Influence of Health Care Providers on the Development of Diabetes Complications

Long-term follow-up from the Pittsburgh Epidemiology of Diabetes Complications Study

OBJECTIVE — To quantify total diabetes care received (generalist or specialist) from diagnosis onward and its association with the incidence of diabetes complications in a representative cohort of patients with type 1 diabetes.

RESEARCH DESIGN AND METHODS — A total of 429 subjects from the Pittsburgh Epidemiology of Diabetes Complications Study, a prospective follow-up study of childhood-onset type 1 diabetic subjects first seen between 1986 and 1988 (mean age 28 years, mean duration 19 years), followed biennially for up to 10 years were studied. Specialist care was defined as care received from a board-certified endocrinologist, diabetologist, or diabetes clinic and quantified as the percent of diabetes duration spent in specialist care.

RESULTS — There was a significant trend for a higher incidence of neuropathy, overt nephropathy, and coronary artery disease with lower use of specialist care. Multivariate analyses controlling for diabetes duration, demographic characteristics, health care practices, and physiological risk factors demonstrated that higher past use of specialist care was found to be significantly protective against the development of overt nephropathy (risk ratio 0.43, 95% CI 0.21–0.88) and neuropathy (0.54, 0.35–0.83) and weakly protective against coronary artery disease (0.65, 0.37–1.1).

CONCLUSIONS — A higher proportion of diabetes duration spent in specialist care may result in delayed development of certain diabetes complications independent of other risk factors. This study thus supports the concept that the benefits of specialist care should be available to all patients with type 1 diabetes.

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Primary care providers are the main source of care for patients with chronic disease (1,2). However, studies examining the quality of care delivered by provider type (generalist or specialist physician) in chronic diseases have generally demonstrated that specialists adopt newer, more effective treatment techniques (3,4), provide care that more closely adheres to established practice guidelines (5), deliver care that results in better outcomes (6,7), and may be more cost-effective (8) when compared with generalists. Studies comparing care received by specialists and generalists and use of preventive care services for people with diabetes have demonstrated higher rates of self-monitoring of blood glucose, intensive insulin therapy (more than two injections per day), and dilated eye examinations and better glycemic control in individuals receiving care from diabetes specialists (7,9,10).

Examination of the effect that health care providers have on long-term outcomes is complex because providers change over time, as does the therapeutic treatment of diabetes. To date, there have been few prospective data in cohorts of patients with diabetes examining the effect of care received over the duration of diabetes and complication incidence. Therefore, this study sought to quantify the diabetes care received (generalist or specialist) from diagnosis onward and its association with the incidence of diabetes complications in a representative cohort of patients with childhood-onset type 1 diabetes.

RESEARCH DESIGN AND METHODS — Participants for this evaluation were identified from the Pittsburgh Epidemiology of Diabetes Complications Study (EDC) cohort: a 10-year prospective follow-up study of childhood-onset (<17 years of age) type 1 diabetes. The study design was a prospective cohort design examining the association of specialist care with the incidence of diabetes complications during the 10-year EDC follow-up period. The EDC has been previously described (11,12). Briefly, study participants were diagnosed between 1950 and 1980 and seen within 1 year of diagnosis at Children’s Hospital of Pittsburgh. Although this population is clinic based, it was shown to be representative of the type 1 diabetic population of Allegheny County, Pennsylvania (13). By
definition, all subjects received at least 1 year, and in some cases as many as 18 years, of specialist care. Of the current cohort, 35.7% continued to receive diabetes specialist care immediately after stopping care at Children’s Hospital. There were 658 subjects who participated in the baseline examination (1986–1988) and who received care in the general community. The 429 subjects included in these analyses (mean age 27 years, mean duration 19 years at baseline, mean age at diagnosis 8 years) were participants of the sixth biennial examination (10-year follow-up: 1996–1998). Before their scheduled clinic visit, participants were sent questionnaires concerning demographic, health care, self-care, and medical history information. Included in these surveys was the Diabetes Care History Survey (DCHS). In this instrument, participants were asked to provide information on providers of their diabetes care from the time of diagnosis until the 10-year follow-up. Participants were asked to list the names of two health care providers for any given year, each provider was equally weighted. Patients prevalent for the complication at baseline were excluded from all incidence analyses. Univariate associations of baseline data were performed using the χ² test, Student’s t test, or the Wilcoxon’s rank-sum test. The Cochran Armitage test for trend was used to examine associations between tertiles of specialist care and incident complication rate to examine a possible dose-response relationship. Independent associations between specialist care and incident complications were assessed using Cox proportional hazards modeling. The outcome variable in these models was the complication of interest. Explanatory variables from the baseline examination were included using the following series of regression models with specialist care (up to and including the baseline examination) and duration forced into all models: model 1 (base model) = specialist care + diabetes duration; model 2 = model 1 + sex + income; model 3 = model 2 + physician visit in previous 12 months + test blood glucose at least weekly + more than two insulin injections/day; model 4 = model 3 + other variables primarily found to be associated with the complication of interest (enumerated in Table 3). Explanatory variables chosen for inclusion in the models were not limited by statistical significance but were based on literature review and analyses previously conducted in the EDC in addition to the current analyses. Potential confounders were entered into models 1–3 to examine if these indeed affected results. Explanatory variables with the exception of specialist care and diabetes duration were entered into the models in a forward stepwise fashion. Follow-up time for participants who did not develop the complication ended at examination 6. Because the specialist care variable was not normally distributed, it

**Statistical analysis**

The type of provider listed by the participants often changed. Thus, specialist care was calculated as a variable based on the total percent of diabetes duration that a patient was treated by a specialist provider. To calculate the care received, the number of years treated by each listed provider was totaled. The totals were then divided by the duration of diabetes to derive a percent of diabetes duration spent in specialist care. Because participants could list the names of two health care providers for any given year, each provider was equally weighted. Patients prevalent for the complication at baseline were excluded from all incidence analyses. Univariate associations of baseline data were performed using the χ² test, Student’s t test, or the Wilcoxon’s rank-sum test. The Cochran Armitage test for trend was used to examine associations between tertiles of specialist care and incident complication rate to examine a possible dose-response relationship. Independent associations between specialist care and incident complications were assessed using Cox proportional hazards modeling. The outcome variable in these models was the complication of interest. Explanatory variables from the baseline examination were included using the following series of regression models with specialist care (up to and including the baseline examination) and duration forced into all models: model 1 (base model) = specialist care + diabetes duration; model 2 = model 1 + sex + income; model 3 = model 2 + physician visit in previous 12 months + test blood glucose at least weekly + more than two insulin injections/day; model 4 = model 3 + other variables primarily found to be associated with the complication of interest (enumerated in Table 3). Explanatory variables chosen for inclusion in the models were not limited by statistical significance but were based on literature review and analyses previously conducted in the EDC in addition to the current analyses. Potential confounders were entered into models 1–3 to examine if these indeed affected results. Explanatory variables with the exception of specialist care and diabetes duration were entered into the models in a forward stepwise fashion. Follow-up time for participants who did not develop the complication ended at examination 6. Because the specialist care variable was not normally distributed, it
was dichotomized at the median value of 65% for specialist care comparisons and regression analyses. Results were considered significant at \( P \leq 0.05 \).

**RESULTS**

**Baseline characteristics**

Of the original 658 EDC participants, 429 completed questionnaires at the 10-year follow-up examination (68 participants had died since the baseline examination). Nonparticipants of this examination had no cumulative historical provider data available and are thus not included in these incidence analyses. Individuals providing data for the 10-year follow-up did not differ by sex (48.3% vs. 54.7% male), diabetes duration (mean 18.9 years [range 7.7–36] vs. 18.0 years [7.8–37.3]), or complication status (DSP, ON, PR, CAD, and LEAD) from those eligible but not participating in examination 6 \( (n = 161) \). However, participants were older (27.3 years [range 8–44.8] vs. 25.7 years [9.8–46.3], \( P = 0.03 \), were more likely to have an income >$20,000 per year (86.3% vs. 78.3%, \( P = 0.04 \), and had lower Hba1c (10.3% vs. 10.6%, \( P = 0.06 \) and triglyceride (95.6 vs. 117.2 mg/dl, \( P = 0.02 \)) levels.

**Specialist care and complication risk factors**

Comparisons between individuals reporting a higher (defined as >65% of diabetes duration in specialist care) or lower (defined as \( \leq 65\% \) of diabetes duration in specialist care) proportion of specialist care are summarized in Table 1. People with a higher proportion of specialist care were younger, had shorter diabetes duration, and were more likely to have seen a physician in the previous year and to test blood glucose. They had better lipid profiles (no significant difference in HDL cholesterol) and were less likely to be hypertensive or to have ever smoked.

**Incidence of complications**

The number of incident cases and incidence density for each complication is shown in Table 2. The mean proportion of diabetes duration spent in specialist care through the baseline visit is also shown for individuals who were incident cases and for those who remained free from complications. This proportion was significantly higher in individuals who did not develop DSP, ON, and CAD. The association was not significant for PR or LEAD.

Figure 1 shows the proportion of incident cases for each complication by tertile of specialist care. For CDSP, ON, and CAD, the group of individuals with the lowest proportion of diabetes duration spent in specialist care had the largest proportion of patients developing the complication. The test for trend was significant for CDSP, ON, and CAD.
Results, models were conducted because of the potential in multivariate adjustment. Because of the specialist care and LEAD and PR after associations were not found between 0.59, and 0.87 for models 1–4, respectively. Sex, income, seeing a physician in the previous year, and intensive insulin therapy had little effect on the RRs when introduced into the model (models 2 and 3). Results demonstrated that a higher use of specialist care was also significantly and independently associated with less ON across all four models (RR = 0.46, 0.32, 0.34, and 0.21 for models 1–4, respectively). Higher income and self-monitoring were also significantly associated with less ON; however, both income and self-monitoring lost significance when physiological risk factors were introduced into the model. Although associations between specialist care and CAD were not significant, RRs remained protective across models (CAD RR = 0.63, 0.60, 0.59, and 0.87 for models 1–4, respectively). Neither income nor sex was significantly associated with CAD. Higher AER was associated with an increased risk of CAD, whereas a higher HDL cholesterol level was protective. Significant associations were not found between specialist care and LEAD and PR after multivariate adjustment. Because of the potential influence of missing data on the results, models were confirmed by introducing only those variables significantly associated with outcomes in the final model together with specialist care and diabetes duration. These results are presented in Table 3. Because specialist care was related to ON, which is defined by the AER, models were also examined without AER, with no change to the interpretation of the association between specialist care and complications. Further, level of education and household income combined with level of education were introduced into the models. The overall interpretation of the association between specialist care and complications did not change, with the exception of the LEAD model. When education was in the model, the association between specialist care and LEAD became protective but not significantly so (RR = 0.81 [95% CI 0.45–1.5]). The specialist care variable was also entered into the models after being divided into tertiles. Again, the overall interpretation of the results did not change; however, the positive association between specialist care and proliferative retinopathy became borderline significant. Additionally, the CIs around the hazard ratios for specialist care narrowed for all complications.

**CONCLUSIONS**—These analyses examined the influence of diabetes specialist care (quantified since diagnosis) on the incidence of diabetes complications in a representative cohort of patients with type 1 diabetes. Results demonstrated that a higher proportion of diabetes duration spent in specialist care was associated with a lower incidence of ON and neuropathy. In addition, the relative risk for CAD was also consistently reduced, albeit statistically nonsignificantly in individuals with greater specialist care. This relationship remained independently protective for the development of ON after adjusting for related variables, including diabetes duration, sex, health care practices (e.g., seeing a physician in the previous year, self-monitoring of blood glucose, and intensive insulin therapy [more than two injections per day]), and physiological risk factors. Although the independent influence of specialist care was attenuated for CDSP and CAD in the final models, when physiological risk factors were ignored, RRs were 0.48, 0.44, 0.53, and 0.76 for models 1–4, respectively. Sex, income, seeing a physician in the previous year, and intensive insulin therapy had little effect on the RRs when introduced into the model (models 2 and 3). Results demonstrated that a higher use of specialist care was also significantly and independently associated with less ON across all four models (RR = 0.46, 0.32, 0.34, and 0.21 for models 1–4, respectively). Higher income and self-monitoring were also significantly associated with less ON; however, both income and self-monitoring lost significance when physiological risk factors were introduced into the model. Although associations between specialist care and CAD were not significant, RRs remained protective across models (CAD RR = 0.63, 0.60, 0.59, and 0.87 for models 1–4, respectively). Neither income nor sex was significantly associated with CAD. Higher AER was associated with an increased risk of CAD, whereas a higher HDL cholesterol level was protective. Significant associations were not found between specialist care and LEAD and PR after multivariate adjustment. Because of the potential influence of missing data on the results, models were confirmed by introducing only those variables significantly associated with outcomes in the final model together with specialist care and diabetes duration. These results are presented in Table 3. Because specialist care was related to ON, which is defined by the AER, models were also examined without AER, with no change to the interpretation of the association between specialist care and complications. Further, level of education and household income combined with level of education were introduced into the models. The overall interpretation of the association between specialist care and complications did not change, with the exception of the LEAD model. When education was in the model, the association between specialist care and LEAD became protective but not significantly so (RR = 0.81 [95% CI 0.45–1.5]). The specialist care variable was also entered into the models after being divided into tertiles. Again, the overall interpretation of the results did not change; however, the positive association between specialist care and proliferative retinopathy became borderline significant. Additionally, the CIs around the hazard ratios for specialist care narrowed for all complications.

Table 2—Incidence and percent of diabetes duration spent in specialist care by the 10-year incidence of diabetes complications in type 1 diabetes: EDC

<table>
<thead>
<tr>
<th>Complication</th>
<th>Cases (n)</th>
<th>Incidence density (per 100 person-years)</th>
<th>Mean % (SD) duration in specialist care</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>With complications</td>
<td>Without complications</td>
<td></td>
</tr>
<tr>
<td>CDSP</td>
<td>108</td>
<td>3.9</td>
<td>49.6 (35.8)</td>
<td>68.9 (35.2)</td>
</tr>
<tr>
<td>ON</td>
<td>41</td>
<td>1.2</td>
<td>46.5 (40.6)</td>
<td>63.2 (33.6)</td>
</tr>
<tr>
<td>PR</td>
<td>113</td>
<td>4.1</td>
<td>62.1 (34.7)</td>
<td>62.4 (36.5)</td>
</tr>
<tr>
<td>CAD</td>
<td>68</td>
<td>1.7</td>
<td>47.1 (34.7)</td>
<td>61.9 (34.7)</td>
</tr>
<tr>
<td>LEAD</td>
<td>95</td>
<td>2.7</td>
<td>55.9 (35.46)</td>
<td>60.3 (35.5)</td>
</tr>
</tbody>
</table>

*Determined by the Wilcoxon rank-sum test.

**Figure 1**—The 10-year incidence of diabetes complications by tertile of specialist care: EDC. The proportion of patients' incident for each of the complications presented by tertile of specialist care is represented. Low use of specialist care (I) (0–33.3% of diabetes duration), moderate use of specialist care (II) (>33.3–66.7% of diabetes duration), and high use of specialist care (III) (>66.7–100% of diabetes duration) are shown.
Specialist care and incidence of complications

Table 3—Independent risk factors associated with incidence of diabetes complications: Cox regression analysis, EDC

<table>
<thead>
<tr>
<th>Model</th>
<th>Total n (events)</th>
<th>Risk factor</th>
<th>RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDSP</td>
<td>307 (107)</td>
<td>Specialist care (high:low)</td>
<td>0.54</td>
<td>0.35–0.83*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diabetes duration (years)</td>
<td>1.3</td>
<td>1.0–1.6†</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HbA1c (%)</td>
<td>1.6</td>
<td>1.3–2.0‡</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Height (cm)</td>
<td>1.0</td>
<td>1.0–1.0†</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AER (µg/min)</td>
<td>1.3</td>
<td>1.0–1.5†</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypertension (yes:no)</td>
<td>2.8</td>
<td>1.6–5.0‡</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Smoking (yes:no)</td>
<td>1.5</td>
<td>0.98–2.2</td>
</tr>
<tr>
<td>ON</td>
<td>339 (39)</td>
<td>Specialist care (high:low)</td>
<td>0.43</td>
<td>0.21–0.88†</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diabetes duration (years)</td>
<td>0.79</td>
<td>0.54–1.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HbA1c (%)</td>
<td>2.0</td>
<td>1.5–2.7‡</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HDL cholesterol (mg/dl)</td>
<td>0.71</td>
<td>0.49–1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypertension (yes:no)</td>
<td>3.2</td>
<td>1.2–8.7†</td>
</tr>
<tr>
<td>PR</td>
<td>314 (112)</td>
<td>Specialist care (high:low)</td>
<td>1.1</td>
<td>0.79–1.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diabetes duration (years)</td>
<td>1.0</td>
<td>0.87–1.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HbA1c (%)</td>
<td>1.6</td>
<td>1.3–1.9‡</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AER (µg/min)</td>
<td>1.4</td>
<td>1.2–1.8‡</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Systolic blood pressure</td>
<td>1.2</td>
<td>1.0–1.3†</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(mmHg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAD</td>
<td>404 (67)</td>
<td>Specialist care (high:low)</td>
<td>0.65</td>
<td>0.37–1.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diabetes duration (years)</td>
<td>2.2</td>
<td>1.6–2.9‡</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HDL cholesterol (mg/dl)</td>
<td>0.68</td>
<td>0.51–0.9*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AER (µg/min)</td>
<td>1.5</td>
<td>1.2–1.9‡</td>
</tr>
<tr>
<td>LEAD</td>
<td>205 (37)</td>
<td>Specialist care (high:low)</td>
<td>0.95</td>
<td>0.53–1.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diabetes duration (years)</td>
<td>1.3</td>
<td>0.96–1.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alcohol (drinks/week)</td>
<td>0.69</td>
<td>0.46–1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hypertension (yes:no)</td>
<td>2.7</td>
<td>1.5–5.1*</td>
</tr>
</tbody>
</table>

Specialist care (>65%: ±65%) and diabetes duration were included in all models. *P < 0.01; †P < 0.05; ‡P < 0.001. Additional risk factors were made available to the final models as follows: CDSP: Sex, HbA1c, height, AER, hypertension, smoking, ON: HbA1c, HDL cholesterol, hypertension, PR: HbA1c, AER, systolic blood pressure, CAD: HDL cholesterol, AER, LEAD: alcohol consumption, HbA1c, triglycerides, hypertension. All risk factors presented are those significant in the model at the P < 0.10 level. RRs are presented per 1 SD increase for the following continuous variables: diabetes duration = 7.5 years, HbA1c = 1.8%, AER = 1.9 µg/min, HDL cholesterol = 12.5 mg/dl, alcohol = 7.3 drinks/week, systolic blood pressure = 7.3 mmHg, triglycerides = 0.5 mg/dl. RRs for height are reported per 1-cm increase.

introduced, these findings did not diminish the importance of the relationship between specialist care and complications because it is likely these factors are true mediators of risk that explain how specialist care exerts its effect. Specialist care was not only associated with the complication outcome but was also associated with certain physiological risk factors (e.g., LDL cholesterol, HDL cholesterol, AER, and hypertension). Thus, adding these mediators to the model may attenuate the relationship between specialist care and complications because the physiological risk factors are also known to be associated with the outcome. Additional risk factors may have gone to specialists until having one or more complications, which could potentially underestimate the effect of specialist care.

Little prospective research is available that examines the influence of diabetes specialist care on complication outcomes. In a study by Schiel et al. (24), decentralization of diabetes care from specialist centers to general practice demonstrated an increase in rates of proliferative retinopathy and worse glycemic control in people with type 1 diabetes when comparing nonspecialized care in the decentralized system to centralized diabetes care. This study, however, did not follow the same cohort for the two time periods. In a cross-sectional comparison, Tabak et al. (25) found lower rates of proliferative retinopathy, albuminuria, and end-stage renal disease when comparing the Diabetic Care Hungary, where diabetes care is specialized, with the EDC population, where care is a mixture of specialist and generalist providers. In the Verona Diabetes Study (26), individuals attending the diabetes center experienced a 17% lower mortality rate than individuals seeing family practitioners. Similarly, individuals regularly attending Steno Memorial Hospital (a diabetes specialty clinic) had better survival with later and less frequent occurrence of serious late diabetes complications than those with sporadic or no contact with the Steno Clinic. The excess mortality in the Steno study was due to an earlier and more common occurrence of renal disease in individuals with sporadic
knowledgeable about self-management
mencations because they may feel more
may result in better adherence to recom-
studies support that outcomes may be
alist care (29). The aforementioned
participants had to recall a long period of
care, a validation study using medical record review was also un-
der taken in these 19 participants. Complete medical record ascertainment was
available for eight participants. Of the
responses given by participants regard-
ing the health care provider, 86% were
validated through medical records pro-
vided by the physician named in the
questionnaire.

The EDC is a prospective follow-up
study of subjects shown to be representa-
tive of the childhood-onset type 1 diabe-
es population in Allegheny County,
Pennsylvania (13). By design, this study
provided clinical, socioeconomic, and de-
mographic data for up to 10 years of fol-
low-up in these patients, thus allowing
the evaluation of the influence of a variety
of risk factors on complication outcomes.
This substudy is original in its design.
Other studies, to the knowledge of the
authors, have not examined the influence
of specialist or generalist care on the inci-
dence of diabetes complications during a
patient’s duration of diabetes. Although
the provider data were historical in na-
ture, complications were assessed pro-
spectively, thus allowing the influence
of type of provider on the incidence of com-
plexion to be assessed. Other studies
exami ning effects of specialist care have
not used standardized methods to classify
care, as was done in this study. Addition-
ally, studies examining this research
question have been cross-sectional in na-
ture (3,4,24,28,30) or conducted in clinic
populations (5,9,10,31) with few exami-
n ing complication outcomes. Studies ex-
ami ning the interrelationship between
types of care received, socioeconomic fac-
tors, and complication outcomes appear
to be absent in the literature. The current
study adds to the available literature be-
cause it documents health care history
and associations with the subsequent de-
velopment of complications of the same
cohort. One limitation of the current
study is that other practice characteristics,
e.g., solo versus group, and practice sta-
bility over time were not studied because
these data were not fully available for the
>700 providers studied. However, be-
cause most of the specialists were in stable
group practices, the potential for further
analysis is limited. This result does dem-
strate the need for further study to iden-
tify characteristics of “best practices”
and to translate these findings because the
current analyses did not capture certain
aspects of specialist care, such as fre-
quency of self-monitoring or provider
practice characteristics that may lead to
an acute improvement in glycemic con-
tr ol, consequently affecting complication
onset.

The results of this study suggest that
specialist care may play a role in influen-
cing health care practices and incidence of
OF and neuropathy in patients with type
1 diabetes. This study did demonstrate
associations between specialist care, so-
cioeconomic status, and complication,
mediating variables that can influence the
development of complications. The inter-
relationship between the role of health
care provider, socioeconomic status, and
clinical characteristics as they relate to
outcomes is a complex issue to disentan-
gle. Although it is not feasible for all pa-
ients with diabetes to be seen by a
diabetes specialist and some generalists
may indeed deliver high-quality diabetes
care, efforts aimed at the primary and sec-
ondary prevention of diabetes complica-
tions should focus on the identification of
aspects of high-quality care that may lead
to better outcomes, coordinated care be-
tween specialist and generalist physi-
cians, and mechanisms that increase both
patient and provider awareness of pre-
ventive service use.

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Scientific Sessions of the American Diabetes
Association, San Antonio, Texas, 9–13 June
2000 (Abstract 186).

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Specialist care and incidence of complications


