was 1.9 mmol/l. Serum and urinary C-peptide levels were low, 0.24 ng/ml and 5.6 μg/day, respectively. She had no diabetes-related antibodies (GAD antibody, tyrosine phosphatase-like protein [IA-2] antibody, islet cell antibody, or insulin autoantibody). These findings were consistent with the characteristics of fulminant type 1 diabetes.

The patient's serum amylase level was 71 IU/l in the emergency room and 135 IU/l at the time of her admission to our hospital, but it rose to 761 IU/l the next day. The serum levels of other exocrine pancreatic enzymes lipase and trypsin also rose, although the levels of these two enzymes were not measured on the day of admission. These findings suggested that injury to exocrine pancreatic tissue indeed occurred in this subject. However, we considered this injury to be secondary, based on the initially normal amylase level and its subsequent rise.

This patient had HLA-DRB1*0405/*0405, DQA1*0303/*0303, DQB1*0405/*0405, the haplotype associated with type 1 diabetes in Japanese people. Furthermore, her immunological examinations after ad-

Table 1—Partial Spearman correlation coefficients of the relation between UAE and carotid IMT in type 2 diabetic and nondiabetic subjects

Carotid IMT (mm)	UAE (mg/24 h)	P
Nondiabetic subjects (n = 681)		
Model 1	0.14	<0.001
Model 2	0.04	NS
Model 3	-0.01	NS
Type 2 diabetic subjects (n = 57)		
Model 1	0.31	0.02
Model 2	0.37	0.0056
Model 3	0.40	0.0049

Model 1 unadjusted; model 2 adjusted for age and sex; model 3 adjusted for age, sex, diastolic and systolic blood pressure, BMI, current smoking, plasma glucose, and total, LDL, and HDL cholesterol. NS, not significant.

mission showed elevated rheumatoid factor and the temporal presence of TSH receptor antibody. These findings suggested that her disease had the immunogenetic characteristics of an autoimmune disease but not against the endocrine pancreas.

Unlike previous cases of fulminant type 1 diabetes (4), this case was characterized by a late increase in serum amylase level and autoimmune characteristics. Therefore, although fulminant type 1 diabetes has been clinically identified, its etiology remains in question.

SHINJI SAKAUE, MD¹
MEGUMI NAGATA, MD¹
OSAMU WAKABAYASHI, MD¹
TOSHIRO HONDA, MD²
HARUHIKO YOSHIMURA, MD¹
ETSURO YAMAGUCHI, MD¹
MASAHARU NISHIMURA, MD¹

From the ¹First Department of Medicine, Hokkaido University School of Medicine, Sapporo, Japan; and the ²Department of Internal Medicine, Konan Hospital, Sapporo, Japan.

Address correspondence to Shinji Sakaue, MD, First Department of Medicine, Hokkaido University School of Medicine, Sapporo 060-8638, Japan. E-mail: sakaue-s@tb3.so-net.ne.jp.

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Difference in the Relation Between Urinary Albumin Excretion and Carotid Intima-Media Thickness in Nondiabetic and Type 2 Diabetic Subjects

Microalbuminuria is an indicator of an increased cardiovascular risk in diabetic and nondiabetic populations (1,2). Predominantly based on studies in type 2 diabetic populations, it has been suggested that microalbuminuria is an early indicator of atherosclerosis (3). Whether, in nondiabetic subjects, microalbuminuria is an independent indicator of subclinical atherosclerosis or merely a reflection of the increased prevalence of cardiovascular risk factors remains a matter of debate (4). Therefore, in the present study, we investigated the relation between urinary albumin excretion (UAE) and intima-media thickness (IMT) in both a nondiabetic and a type 2 diabetic population.

Subjects were recruited on the basis of reproducible microalbuminuria (UAE once >10 mg/l in an early morning spot

urine and at least once 15–300 mg/24 h in 2 × 24 h urine samples). The IMT was measured at the posterior wall of the left common carotid artery using radio frequency signal analysis obtained by M-mode ultrasonography. Type 2 diabetes was defined as currently using antidiabetic drugs or a fasting plasma glucose exceeding 6.1 mmol/l. A total of 481 men and 257 women with a mean age of 50 years were included. Adjusted for age and sex, UAE was related to diastolic and systolic blood pressure as well as BMI in diabetic (n = 57) and nondiabetic subjects (n = 681). All relations between UAE and these variables were stronger in the type 2 diabetic population. In both diabetic and nondiabetic subjects, a positive relation was present between UAE and IMT (Table 1). In nondiabetic subjects, this relation could no longer be demonstrated after correction for age, sex, and classical cardiovascular risk indicators. In contrast, in type 2 diabetes patients, the relation between UAE and IMT remained highly significant after risk factor correction.

This study shows that UAE is strongly related to subclinical atherosclerosis (assessed as IMT) in type 2 diabetes patients, whereas in healthy volunteers, the relation between UAE and IMT is predominantly a consequence of a clustering of cardiovascular risk indicators. The latter observation implies that if microalbuminuria proves to be an independent risk indicator for cardiovascular disease in the nondiabetic population, this is due to mechanisms other than enhanced atherosclerosis progression per se.

GILLES F.H. DIERCKS, MD¹
ERIK S.G. STROES, MD, PHD²
AD J. VAN BOVEN, MD, PHD³
ARIE M. VAN ROON, PHD⁴
HANS L. HILLEGE, MD¹
PAUL E. DE JONG, MD, PHD⁵
ANDRIES J. SMIT, MD, PHD⁴
RUIK O.B. GANS, MD, PHD⁴
HARRY J.G.M. CRIJNS, MD, PHD³
TON J. RABELINK, MD, PHD⁶
WIEK H. VAN GILST, PHD^{1,3}

From the ¹Department of Clinical Pharmacology, University of Groningen, Groningen, the Netherlands; the ²Department of Vascular Medicine, Utrecht Medical Center, Utrecht, the Netherlands; the ³Department of Cardiology, Thoraxcenter, Academic Hospital, Groningen, the Netherlands; the ⁴Department of Internal Medicine, Academic Hospital, Groningen, the Netherlands; the ⁵Department of Nephrology, Academic Hospital, Groningen, the Netherlands; and the ⁶Department of Internal Med-

icine, Utrecht Medical Center, Utrecht, the Netherlands.

Address correspondence to G.F.H. Diercks, MD, Department of Clinical Pharmacology, University of Groningen, A. Deusinglaan 1, 9713 AV Groningen, the Netherlands. E-mail: g.f.h.diercks@med.rug.nl.

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Correlation of Serum Leptin Levels With Insulin Sensitivity in Patients With Chronic Hepatitis-C Infection

Diabetes is a less-recognized association of hepatitis-C virus (HCV) infection, although several recent studies provide data linking HCV infection and diabetes (1–5). To investigate whether patients with chronic HCV infection without evidence of cirrhosis have an increased risk of diabetes, we conducted a case-control study in 44 consecutive eligible patients with HCV infection and no clinical or histological evidence of cirrhosis and in 20 control subjects without liver disease who were matched by age, sex, and BMI. All 44 patients with chronic HCV infection had biochemical evidence of ongoing inflammation with elevated alanine aminotransferase activity and histologic confirmation. There was no evidence of decompensated liver disease.

No patient received any antiviral, immunomodulatory, or immunosuppressive therapy. Immunoreactive insulin was determined by double-antibody radiomimmunosassay (Coat-a-count; Diagnostic Products, Los Angeles, CA). Serum leptin level was determined by the quantitative sandwich enzyme immunoassay technique (Quantikine R & D Human Leptin Immunoassay Systems). Insulin sensitivity was assessed by homeostasis model assessment (HOMA)-estimated insulin sensitivity with the formula that was defined by Matthews et al. (6).

The fasting serum insulin levels were significantly elevated in patients with chronic HCV infection compared with control subjects (22.5 ± 7.9 vs. 9.0 ± 2.8 , $P < 0.001$). Serum leptin levels were also significantly elevated in patients with chronic HCV infection compared with control subjects (11.8 ± 4.3 vs. 6.0 ± 3.6 , $P < 0.001$). Fasting serum leptin and insulin levels and HOMA-estimated insulin sensitivity were correlated in the whole group. There was a significant positive correlation between serum leptin and insulin ($r = 0.43$, $P < 0.001$) and between leptin and HOMA-estimated insulin sensitivity ($r = 0.42$, $P < 0.01$). Mehta et al. (5) reported the analysis of HCV infection and type 2 diabetes in the Third National Health and Nutrition Examination Survey. They reported that patients with HCV infection were more than three times as likely to have type 2 diabetes than those without HCV infection.

In conclusion, our study results suggest that HCV infection may serve as an additional risk factor for the development of type 2 diabetes due to insulin resistance and hyperleptinemia. Investigators from many disciplines will need to prospectively characterize the temporal sequence of HCV infection and type 2 diabetes, define the relationship with serious liver disease, and explicate the biological mechanisms.

ORAL ÖNCÜL, MD¹
 CÝHAN TOP, MD²
 PABAN ÇAVUPLU, MD¹

From the ¹Department of Infectious Disease, Gülhane Military Medical Academy, Haydarpa Training Hospital, İstanbul, Turkey; and the ²Department of Internal Medicine, Gülhane Military Medical Academy, Haydarpa, Training Hospital, İstanbul, Turkey.

Address correspondence to Oral Öncül, MD, Department of Infectious Disease, Gülhane Military

Medical Academy, Haydarpa Training Hospital, 81327 Uskudar, İstanbul, Turkey. E-mail: gatadahiliye@superonline.com.

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COMMENTS AND RESPONSES

Reduced Insulin Sensitivity in Mexican-Americans From San Antonio With Elevated Incidence of Type 2 Diabetes Compared With Mexicans From Mexico City

The interesting article by Burke et al. (1) in the September issue of *Diabetes Care* reports a higher incidence of type 2 diabetes among low-income Mexican-American residents in San Antonio, Texas, than in a comparable population

Hopefully these comments will aid in the interpretation and application of the findings of this unique study.

DAVID A. SACKS, MD

From the Division of Maternal-Fetal Medicine, Department of Obstetrics and Gynecology, Kaiser Foundation Hospital, Bellflower, California.

Address correspondence to David A. Sacks, MD, Division of Maternal-Fetal Medicine, Department of Obstetrics and Gynecology, Kaiser Foundation Hospital, Bellflower, CA 90706. E-mail: dasacks@worldnet.att.net.



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Response to Letter by Sacks

The response letter by Sacks (1) in this issue of *Diabetes Care* acknowledges that our study (2) was meticulous, but raises concerns as to the

reliability of results, and reminds that hematocrit influences glucose values determined on whole blood. In this respect, some observations can be made.

First, the women involved in our study were absolutely free to leave the glucose profile monitoring program, which indeed was discontinued by a significant proportion of them (10%). This does not imply that the remainders were reliable but lends some credence to the fact that they performed and recorded the appropriate determinations at the right time. In addition, it is true that Accutrend α can only record the last nine values, but this allowed verification of determinations achieved in the night, which no doubt were those more likely to be skipped. Maybe hospitalization, as performed in previous studies, would positively contribute to obtaining precise plasma glucose determinations with reliable written results issued directly from the laboratory, but one may argue that the bias introduced by hospital stay in terms of lifestyle modifications (e.g., lack of physical activity) would in turn have some impact on the reliability of the results; also, the implications of hospitalization, in terms of both social costs and personal restrictions, would most probably limit, to a significant extent, the number of subjects available for such a study. More generally, if reliability of subjects enrolled in a study is questioned, then it would be tempting to suggest the absolute unreliability of many studies published thus far, as well as the fragility of most parameters on which clinical management relies, because it seems very difficult to achieve evidence that subjects enrolled in randomized controlled trials actually take their medications at the expected time with the expected continuity and, as for clinical practice, that pregnant women follow physicians' advice and prescriptions.

Second, the influence of hematocrit on whole-blood glucose determinations is well known, but we believe that this criticism, despite formal correctness, is beside the point. In fact, the conversion in plasma glucose equivalents, assuming a hematocrit of 35%, still shows that glucose concentrations documented in our study are lower than those reported by others, although to a lesser extent. In addition, it is undeniable that glycemic normalization achieved in pregnant diabetic

patients is commonly accomplished by following indications provided by capillary blood glucose determinations, without taking into account adjustments for hematocrit. It is important to realize that the aim of our study was to explore third-trimester glucose values in a group of nondiabetic pregnant women, because we felt the striking contrast of treating diabetes in pregnancy in an attempt to normalize glycemia without defining normoglycemia. This paradox could also explain the strange high rate of macrosomia found in some studies, despite apparent glycemic rectification. We contributed to this definition with a study involving 51 women who carefully followed our indications with high compliance; all pregnancies reported in our study were uneventful and had maternal cardiovascular adaptation with consequent changes in hematocrit values. In this context, the fact that capillary blood instead of plasma glucose was determined make the results more clinically useful, because the treatment of diabetic pregnant women is, in most instances, based on fingerstick measurements. For these reasons, we believe that glycemic values reported in our study, appropriately defined as unique, can be regarded as a point of reference.

GIORGIO MELLO, MD
ELENA PARRETTI, MD
RICCARDO CIONI, MD

From the Second Obstetric and Gynecologic Clinic, Department of Gynecology, Perinatology and Human Reproduction, University of Florence, Florence, Italy.

Address correspondence to Giorgio Mello, MD, Via Masaccio 92, Florence I-50100, Italy. E-mail: mellog@unifi.it.



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Diabetes Care: Interventions in the Community

In the timely review by Renders et al. (1), phoning patients with reminders for follow-up visits is suggested as an intervention of possible value. In the studies quoted, this intervention had not been used in isolation. We recently completed a prospective study looking at the effectiveness of this single intervention in a primary care environment. We hypothesized that having a nurse call patients to remind them of their follow-up visit would be beneficial.

A total of 59 patients diagnosed with type 2 diabetes were recruited between July 1999 and January 2000 while attending outpatient diabetes teaching programs at the University of Alberta Hospitals. A nurse contacted the patients in the test group by telephone at 1, 3, 6, 9, and 12 months after attendance at the Metabolic Center to advise them of the need to attend follow-up visits with their family doctor at those intervals. Patients in the control group were not contacted or reminded of their need for follow-up visits with their physicians, other than a suggested follow-up visit at the time of discharge from the program. There was concern that obtaining information prospectively regarding how often patients in the control group visited their own physicians would undermine the control group. We obtained this information retrospectively. Patients were randomly allocated to either the test or the control group.

Subject characteristics were not significantly different between the two groups at study entry. The mean age in the control and experimental groups was 51.8 ± 12.2 and 54.2 ± 12.4 years, respectively. The duration of diabetes was 6.69 ± 8.5 and 4.21 ± 4.6 years in the control and experimental groups, respectively. In the control and experimental groups, 13.8 and 21.4% required insulin and 48.3 and 42.9% used oral hypoglycemic agents alone, respectively. The primary end point was glucose control as assessed by HbA_{1c}. Data are reported as the means \pm SD. Student's *t* test was used for statistical analysis, with a significance level set at $P < 0.05$.

In total, 57 subjects completed the

study. Our research nurse was successful in contacting patients in the test group regarding their visit 95% of the time. Despite telephone reminders, only 9 of the 28 test group participants completed follow-up visits with their family physicians at all time points (i.e., 1, 3, 6, 9, and 12 months), a success rate of only 32%. A further seven test group patients completed at least half of the expected follow up visits. A retrospective analysis of the control group subjects' attendance at their family doctor's office (21 of 29 doctor's offices responded to our query) indicated that the frequency of visits was not significantly different from that of the test group.

HbA_{1c} and lipid values were obtained for 85% of study participants at the study end. No significant difference was found between the HbA_{1c} or lipid values of the control and test groups. HbA_{1c} at entry was 7.6 ± 1.8 and $7.6 \pm 1.8\%$ for the control and test groups, respectively, and at 1 year, HbA_{1c} was 7.6 ± 1.8 and $7.5 \pm 1.6\%$, respectively. Total cholesterol at entry was 5.16 ± 0.9 and 5.41 ± 1.3 mmol/l for the control and test groups, respectively, and at 1 year, it was 5.14 ± 1.0 and 5.06 ± 1.2 mmol/l, respectively. The relatively good lipid and HbA_{1c} values may have reduced our chance of seeing an effect.

The single intervention of providing telephone reminders did not significantly improve compliance, and there was no measurable improvement in diabetes care. Although it seemed reasonable to expect that reminding patients to see their physicians at recommended intervals would improve diabetic care, the study does not support this assumption. It is clear that more than simple telephone reminders are required.

M. TAMI SHANDRO, MD^{1,2}
 MARY E. PICK, MSc, RD¹
 ADRIEANNE GRUNINGER, RN²
 EDMOND A. RYAN, MD¹

From the ¹Department of Medicine, Division of Endocrinology and Metabolism, University of Alberta, Edmonton, Alberta, Canada; and the ²Beaumont Family Medical Associates, Beaumont, Alberta, Canada.

Address correspondence to M. T. Shandro, MD, the Northern Alberta Clinical Trials and Research Center, Suite 1800, 8215-112 St., Edmonton, AB T6G 2C8 Canada. E-mail: t.shandro@shaw.ca.

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Response to Shandro et al.

We read with interest the letter from Shandro et al. (1) in this issue of *Diabetes Care*. In our systematic review, in which we reviewed the effectiveness of interventions targeted at health care professionals and/or the structure of care to improve the management of diabetes in primary care, outpatient, and community settings, only a few of the studies that were included sent reminders to patients for follow-up visits. In these studies, this intervention was usually combined with other interventions. Consequently, the effectiveness of this single intervention was difficult to assess.

The only study in which sending reminders to patients was used as a single intervention was the study carried out by Halbert et al. (2). In that study, the intervention affected process measures only in the short term. Its effectiveness on patient outcomes was not assessed.

The other studies included in the review investigated the effectiveness of multifaceted interventions, and sending reminders to patients for follow-up visits was combined with other professional or organizational interventions, or with patient education. These multifaceted interventions improved the process of care, and if they were combined with patient education or the enhancement of the role of nurses in diabetes care, they also resulted in improvements in patient outcomes.

Shandro et al. conclude in their study that simple telephone reminders are not enough to improve diabetes care. This supports the conclusion of our review that multifaceted interventions that facilitate structured and regular review of patients are effective in improving the process of diabetes care. In studies on the effectiveness of multifaceted interventions, little effort has been made to disentangle the effects of the various components. However, it seems that only

