AHRQ FINAL Project Report
Title Page:
"Assessing Barriers to ADA Guideline Adherence"

Principal Investigator and Team Members:
Mitchell A. Kaminski, M.D., Principal Investigator
Chairman, Department of Family Medicine
Crozer-Chester Medical Center
Director, Crozer-Keystone Practice-Based Research Network

Dale N. Schumacher, M.D., M.P.A., Co-Principal Investigator
Chief Informatics Officer, Crozer-Keystone Health System

Bret A. Boyer, Ph.D., Co-Investigator
Assistant Professor, Institute for Graduate Clinical Psychology
Widener University

Gina Bodycot, R.N.
Quality Director, Crozer-Keystone Health Network

AnneMarie Allie, B.S.
Research Coordinator

Organization:
Crozer-Keystone Health System
Crozer-Keystone Health Network
Crozer-Keystone Practice-Based Research Network

Dates of Project:
5/15/2006-8/14/2008

Federal Project Officer:
David Meyers

Supported by AHRQ Grant # R03 HS016065-01

Structured Abstract:

Purpose: We developed a barrier assessment tool (BAT) to quantify provider-perceived barriers to the implementation of diabetes guidelines.
Scope: The Crozer Keystone Health Network (CKHN) includes 53 primary care providers and 100 medical support staff in 23 practices; 204 CKHN primary care employees in 21 primary care practices were invited to participate, and 126 (62%) consented to participate.
Methods: We administered the BAT twice during the 15-month study period to providers and support staff, and we correlated BAT responses with provider and practice adherence to diabetes care guidelines, outcome measures, and use of a tracking tool.
Results: The instrument demonstrated internal consistency and an identifiable subscale structure. Although use of the Diabetes Flow Sheet inversely correlated with perceived barriers to use, the care process and outcome measures, unexpectedly, *directly* correlated with barrier scores. (Higher barrier scores predicted better adherence to ADA guidelines.) A simple model of barrier scores that inversely correlate with care process and outcome measures is not supported by this study. Perceived barriers may be greater in more conscientious providers, who recognize and confront them to achieve better outcomes. Addressing whether perceived barriers interfere with following guidelines needs to be more clearly ascertained in a follow-up study.
Keywords: Barriers, Guideline Adherence, Translation

Purpose:
Can a questionnaire about barriers administered to primary care providers and staff be shown to correlate with that provider's and practice's success at implementing care guidelines? We have developed such a questionnaire, "The Barrier Assessment Tool" (BAT), and are applying it to test five hypotheses:

1. The BAT measures perceived barriers to adherence to diabetes guidelines while showing adequate internal consistency and an identifiable subscale structure.
2. The BAT results inversely correlate with practice and provider adherence to ADA guidelines.
3. BAT scores will inversely correlate with use of the Diabetes Flow Sheet.
4. The BAT scores inversely correlate with clinical outcomes (glycemic and lipid control).
5. The use of the Diabetes Flow Sheet correlates with higher provider and practice adherence to ADA guidelines.

We chose diabetes, a condition that has received attention in our Network's quality activities, as the clinical problem.

Scope: (Background, Context, Settings, Participants, Incidence, Prevalence)
Diabetes care in the U.S. consistently fails to meet recommended quality standards. Barriers impede the translation of evidence-based guidelines into sustainable practice. Although most researchers have addressed one barrier and interventions in an organization, this effort has not lead to a comprehensive strategy to address the multiple

barriers that are operative in clinical practice. Few studies have considered multiple barriers, and there is a lack of evidence-based strategy in choosing interventions to overcome these barriers. This proposal involves a comprehensive assessment of practice barriers to diabetes guidelines adherence across our primary care network. Cabana et al (1999) performed a comprehensive meta-analysis based upon a review of the literature addressing barriers to guideline adherence. They compiled a list of the categories of barriers identified by these studies and proposed that studies are needed to address multiple barriers within an organization. In our proposal, a Barrier Assessment Tool (BAT) based upon the framework proposed by Cabana et al will be assessed for internal consistency and an identifiable subscale structure. Self-perceived barrier scores then will be correlated with adherence to guidelines and diabetes outcomes as well as with use of a tracking Diabetes Flow Sheet tool that was previously implemented.

In total, 126 (62%) of 204 CKHN primary care providers and support staff members in the 25 primary care practices consented to participate. This sample size of providers and support staff provides adequate power for exploratory factor analyses. A sample size sufficient for adequate statistical power would equal 70 for the regressions with two independent variables and 140 for the regressions with nine independent variables (see p. 26 of the grant proposal). There are no control and intervention groups, because this is not an experimental design project. No vulnerable populations are included in our subjects. The subjects were recruited from our Network practices using an introductory presentation by the Research Coordinator and a letter that explained the purpose of the project. Participation was voluntary. Communications about the project were directly with study participants and were outside the Network administrative structure. Participants were asked to complete a questionnaire twice during the period of the study, and this could be filled out in privacy wherever the participants chose. Diabetes Flow Sheet usage and outcomes data were collected from chart reviews conducted in the practices and from commercial and hospital lab data downloads. Chart reviews conducted within practices are already an established part of other quality monitoring programs that predated our study.

The study itself took place over 15 months. We administered the same BAT questionnaire twice, 5 months apart, to study participants.

Methods:

The study involved administration of the BAT questionnaire to subjects twice. Diabetes outcome data collection involved chart review for Diabetes Flow Sheet completion and three lab clinical outcome measures obtained from a commercial and hospital lab data download.

Thirteen items, based upon a meta-analysis of research into barriers as suggested by Cabana et al (1999), assessed the following dimensions of potential barriers:

- Lack of **Familiarity** with guidelines
- **Disagreement** with guidelines
- Perceived **Self-efficacy** to follow guidelines
- Belief that guidelines will **not improve clinical outcomes**
- Experience that guidelines are **Confusing**
- Experience that guidelines are **Inconvenient**

- Perception that following guidelines requires a significant **Change** in practice
- Perception that patients **Resist** following the recommendations of the guidelines
- Guidelines require too much **Time**
- **Medicolegal concerns** with guidelines
- Lack of **staff support** for guidelines
- Patient **Insurance barriers** to guideline recommendations
- Lack of **Resources** to adhere to the guidelines

The questionnaire to measure perceived barriers to guideline adherence is "experimental." The chart review for Diabetes Flow Sheet completion has been part of our quality program for the past 2 years. The lab data are generated from regular medical care. We had used similar downloads of data for a previous, AHRQ-funded, preventive cardiovascular care study performed in our PBRN.

The participants were responsible for completion of the BAT questionnaire. The following of ADA guidelines in the care of patients with diabetes is an accepted clinical responsibility of the primary care providers in our Network.

The chart review was performed two times during the 15-month period of study, and the laboratory download also was performed twice.

The participants were not given information about their individual questionnaire responses or results of the outcome data analysis during the study. The participants will be able to receive a summary of the findings when the study is completed to see where their practice scored on barriers perceived and guideline adherence compared with the Network in aggregate. The outcomes will be coded and not traceable back to an individual provider or subject.

Participants were reassured that their completion of the BAT is confidential and that data will correspond only to a unique tracking code when analyzed.

Copies of the Barrier Assessment Tool and the Diabetes Flow Sheet may be included with this report.

Responses on the Barrier Assessment Tool were entered using Microsoft Access and analyzed using SPSS software. Calculations of diabetes patient outcomes from lab data were also performed using Excel and SPSS software.

Scoring of Diabetes Flow Sheet completion was performed on a summary form.

Results:

Psychometric Qualities of the Barrier Assessment Tool

Internal Consistency

In our initial design of the BAT, we assumed that it would be necessary to assess two different subdimensions regarding each barrier dimension. These were 1) the degree to which the provider/staff perceived the presence of that barrier in their practice and 2) the degree to which that barrier actually *interfered* with ADA guideline adherence. Summary scores were created for the total presence of barriers, for both the implementation of ADA guidelines and the use of the Diabetes Flow Sheet (DFS), as well as for the interference items for barriers affecting the ADA guidelines and DFS.

Cronbach's alphas for the items that constitute the ADA guidelines' total barrier score and the DFS' total barrier score were strong (.83 and .88, respectively). Cronbach's alphas for the items that constitute the ADA guidelines' total barrier interference score and the DFS' total barrier interference score were adequate (.62 and .67) but less strong than for the ADA guidelines' total barrier score and the DFS' total barrier score.

Based upon the strong internal consistency of the ADA guidelines' total barrier score (.83) and the DFS' total barrier score (.88), these summary scores appear reliable and useful as a measure of total barriers perceived regarding ADA and DFS application. Because of the lower internal consistency for the interference scores, and because of feedback from participants saying that they did not understand the difference between perceiving a barrier and rating the degree to which that barrier actually *interfered* with the clinical practice topic, these interference summary scores---and, indeed, these interference items---will not be employed when administering and scoring the BAT in future studies.

In summary, the internal consistency scores for the barriers regarding the ADA guideline adherence and the DFS were strong, indicating the measurement of a definable construct.

Test-Retest Reliability

Test-retest reliability was strong, with a time-1-to-time-2 correlation of .74 for the ADA guidelines' total barrier score and .84 for the DFS' total barrier score. All dimensions of barriers were significantly correlated, and planned paired t tests comparing time 1 with time 2 revealed no significant differences between participants' ratings for any dimension of barriers or for either total barrier score.

The second data collection for the BAT occurred 5 months after the first data collection, and this time lapse constitutes a stringent examination of test-retest reliability. In addition, it documents that the phenomena measured, the perceived barriers to application of the ADA guidelines and the use of charting tools to apply these guidelines, appear stable among professionals over time in the absence of intervention.

Barrier Dimension	Pearson correlation	P value of correlation	Planned-paired t-test value	Significance of t test
		ADA Guideline Barrier Scores		
Agreement (with guidelines generally)	.534	.0001	1.1551 (89)	ns
Familiarity	.69	.0001	.276 (89)	ns
Agreement (with ADA guidelines)	.45	.0001	.096 (87)	ns
Self-efficacy	.61	.0001	.467 (84)	
Belief that ADA guidelines improve clinical outcomes	.40	.001	-.918 (87)	ns
ADA confusing	.39	.001	-.587 (84)	ns
ADA inconvenient	.44	.0001	-.888 (85)	ns
Patient resistance to ADA guidelines	.51	.0001	1.136 (85)	ns
ADA guidelines are change in practice	.48	.0001	.606 (85)	ns
Time for ADA guidelines	.51	.0001	-.573 (88)	ns
Medical liability concerns re: ADA guidelines	.36	.001	-1.8 (85)	ns
Staff support for ADA guidelines	.69	.0001	-.338 (88)	ns
Insurance barriers to ADA guidelines	.52	.0001	.257 (86)	ns
Lack resources for ADA guidelines	.34	.001	-.063 (84)	ns
		DFS Barrier Scores		
Familiarity-DFS	.60	.0001	-.179 (83)	ns
Agreement-DFS	.63	.0001	-.789 (86)	ns
Self-efficacy for DFS	.71	.0001	-1.02 (81)	ns
DFS improves outcomes	.67	.0001	.24 (85)	ns
DFS confusing	.44	.0001	-1.11 (82)	ns
DFS inconvenient	.63	.0001	.803 (82)	ns
DFS is change in practice	.58	.0001	1.73 (81)	ns
Patients resist DFS	.39	.0001	-.458 (78)	ns
Time constraints for DFS	.64	.0001	1.02 (84)	ns
DFS not helpful toward ADA guidelines	.68	.0001	.549 (84)	ns
Staff support for DFS	.74	.0001	-.289 (83)	ns
Lack resources for DFS	.41	.0001	-.769 (82)	ns
		Summary Scores		
ADA barrier total score	.74	.0001	.426 (64)	ns
DFS barrier total score	.84	.0001	.077 (63)	ns

Factor Analysis

Factor analysis was conducted to evaluate whether dimensions grouped meaningfully into identifiable factors. Principal components factor analysis was employed, using Promax rotation, as individual dimensions were assumed to be related and not orthogonal.

The first two factors (items related to DFS and items related to ADA guidelines) accounted for 40.51% of the variance in the BAT scores, with the first factor accounting for 29.5% and the second factor accounting for 11.1%.

Rotated Factor Matrix

	Factor	
	1	2
Agreement with general guidelines	.138	.636
Familiar with ADA guidelines	.173	.622
Agree with ADA	.315	.498
Self-efficacy to follow	.447	.568
Improve outcomes	.417	.582
Confusjng_ADA	.321	.336
Inconvenient_ADA	.608	.349
Change_ADA	.267	.690
Patient_resistance_ADA	-.018	.558
Medical liability ADA	.329	.412
Lack of resources_ADA	.174	.527
Time for ADA guidelines	.456	.448
Staff promotes ADA	.244	.374
Patients insurance for ADA	-.030	.620
Familiar with DFS	.551	.078
Agree with DFS	.858	.167
Self-efficacy to use DFS	.736	.205
Effective to improve outcomes	.911	.073
Time for DFS	.790	.142
DFS effective to improve ADA	.836	.154
Staff assistance for DFS	.310	.282
DFS is confusing	.515	.162
DFS is inconvenient	.728	.030
DFS requires change	.785	.232
Patients resist DFS	-.311	.667
Lack resources for DFS	.189	.548

Guided by this factor analysis, it appears that multiple barriers do not cluster regarding type of barrier; rather, they cluster regarding the task to which these barriers related.

Three sets of data analysis were conducted. First, relationships between BAT scores and DFS scores from the chart reviews were assessed using multiple regressions. Second, relationships between BAT scores and laboratory data related to physician's ordering of HbA1c, lipid assays, and microalbumin assessments, as well as average values for HbA1c and lipid profiles, were assessed using multiple regression. Finally, relationships between use of the DFS and laboratory data were assessed using Pearson-product moment correlations.

Barrier Assessment Scores and Diabetes Flow Sheet usage

Because no previous empirical studies are available to guide the hierarchical entry of different variable dimensions as independent variables, stepwise multiple regression was chosen to identify barriers that account for significant variance in DFS usage.

Frequency of DFS Usage. The chart reviews first noted whether a DFS was in the patient's chart or not and, even if the DFS was in the chart, whether it was used at all. Only two BAT score dimensions accounted for significant variance in the percentage of patients for whom the DFS was used at all. Perceived *self-efficacy to use the DFS* and perception that the *patients resisted usage of the DFS* accounted for a significant portion of variance ($F=7.6$, $p<.001$), accounting for 20.2% of variance in percentage of patients for whom the DFS was used. The *self-efficacy to use the DFS* dimension showed a partial R of -.38 ($p<.002$); the *patient resistance* dimension showed a partial R of -.25 ($p<.004$).

Frequency of HbA1c. ADA guidelines recommend two HbA1c tests per year per patient. Only two BAT score dimensions accounted for significant variance in the percentage of patients for whom at least two HbA1c were entered on the DFS. Perceived *lack of resources* and perception that the *ADA guidelines will not improve clinical outcomes* accounted for a significant portion of variance ($F=16.6$, $p<.001$), accounting for 35.7% of variance in percentage of patients with at least two HbA1c/year noted on the DFS. The *lack of resources* dimension showed a partial R of -.44 ($p<.001$); the *ADA guidelines will not improve clinical outcomes* dimension showed a partial R of -.37 ($p<.004$).

Frequency of Microalbumin Testing. ADA guidelines recommend one microalbumin assessment per year for those with diabetes (DM). Only one dimension accounted for significant portion of variance in the percentage of patients per practice for whom at least one microalbumin test was noted on the DFS. Perceived *lack of resources* showed significant relationship to microalbumin frequency ($F=9.78$, $p<.003$), with a partial R of -.37 ($p<.003$), accounting for 13.8% of the variance.

Frequency of Lipid Testing. ADA guidelines recommend one LDL assessment per year for those with DM. Only two BAT score dimensions accounted for significant variance in the percentage of patients for whom practices noted at least one lipid profile on the DFS. Perceived *lack of resources* and perceived *lack of time* accounted for a significant portion of variance ($F=6.87$, $p<.011$), accounting for 35.8% of variance in percentage of patients with at least one lipid profile/year noted on the DFS. The *lack of resources* dimension showed a partial R of -.47 ($p<.001$); the perceived *lack of time* dimension showed a partial R of -.32 ($p<.011$).

Frequency of Eye Examinations. Only one dimension accounted for significant portion of variance in the percentage of patients per practice for whom at least one eye examination was noted on the DFS. The *lack of familiarity with DFS* dimension showed significant relationship to eye examination frequency on the DFS ($F=6.78$, $p<.012$), with a partial R of -.36 ($p<.012$), accounting for 10% of the variance.

Frequency of Foot Examinations. Only two BAT score dimensions accounted for significant variance in the percentage of patients for whom practices noted at least one foot examination on the DFS. Perceived *ineffectiveness of the DFS to achieve ADA guideline outcomes* and perceived *medical liability risk* accounted for a significant portion of variance ($F=4.98$, $p<.029$), accounting for 14.7% of variance in percentage of patients with at least one foot examination noted per year. The perceived *ineffectiveness of the DFS to achieve ADA guideline outcomes* dimension showed a partial R of -.30 ($p<.019$); the perceived *medical liability risk* dimension showed a partial R of -.28 ($p<.029$).

Frequency of Flu Vaccines. Only two BAT score dimensions accounted for significant variance in the percentage of patients for whom practices noted at least one flu vaccine on the DFS. Perceived *lack of time* and perceived *medical liability risk* accounted for a significant portion of variance ($F=8.33$, $p<.001$), accounting for 21.7% of variance in percentage of patients with at least one flu vaccine noted per year. The perceived *lack of time* dimension showed a partial R of -.40 ($p<.001$); the perceived *medical liability risk* dimension showed a partial R of -.26 ($p<.04$).

Frequency of ACE Inhibition. The chart review collected data regarding the frequency of noting ACE inhibition on the DFS. As such, this datum represents the frequency of noting whether or not the patient was prescribed ACE inhibitors rather than frequency that ACE inhibition was actually prescribed. Only one dimension accounted for significant portion of variance in the percentage of patients per practice for whom at least one assessment of need for ACE inhibition was noted on the DFS. The perceived *ineffectiveness of the DFS to achieve ADA guideline outcomes* dimension showed significant relationship to frequency regarding ACE inhibition on the DFS ($F=5.83$, $p<.019$), with a partial R of -.30 ($p<.019$), accounting for 8.7% of the variance.

Frequency of Aspirin Consideration. The chart review collected data regarding the frequency of noting consideration for aspirin prescription on the DFS. As such, this datum represents the frequency of noting whether or not the patient was prescribed aspirin rather than frequency that aspirin was actually prescribed. Only one dimension accounted for significant portion of variance in the percentage of patients per practice for whom at least one consideration regarding aspirin was noted on the DFS. The *lack of familiarity with DFS* dimension showed significant relationship to aspirin consideration frequency on the DFS ($F=4.7$, $p<.048$), with a partial R of -.25 ($p<.048$), accounting for 6.2% of the variance.

When the DFS barrier summaries were included, multiple regression equations to predict the number of HbA1c measures per patient were predicted significantly when internal ADA barriers, external ADA barriers, and internal DFS barriers were included as independent variables ($F=3.12$, $p<.031$); only internal DFS barriers contributed to the prediction (partial $R=.23$, $p<.04$). Note, however, that higher the number of HbA1c measures per patient per year was associated with greater internal barriers perceived regarding the use of the Diabetes Flow Sheet.

Barrier Assessment Scores and Diabetes Care Process and Outcome Measures

Because no previous empirical studies are available to guide the hierarchical entry of different variable dimensions as independent variables, stepwise multiple regression was chosen to identify barriers that account for significant variance in frequency of meeting ADA guidelines.

The only significant correlations were between the total global score for barriers regarding ADA guidelines and the following medical outcome measures:

1. The number of HbA1c per patient within each practice was significantly correlated with the total score for BAT related to ADA guidelines ($R=.242$, $p<.026$).
2. The percentage of each practice's patients meeting the criteria for ≥2 HbA1c measures per year was significantly associated with the total score for BAT related to ADA guidelines ($R=.215$, $p<.048$).

Note that the direction of these relationships is opposite what was hypothesized. That is, greater BAT barriers reported by providers and staff correlated with greater numbers of HbA1c per patient and percentage of patients for whom ≥2 HbA1c per patient was conducted each year.

Individual barrier dimensions were analyzed for relationships to diabetes care process and outcome measures *by practice*:

Familiarity with ADA guidelines was the only barriers dimension to contribute to the prediction of average number of HbA1c values for each practice ($R=.58$, $p<.008$), accounting for 35% of the variance in HbA1c values. The correlation was positive, indicating that a higher average number of HbA1c values per patient for a practice was associated with a greater self-perceived lack of familiarity with the ADA guidelines by the practice personnel.

The only barrier dimension to predict the percentage of patients per practice that met the ADA guideline of ≥2 HbA1c values per year was the perceived effectiveness of the ADA guidelines to produce improvements in clinical outcomes (i.e., what Cabana et al [1999] entitled outcome expectancy). With an R and a standardized Beta of .46 (p<.045), this dimension accounted for 22% of the variance. The correlation was positive, indicating that a lower practice personnel expectation that the ADA guidelines would produce clinical improvements was associated with a higher percentage of patients per practice who were prescribed and who obtained two or more HbA1c measures per year.

The only barrier dimension to predict the percentage of patients per practice that met the ADA guideline of HbA1c <7.0 was barriers to the familiarity with the ADA guidelines (R=.59, p<.007), accounting for 35% of the variance. The correlation was negative, indicating that a greater lack of familiarity with the ADA guidelines by practice personnel was associated with a lower percentage of patients per practice with HbA1c values <7.0. That is, greater familiarity was associated with higher percentages of patients meeting ADA guidelines for HbA1c <7.0.

No other diabetes care process or outcome measures (number of HbA1c per patient per practice, number of lipid profiles per patient per practice, percentage of patients per practice meeting ADA guidelines of one or more lipid profile per year, number of microalbumin tests per patient per practice, or percentage of patients per practice meeting ADA guidelines of one or more testing per year) were predicted by individual barrier dimensions in regression analyses.

Individual barrier dimensions were analyzed for relationships to diabetes care process and outcome measures *by individual*:

When data were analyzed by all individual participants, rather than by practice, the following relationships were found between the BAT dimensions and medical process and outcome data defined by laboratory records:

Perceived inconvenience and time barriers contributed to the prediction of average number of HbA1c per patient per practice (F[91]=14.32, p<.001), accounting for 18.9% of the variance. Although both perceived inconvenience and time barriers contributed to the prediction, only time remained significant (Partial $=.37, p<.001) when both variables were present in the equation, and inconvenience was no longer significant. Note that greater time barriers identified corresponded to a *higher* number of HbA1c measures per patient.

Perceived inconvenience and time barriers contributed to the prediction of the percentage of an individual's practice patients meeting the requirement for two or more HbA1c values/patient/year (F[91]=11.62, p<.001), accounting for 16.5% of the variance. Whereas both perceived inconvenience and time barriers contributed to the prediction, when both variables were present in the equation, only time remained significant (partial R=.34, p<.001), and inconvenience was no longer significant. Note that greater time barriers identified corresponded to a greater percentage of practice patients meeting the criteria for two or more HbA1c values per year.

Perceived time barriers was the only variable to significantly contribute to predicting the average number of lipid profiles per patient (F[92]=12.23, p<.001). The partial R for the time barriers relationship to lipid tests per patient was .343 (p<.001).

Note that greater time barriers identified corresponded to a higher number of lipid profiles per year per patient.

Perceived time barriers was the only variable to contribute significantly to predicting the percentage of patients meeting the criteria for one or more lipid profiles per year (F[92]=8.74, p<.004). The partial R for the time barriers relationship to lipid tests per patient was .295 (p<.004). Note that greater time barriers identified corresponded to a higher number of patients meeting the ADA guideline for one or more lipid profiles per year per patient.

Greater outcome expectancy was the only variable to contribute to the prediction of number of microalbumin test per year per patient (F[92], p<.02), accounting for 5.8% of the variance, with a partial R of .24. Note that greater outcome expectancy corresponded to a higher number of microalbumin test per year per patient.

Individual barrier dimensions perceived and reported by all participants did not significantly relate to other process and outcome variable: HbA1c values per patient, percentage of patients meeting ADA recommendation, lipid values, percentage of patients meeting ADA recommendations, or percentage of patients with one or more microalbumin tests per year.

Relationships between Cabana et al (1999) Summary Scores and Medical Outcomes

When ADA BAT summaries were employed as independent variables in regression equations to predict percentage of patients meeting ≥2 HbA1c per year, average HbA1c values, percentage of patients meeting ADA guidelines (for HbA1c <7.0), number of lipid profiles per year, percentage of patients meeting ADA guidelines for lipid measurement ≥1/year), average lipid values, number of microalbumin tests per patient, percentage meeting ADA guidelines (≥1 microalbumin test per year), and ADA internal and external barrier summaries were not significantly related to any dependent variable.

These results were true when all participants' data were utilized, when only physicians' data were utilized, and when all (i.e., physicians, nurses, nurse practitioners, physician assistants) clinicians' data were utilized.

Internal BAT scores for all participants' perceptions of the ADA guidelines did predict significantly the number of HbA1c measures per patient per year (F=4.16, p<.044), accounting for 4.3% of the variance, with a partial R of .21 (p<.044).

Relationship of Barrier Summaries and Profit

Barrier summaries regarding the ADA guidelines, based upon Cabana et al (1999), showed no significant relationships to profit indices for each practice.

Relationship of DFS Usage to Laboratory Results

Although DFS usage score did not correlate significantly with laboratory indicators for frequency of HbA1c per patient, HbA1c values, frequency of lipid profiles per patient, lipid values, or frequency of microalbumin tests per patient, the usage of specific DFS items correlated significantly with laboratory indicators for those clinical elements.

The percentage of DFS notations for at least one lipid result in a DFS correlation of .312 (p<.03) with number of lipids per patient in the laboratory indicators.

The percentage of DFS notations for at least three lipids/18 months in the DFS correlated at .47 ($p<.001$) with number of lipids per patient in the laboratory indicators.

Percentage of charts in which at least one microalbumin assessment was recorded on the DFS correlated at .44 ($p<.002$) with the frequency of microalbumin tests recorded in the laboratory indicators. Percentage of charts in which at least one microalbumin assessment were recorded on the DFS correlated at .5 ($p<.001$) with the frequency of microalbumin tests documented in the laboratory indicators.

DFS usage regarding HbA1c assessment was not significantly correlated with either HbA1c frequency or HbA1c values per patient in the laboratory indicators.

Relationship between BAT Scores and Chart Review Data

Stepwise multiple regressions, used 1) internal barriers regarding the ADA guidelines, 2) external barriers regarding the ADA guidelines, 3) internal barriers regarding the DFS tool, and 4) external barriers regarding the DFS tool as independent variables; they also used the average number of charts in which the ADA guideline adherence was indicated (a] at least two hbA1cs, b] at least one lipid profile, and c] at least one microalbumin) as dependent variables. Stepwise articles were selected, because there are no empirical data to guide expectations regarding the relative contribution of the subscales for this newly developed Barrier Assessment Tool to predict testing frequency.

Internal barriers regarding the DFS significantly predicted the summary score for average number of charts per practice with two or more HbA1c values, one or more lipid profiles, and one or more microalbumin over 18 months ($F[1]=5.61$, $p<.025$), accounting for 16.7% of the variance. partial R for the relationship was -.41 ($p<..025$); no other barrier subscales contributed to the prediction.

Internal barriers regarding the ADA guidelines significantly predicted the average number of charts per practice with one or more HbA1c values over 18 months ($F[1]=8.82$, $p<.006$), accounting for 24% of the variance. Partial R for the relationship was -.49 ($p<.006$); no other barrier subscales contributed to the prediction.

Internal barriers regarding the DFS significantly predicted the average number of charts per practice with one or more microalbumin over 18 months ($F[1]=4.92$, $p<.035$), accounting for 15% of the variance. Partial R for the relationship was -.39 ($p<.035$); no other barrier subscales contributed to the prediction.

Difference in Medical Outcomes by Practice Groups

When practices were identified based on whether they reported levels of BAT scores in significant ranges (more than 1 SD above the mean for the practices), no significant differences were found among practices categorized as follows:

-Level of reported BAT scores (1. no significant barriers, 2. low percentage of moderate range barriers, 3. high percentage of moderate barriers, 4. severe levels of barriers),

-Type of barriers (internal versus external barriers),

-Significance of barriers (barriers in significant range or not).

In attempts to characterize the practices that displayed scores from laboratory data indicating a performance of the practice that met ADA guidelines, ANOVA were employed to test whether BAT scores differed for those meeting ADA guidelines or not. Practices that met the ADA guidelines of two or more HbA1c values per patient per year showed significantly higher scores for DFS internal summary scores ($F=5.58$, $p<.03$). However, DFS external scores and both internal and external ADA scores were not significantly related to whether practices met the ADA guidelines for HbA1c frequency.

No significant differences were found between the practices meeting ADA guidelines for lipid or microalbumin process or outcome measures.

Discussion

This study was designed to develop a method to measure multiple perceived barriers, based upon a meta-analysis of previous research conducted that addressed individual barriers to implementing evidence-based guidelines and improving outcomes. The simple assumption that multiple perceived barriers could be ameliorated in quality improvement programs, and that this would result in improved process and clinical outcomes, promised a more scientific approach to quality improvement.

We developed a Barrier Assessment Tool designed to measure multiple perceived barriers to implementing ADA guidelines, and we have demonstrated internal consistency with an identifiable subscale structure. Although we demonstrate that greater use of a Diabetes Flow Sheet tool correlated with lower perceived barriers to using the tool, we were surprised to find, consistently, that higher perceived barrier scores were associated with better performance on process measures (testing HbA1c, LDL, and urine microalbumin levels at the ADA minimum recommendation of twice, once, and once a year, respectively) and better outcome measures (lower actual HbA1c values and greater proportion of LDL <100.) This unexpected finding suggests that the assumption that perceived barriers interfere with achieving care goals (and conversely that the absence of perceived barriers improves guideline adherence and outcomes) is erroneous! Could the provider or office staff member who identifies more significant barriers perceive this *because* they are *confronting* barriers in order to meet care guidelines; conversely, does the provider or staff member who does not strive to meet guidelines fail to experience and perceive barriers?

In our original BAT, we attempted to ascertain whether *perceived* barriers were perceived as *interfering* with meeting ADA guidelines. However, this second set of "interference" questions was confusing to study. Participants and their responses did not upon analysis demonstrate internal consistency. We therefore disregarded the "interference" questions in subsequent analyses. A revised BAT could attempt to address the "interference" question, but doing so would address only part of our surprising finding. Participants who perceive barriers may address whether these perceived barriers interfere with meeting guidelines, but participants who fail to perceive barriers would not be able to assess whether those barriers interfere with meeting guidelines.

There has been greater appreciation that primary care practices are unique, complex, and dynamic adaptive systems. Interventions that take this into account may be more likely to succeed in improving outcomes. Although we had hoped that an instrument measuring multiple perceived barriers would allow tailored interventions with the complexity of practices in our primary care network, our results show that an even deeper level of complexity is operative in perceived barriers and actual performance and outcomes.

Future research that explores this association, perhaps in a more qualitative fashion, would help direct programs toward more effective strategies to promote guidelines adherence and improved clinical outcomes.

Conclusions

We developed a questionnaire (the Barrier Assessment Tool, “BAT”) that queried multiple perceived barriers, and we administered it to primary care providers and staff in our practice-based research network. We tested five hypotheses and have shown:

1. The BAT does measure perceived barriers to adherence to diabetes guidelines while showing adequate internal consistency and an identifiable subscale structure.
2. The BAT results **do not** inversely correlate with practice and provider adherence to ADA guidelines.
3. BAT scores **do** inversely correlate with use of the Diabetes Flow Sheet.
4. The BAT scores **do not** inversely correlate with clinical outcomes (glycemic and lipid control).
5. The use of the Diabetes Flow Sheet correlates with higher provider and practice adherence to ADA guidelines.

The promotion of guideline adherence will not prove as straightforward as identifying perceived barriers and expecting them to correlate with lower performance. Quality interventions cannot simply be geared toward reducing perceived barriers. The perception of barriers and of barriers’ impact on care process and outcome measures requires additional study that incorporates recognition of primary care practices as complex and dynamic adaptive systems.

List of Publications and Products:

This study is being prepared for submission for publication in <u>The Annals of Family Medicine.</u>