Published in final edited form as:

Diabetes Educ. 2013 ; 39(4): 468–477. doi:10.1177/0145721713492217.

Characterization of Factors Affecting Attainment of Glycemic Control in Asian Americans With Diabetes in a Culturally Specific Program

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Abstract

Purpose—The purpose of this study is to examine the effectiveness of a culturally specific pilot clinic for Asian Americans (AA) in reaching glycemic target and to characterize factors affecting the attainment of glycemic control in comparison with white counterparts.

Methods—This electronic health record review included all new AA patients with type 2 diabetes ($n = 109$) in a culturally specific program and a randomly selected sample of new white patients with type 2 diabetes ($n = 218$) in the adult clinic within the same time period and diabetes center.

Results—AA and whites had a comparable proportion of patients with A1C $\geq 7\%$ (32.1%, 34.9%; $P = .621$) at baseline and after 12 months of care (48.6%, 56.0%; $P = .210$), with a similar A1C decline ($-0.9\% \pm 1.6\%$, $-0.8\% \pm 1.7\%$, $P = .710$) by 12 months. Factors associated with the lack of success in reaching target in AA but not in whites included older age, lower educational attainment, less likelihood of having health insurance, and a need for more educational visits. The percentage of AA reaching A1C $\geq 7\%$, as compared to whites, worsened among those with highest initial A1C when stratified by ascending quartiles (96.7% vs 85.2%, $P = .101$; 61.9% vs 58.9%, $P = .813$; 24.0% vs 37.7%, $P = .230$; 15.2% vs 35.4%, $P = .044$).

Conclusion—While a culturally specific diabetes program in a specialty setting achieved a similar glycemic outcome for AA compared with whites, reasons for not reaching glycemic target differed. The findings suggest that the elimination of diabetes disparities requires not only

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Conflict of interest statement: W.C.H. is on the advisory board for Novo Nordisk. No other potential conflicts of interest relevant to this article were reported.

Contributions

HL contributed to study design, manuscript writing, data collection and analysis. SW contributed to study design and manuscript review. TI contributed to protocol preparation, manuscript writing, and review. HK contributed to data analysis and manuscript review. GLK contributed to study design and manuscript review. WCH contributed to study design, data research and analysis, manuscript writing, and review.

culturally and linguistically specific programs, but must also identify and address the socio-environmental differences unique to each population.

Diabetes mellitus affects about 10% of Asian Americans despite their lower body weight. While type 1 diabetes is relatively rare, the majority of diabetes cases among Asian Americans is type 2 diabetes.¹ According to the data from National Health Interview Survey, the prevalence of diagnosed diabetes in Asian Americans increased 83% between 2000 and 2010.² Asian Americans are at least 60% more likely to develop type 2 diabetes than white Americans and have higher rates of diabetes than whites, blacks, and Hispanics who are in the same body mass index (BMI) category.³

Compelling data from the New York City (NYC) Health Department shows that 1 in 6 Asian adults living in NYC has diabetes.⁴ Furthermore, the NYC Health and Nutrition Examination Survey and the NYC Community Health Survey show that almost one-half of NYC Asian residents have glucose levels above normal, highlighting the issue of glucose impairment. In addition to having a higher percentage body fat at any given BMI,⁵ studies have also highlighted a propensity for Asian Americans to develop visceral adiposity,⁶⁻⁹ which is directly linked to an increase in diabetes risk.⁸⁻⁹ Our earlier study has also shown that Asian Americans with type 2 diabetes are more insulin resistant than healthy controls and Asian Americans with type 1 diabetes of comparable BMI.¹⁰ Apart from physiology, studies have described Asian Americans with diabetes as having a higher mean A1C when compared to whites, raising the question of racial/ethnic disparities in diabetes care among Asian Americans.¹¹⁻¹² Furthermore, certain complications such as end stage renal disease tend to disproportionally impact Asian American patients even with uniform access to care.¹³ This initial profile of diabetes among Asian Americans serves as an important foundation for understanding and developing treatments specific to this population.

Racial and ethnic disparities in glycemic control and diabetes-related health outcomes have been well documented in the primary care setting.¹⁴⁻¹⁵ In regard to the Asian American population, of whom many are first-generation immigrants, previous studies have suggested that linguistic and cultural barriers and lack of culturally appropriate educational materials contribute to suboptimal diabetes control and quality of care.¹⁶⁻¹⁷ In response to these challenges, some neighborhoods heavily populated with minority patients have implemented educational or clinical programs specifically designed for minority groups. The main components of these culturally specific clinics include employing health care providers (primary care physicians, nurse practitioners, or diabetes educators) and staff who speak the same language as patients and utilizing culturally tailored educational materials in patients' primary languages. Other studies have shown that when access to health care is secured, social factors such as economic or educational background became more important contributors to outcomes.¹⁸ Given that the factors leading to uncontrolled diabetes are complex and often go beyond linguistic and cultural barriers, it is unclear whether the current focus in addressing these challenges is sufficient in overcoming racial and ethnic disparities in Asian Americans with diabetes. With the goal of improving the model for culturally specific programs for Asian Americans with diabetes, this study was designed to compare glycemic control between Asian American and white patients and to characterize the factors associated with Asian Americans reaching or not reaching glycemic target.

Methods

Setting

This is a retrospective study analyzing data in electronic health medical records (EMR) at a diabetes referral center. According to a recent internal review of 3945 new patients with type 2 diabetes, the makeup of the center's diabetes population is approximately 75.0% whites, 5.0% Asians, 13.8% blacks, and 6.2% Hispanics. Adult patients receive care through the Adult Diabetes section (AD) of the diabetes center, which is staffed by a team of experts including endocrinologists, nurse educators, nurse practitioners, medical assistants, dietitians, exercise physiologists, and care coordinators. The health care team actively involves patients and their families in the decision making about individual options for treatment and emphasizes provider-patient partnership in the care design and implementation. The Asian Clinic (AC) team at Joslin includes endocrinologists, a dietitian who is also a certified diabetes educator, and a care coordinator, all of whom are skilled in integrating the unique physiology, cultural beliefs, and explanatory models of predominant Asian cultures into the care they provide. Linguistic and cultural knowledge of the staff along with culturally appropriate educational materials form the foundation of the culturally specific clinic. The dietitian is familiar with many Asian cuisines and offers culturally tailored self-care education and training. Most educational materials are available in the patients' primary languages. All educational materials follow the diabetes center's guidelines, but are modified and translated to fit the language, cultural, and physiological needs of the AC patients. Due to linguistic barriers, the majority of the AC patients who are unable to join the center's group education classes will meet individually with the AC certified diabetes educator to develop a diabetes care plan. The AC team also utilizes an interactive and multilingual website to provide information for patients who have Internet access. The AC care coordinator serves as the liaison between patients and health care providers. Aside from performing routine scheduling of AC patients, the care coordinator participates in weekly patient rounds, coordinates patients' family meetings, and assists with finding social services. When language discordance with patients occurs, a professional interpreter is incorporated into the care model. Both AC and AD use EMR to document all medical and educational visits, including laboratory values. The makeup of the AC population is approximately 77% Chinese, with the remaining comprised of Burmese, Cambodian, Filipino, Indian, Japanese, Korean, Malaysian, Pakistani, Sri Lankan, Vietnamese, and multiracial Asian patients. The patient population is made up of predominantly first-generation immigrants.

Study Cohort

The study cohort included new type 2 diabetes adult patients (age >18 years) seen in the AD and in the AC between January 1, 2004 and September 30, 2009. All AC patients are of Asian descent and all AD patients in this study self-identified as non-Hispanic white. For the purpose of this study, other minority patients were not included in the analysis. New patient status was defined as having no visits within the 3 years prior to the start of the study. Subjects were excluded if they were (1) not seen at their respective clinic during the specified time period, or (2) they were only seen once, or (3) if their follow-up visit was not dated within 12 ± 3 months after their initial visit. An AC patient was defined as having seen

the physician or dietitian associated with the AC. All of the eligible patients in the AC were included in this analysis ($n = 109$). Twenty patients were excluded due to having only 1 visit during the study period. To ensure adequate representation of the general clinic population, twice the sample size of AC was selected by systematic sampling to give us the AD white cohort ($n = 218$). In all, 3233 new type 2 diabetes white patients were seen between the dates previously mentioned. Of this population, 1313 had a follow-up visit 9 to 15 months after their initial visit. From this list, patients were sorted by ascending medical number and every sixth patient was selected to give the final sample size of 218 AD patients.

Patient Data of Interest

Patient data, including medication use and glycated hemoglobin (A1C), were obtained from the patient's EMR. The study received Institutional Review Board approval to utilize each participant's address from EMR using de-identified data; therefore, no patient consent was obtained. Since there was no direct contact with study subjects in this retrospective study design, the 2000 census tract linked by zip code was used to determine educational attainment and median household income. A1C results were taken at every provider (medical doctor or nurse practitioner) visit and the results were retrospectively gathered. A patient on an injectable medication was defined as one who was prescribed insulin or injectable therapy such as a glucagon-like peptide-1 receptor agonist. Using the approach of a retrospective EMR review, the assessment of patient participation in services offered by the programs was limited to capturing patients' medical visit histories including MD/NP appointment, missed MD/NP appointment, education visits, and missed education visits. MD/NP was considered as provider visits, and education visits were defined as any appointments with exercise physiologists, nurse educators, or registered dietitians.

Outcome Measures

The major outcome measure of the study was the proportion of each group that reached the target A1C of $\leq 7\%$ after 12 months of care. This particular parameter was chosen as this is the standard clinical goal for glycemic control set by the American Diabetes Association (ADA).¹⁹ A 12-month time period was used because this is the usual time period required to demonstrate program effectiveness as a certified Diabetes Recognition Program by the National Committee for Quality Assurance (NCQA).

The secondary outcomes included absolute A1C decline and the various clinical and social factors associated with glycemic control among those who reached glycemic outcome (A1C $\leq 7\%$) and those who did not in AC and AD.

Statistical Analyses

The study consisted of continuous and nominal data. The Student t test was used for two-way comparisons of continuous variables between those achieving an A1C $\leq 7\%$ within both groups and then across the groups. The chi-square test (χ^2) was used to determine a differential outcome in achievement for categorical data such as medications, gender, marital status, preferred language, and health insurance. A type 1 error of .05 was used in these analyses with no correction for multiple comparisons, as these were a priori hypotheses.

Results

Description of Study Cohort

A total of 109 AC and 218 AD patients were included in the study. Table 1 contains the baseline characteristics of both groups. In this highly insured sample, patients enrolled in AC were different from AD in several aspects, including lower BMI (25.4 ± 3.7 vs 32.1 ± 6.6 kg/m²; $P = .001$), higher percentage taking oral medication (69.7% vs 56.0%; $P = .016$), longer duration of diabetes (11.7 ± 8.0 vs 8.1 ± 6.4 years; $P = .001$), less preference for English for daily use (21.1% vs 97.3%; $P = .001$), and lower median household income ($\$56,336.4 \pm \$31,332.8$ vs $\$64,252.7 \pm \$23,185.5$; $P = .013$). AC patients were also more likely to be female (54.1% vs 39.5%; $P = .011$) and married (83.5% vs 69.3%; $P = .006$).

Glycemic Control After 12 Months of Care

After 12 months of care, AC group had an absolute A1C decline of $0.9\% \pm 1.6\%$ compared to $0.8\% \pm 1.7\%$ in AD group ($P = .710$) (Table 2). Comparing microvascular complications (retinopathy, nephropathy, and neuropathy) and hypertension at the end of 12 months among patients who did not reach glycemic target, only 14.3% in the AC were documented as free of complications versus 27.1% in the AD. The difference, however, was not statistically significant ($P = .068$).

Differential Analysis of Individuals Who Reached Target Outcome Versus Those Who Did Not

Data from both groups were further segregated into subgroups according to their success in reaching glycemic target (Table 3). In AC, patients who did not reach glycemic target when compared to ones who did were disadvantaged by older age ($P = .002$), a longer disease duration ($P = .001$), a more complex treatment regimen, a lack of health insurance ($P = .047$), lower levels of educational attainment ($P = .048$), and a higher initial A1C ($P = .001$). Interestingly, AC patients who did not reach target required and attended more educational visits ($P = .004$).

Certain factors associated with not reaching glycemic target were shared between the AC and AD patients. These factors included being on combination (injectable and oral) or other more complex diabetes regimens, a longer duration of disease, and a higher initial A1C (Table 3). There were also interesting differences. Within the AC group, patients who did not reach target were older (66.2 ± 10.0 vs 59.3 ± 13.0 years; $P = .002$) than those who reached target. In contrast, within the AD group, patients who did not reach target were younger (60.0 ± 11.9 vs 63.4 ± 10.5 years; $P = .019$) than those who reached target. In addition, AC patients who did not reach target had a lower education attainment than those who reached target (39.8% vs 32.1%; $P = .048$), which was not found within the AD group (34.9% vs 32.6%; $P = .340$). Furthermore, within the AC group, patients who did not reach target were less likely to be insured (92.9% vs 100%; $P = .047$) and required more education visits (3.3 ± 2.1 vs 2.2 ± 1.7 ; $P = .004$) compared to those who reached target; while within the AD group, patients who did not reach target did not show any significant differences with those who reached target in terms of insurance or education visits (Table 3). Of interest, among all patients who did not reach target, AC patients had a higher baseline A1C

compared to AD patients ($9.3\% \pm 1.7\%$ vs $8.5\% \pm 1.6\%$; $P = .010$), but had a greater absolute A1C reduction ($1.0\% \pm 1.7\%$ vs $0.3\% \pm 1.6\%$; $P = .022$) at the end of 12 months.

Stratification Using Initial A1C

Stratification according to patients' initial A1C was done to determine if the culturally specific program effectively improved glycemic control for all patients. When patients were stratified according to initial A1C quartiles in ascending order, both AC and AD groups showed lower rates of reaching glycemic target in accordance to a higher initial A1C. AC patients who started out in the lower 2 quartiles of initial A1C did relatively well in reaching the glycemic target compared with their AD counterparts (first quartile of initial A1C 6.8%, 96.7% vs 85.2%; $P = .101$; second quartile of initial A1C 6.9%–7.6%, 61.9% vs 58.9%; $P = .813$). In contrast, those who started out in the higher 2 quartiles of initial A1C demonstrated a significant divergence in percentage of subjects reaching final A1C target between AC and AD groups (third quartile of initial A1C 7.7%–9%, 24.0% vs 37.7%; $P = .230$, fourth quartile of initial A1C 9%, 15.2% vs 35.4%; $P = .044$) (Figure 1).

When comparing AC patients who had an initial A1C $\geq 7.7\%$ (7.7% being the median A1C for the cohort) to AC patients who started out with an A1C $< 7.7\%$, the study found that older age (65.0 ± 10.3 vs 60.4 ± 13.3 years; $P = .043$), longer duration of diabetes (14.2 ± 7.9 vs 8.9 ± 7.4 years; $P = .001$), being on combination therapy (17.2% vs 2.0%; $P = .008$), and lower educational attainment (41.1% vs 30.2%; $P = .005$) were factors associated with not reaching glycemic target. These findings were consistent with factors associated with not reaching target within the AC group in Table 3.

Discussion

After 12 months of care, the general improvement in A1C achieved by AC was comparable to that attained by AD. As a group, these improvements supported the conclusion from studies suggesting that A1C levels will improve after a patient's first year of care at specialty clinics²⁰ and validated the effectiveness of culturally specific programs and diabetes care by language and ethnic concordant providers.^{17,21} However, when percentage reaching A1C of $\leq 7\%$ after 12 months of care was used as an outcome measure, the statistical trend suggested that fewer AC patients compared to AD patients would reach glycemic goal. Challenges in achieving racial/ethnic equity in diabetes care became apparent when AC patients who started in the highest quartile of initial A1C were shown to be less likely than AD patients with comparable initial A1C to reach glycemic target by the 12-month mark.

Our data illuminate the complex issue of examining racial and ethnic health disparities in Asian Americans. While the overall improvement in A1C for AC offered reassurance regarding the effectiveness of a culturally specific program, the analysis of the AC subgroups indicated that challenges exist in diabetes control for AC patients at high risk for complications. One possible reason for the differential success in attaining A1C of $\leq 7\%$ is the wider range of socioeconomic and educational levels in the Asian American community. For example, 48% of the Asian American population has a bachelor's degree or higher,²² which is significantly higher than the 30% of whites.²³ This finding would suggest that the

Asian American community in general has received higher levels of education. However, 15% of Asian Americans have never graduated from high school compared to 11% of whites. Our data reflect a similar bipolar distribution in patient characteristics. For example, in terms of age, BMI, treatment complexity, insurance status, disease duration, median household income, education, and initial and final A1C, AC patients who reached glycemic target were in a similar or more favorable condition than their counterparts from the AD group. In contrast, AC patients who did not reach target had far more difficult barriers to overcome in achieving glycemic control when compared to a similar group in the AD cohort. As a trend, they were older in age, had longer disease duration, were less likely to have health insurance, and had a lower median household income, lower levels of education attainment, and a higher initial A1C. Essentially, these findings demonstrated that when data from a group as diverse as Asian Americans are aggregated, we risk overlooking the differences and needs in the population.

More specifically, racial comparisons of factors associated with failing to reach target between the AC and AD patients showed interesting similarities and differences. Consistent with findings by Sanal et al, we observed that older age was associated with AC patients who did not reach target,²⁴ but a younger age was associated with AD patients who did not reach target, which was supported by other studies.²⁵ A potential explanation may be the language preference of elderly Asian Americans and its role in glycemic control. A majority of elderly Asian Americans prefers a non-English language as the primary language of choice.²⁶ As we have shown in a previous study, those who preferred to speak Chinese as their primary language had a higher A1C and less diabetes knowledge despite receiving care in a language-concordant environment.¹⁶ Furthermore, West and Goldberg reported an inverse relationship between diabetes knowledge and age, describing a 3% decrease in diabetes knowledge for every 10 years increase in age.²⁷ This description of an inverse relationship between diabetes knowledge and age was also supported by a study involving Chinese patients with type 2 diabetes.²⁸ Of equal importance were the findings that AC patients who did not reach target were less likely to have health insurance, had lower levels of educational attainment, and required more educational visits when compared to AC patients who reached target. These same factors were not found to be associated with those who failed to reach target in AD. These differences indicate that distinct solutions are needed for AC and AD patients who failed to reach target. Moreover, current models of culturally specific programs for Asian Americans that are largely based on language or cultural needs can greatly benefit from addressing the environmental and pathophysiologic factors described previously. These results support the idea that language and ethnic concordance is only one piece out of many in the design of a successful diabetes program. Social, economic, and pathophysiologic factors also play key roles in diabetes health outcomes.

The study has specific implications for developing culturally specific programs for Asian Americans and potentially other ethnic minorities. The fact that this type of program is beneficial for Asian Americans is evident in the A1C improvement in AC patients who did not reach glycemic target ($1.0\% \pm 1.7\%$) as compared with their counterparts from AD ($0.3\% \pm 1.6\%$; $P = .022$). Furthermore, among AC patients who began in the lower 2

quartiles of initial A1C ($\geq 7.7\%$), there was no difference in percentage reaching target A1C when compared with AD patients. This particular group of individuals reached and maintained a similar degree of glycemic control as the AD group and has been adequately cared for by the current model of culturally specific programs. Given the resource strained environment in health care, further efforts to eliminate ethnic and racial disparities in diabetes should be focused on those who have the highest risk for not reaching glycemic target. To help identify these patients, the study used patients' baseline A1C as a way to stratify patients and identify at-risk Asian American patients. When validated by larger studies in the future, this approach of identifying those who are high risk at an earlier stage could complement the culturally specific programs by placing these individuals into more focused treatments.

There are other programmatic considerations. Even with the significant A1C improvement (1%) among AC patients who did not reach glycemic target, the decrease was not sufficient to reach the glycemic goal of A1C $\leq 7\%$ partly because they started with a higher mean A1C. One potential solution may be to extend the treatment period to greater than 1 year to allow more interventions to take place. Alternatively, addressing other physiologic or environmental factors may be needed. For example, for the older patients who have difficulty meeting glycemic targets, the program may consider incorporating approaches^{29–30} commonly used for geriatric patients. These may include assessing cognitive dysfunction and more involvement of and support from family members in medical decision making. For those with longer disease durations, particular attention to simplifying the regimen may be especially important in enhancing medication adherence.³¹ Addressing the socioeconomic issues within the context of clinical programs is challenging to say the least. However, providing nutritional and exercise education choices that are culturally relevant, responsive to different learning styles, and sensitive to the resource limitations and needs of different communities would be a meaningful start to a systemic solution that clinical programs can take part in. Overall, tailored programs are resource intensive and ultimately the feasibility for such programs will depend on the availability of qualified staff, funding, and patient willingness to participate. This study reinforces the importance of identifying and addressing those socioeconomic issues.

Some weaknesses of the study include the lack of data on self-care behaviors, which are critical to optimal diabetes outcomes. Also, despite reporting the MD/NP and educational visits of each participant, the study did not capture data on the overall participation in the clinical services including non-face-to-face contacts such as e-mails, phone calls, and faxing between providers and patients. Some cultural factors, which may have contributed to the study's findings, were not collected. These may include: degree of acculturation, length of time residing in the United States, health literacy, family relationships/support system, cultural views and beliefs about traditional and Western medicine, and self-management behaviors and attitudes. In addition, the study was conducted at a specialty center and the findings have not been tested at the primary care setting. It is also important to note that our sample size consisted of highly insured Asian Americans. Future studies are needed to confirm these findings in a more well-represented population of Asian Americans. A future study stratified by age comparing Asians in AC versus Asians in AD may provide additional insights into the impact of culturally specific programs.

In summary, the study results suggest the effectiveness of a culturally tailored diabetes program for Asian Americans while raising concerns toward a trend of poorer glycemic control in certain Asian American subgroups. These findings serve as a beginning step in exploring the various factors that may contribute to the lack of success in reaching glycemic goal. Disaggregation of data based on patient background and using initial A1C may also assist in this characterization. Future research should study the various cultural factors related to diabetes care that were not collected by this study in high-risk patients. Ultimately, a model of care that is responsive to socioeconomic, pathophysiologic, cultural, and other environmental factors can best promote equity in diabetes outcomes for Asian Americans.

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Percentage of Patients in Both Groups that Reach HbA1c $\leq 7\%$ Stratified According to Initial HbA1c

Figure 1.

Racial differences in percentage of patients reaching A1C $\leq 7\%$ after 12 months of care, stratified according to initial A1C.

Table 1

Baseline Characteristics Stratified According to Race

Characteristic	Asian Clinic (AC) (n = 109)	Adult Diabetes (AD) (n = 218)	P-Value
	Mean ± SD	Mean ± SD	
Age (yrs)	62.8 (12.0)	61.8 (11.2)	.430
Body mass index (kg/m ²)	25.4(3.7)	32.1 (6.6)	.001*
Diabetes regimen at baseline			
Injectable and oral (%)	10.1	15.6	.173
Injectable (%)	9.2	12.4	.387
Oral (%)	69.7	56.0	.016*
No medication (%)	11.0	16.1	.220
Duration (yrs)	11.7 (8.0)	8.1 (6.4)	.001*
Female (%)	54.1	39.5	.011*
Married (%)	83.5	69.3	.006*
Preferred speaking English (%)	21.1	97.3	.001*
Health insurance (%)	96.3	98.6	.177
Median household income (\$)	56 336.4 (31 332.8)	64 252.7 (23 185.5)	.013*
Education ^a	36.1	33.6	.240
Initial A1C (%)	8.2 (1.9)	7.9 (1.8)	.190

^aData on education represent the percentage of adults 25+ years of age with a high school degree or less.

* *P* .05.

Table 2

Summary of Results After 12 Months of Care

Characteristic	Asian Clinic (AC) (n = 109)	Adult Diabetes (AD) (n = 218)	P-Value
	Mean ± SD	Mean ± SD	
Initial A1C (%)	8.2 (1.9)	7.9 (1.8)	.190
Final A1C (%)	7.4 (1.3)	7.2 (1.3)	.170
Mean change (%)	−0.9 (1.6)	−0.8 (1.7)	.710
Percentage with initial A1C ≥ 7%	32.1	34.9	.621
Percentage achieving A1C < 7%	48.6	56.0	.210
MD/NP visits	2.7 (1.0)	3.1 (1.5)	.037*
Missed MD/NP visits	0.1 (0.3)	0.1 (0.3)	.290
Education visits	2.8 (2.0)	3.3 (3.3)	.150
Missed education visits	0.1 (0.3)	0.3 (0.6)	.013*

* $P < .05$.

Table 3

Analysis of Asian Clinic (AC) and Adult Diabetes (AD) Patients Stratified According to Final Outcome Defined as Reaching A1C 7%

Characteristic	AC A1C 7% (n = 53)		AC A1C >7% (n = 56)		AD A1C 7% (n = 122)		AD A1C >7% (n = 96)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (yrs)	59.3	(13.0)	66.2	(10.0)	63.4	(10.5)	59.8	(11.9)
Body mass index (kg/m ²)	24.8	(2.8)	26.0	(4.3)	31.6	(6.4)	32.8	(6.7)
Diabetes regimen at end of study period								
Injectable and oral (%)	9.4		39.3		22.1		45.8	
Injectable (%)	9.4		17.9		9.8		15.6	
Oral (%)	64.2		42.9		55.7		38.5	
No medication (%)	17.0		0		12.3		0	
Duration (yrs)	7.9	(5.5)	15.4	(8.4)	7.1	(6.4)	9.4	(6.3)
Female (%)	52.8		55.4		41.8		36.5	
Married (%)	84.9		82.1		77.9		72.9	
English as preferred language (%)	24.5		17.9		95.9		99.0	
Health insurance (%)	100		92.9		98.4		99.0	
Median household income (\$)	60 086.0		52 859.4		65 573.7		62 634.70	
	(30 613.6)		31 868.2)		(23 782.9)		(22 459.5)	
Education ^a	32.1		39.8		32.6		34.9	
Initial A1C (%)	7.1	(1.5)	9.3	(1.7)	7.4	(1.8)	8.5	(1.6)
Final A1C (%)	6.4	(0.4)	8.3	(1.2)	6.3	(0.5)	8.2	(1.1)
Mean change (%)	-0.7	(1.4)	-1.0	(1.7)	-1.1	(1.7)	-0.3	(1.6)
MD/NP visits	2.6	(1.0)	2.8	(1.0)	3.0	(1.6)	3.1	(1.3)
Missed MD/NP visits	0.1	(0.2)	0.1	(0.3)	0.1	(0.3)	0.1	(0.3)
Education visits	2.2	(1.7)	3.3	(2.1)	3.2	(3.7)	3.4	(2.8)
Missed education visits	0.1	(0.3)	0.1	(0.3)	0.2	(0.6)	0.3	(0.7)

^aData on education represents the percentage of adults 25+ years of age with a high school degree or less.