Published in final edited form as:

Eur J Pers Cent Healthc. 2014 ; 2(4): 465–476.

Physician styles of decision-making for a complex condition: Type 2 diabetes with co-morbid mental illness

Felicia L. Trachtenberg, PhD^a, David M. Pober, PhD^b, Lisa C. Welch, PhD^c, and John B. McKinlay, PhD^d

^a Principal Research Scientist and Biostatistician, New England Research Institutes, Watertown, MA, USA

^b Mary K. Iacocca Visiting Interdisciplinary Faculty Fellow, Vascular Cell Biology, Joslin Diabetes Center & Visiting Assistant Professor of Medicine, Harvard Medical School, Boston, MA, USA

^c Director, Clinical and Translational Science Institute, Boston, MA, USA

^d Senior Vice President; Co-director, Health Services and Disparities Research, New England Research Institutes, Watertown, MA, USA

Abstract

Rationale, aims and objectives—Variation in physician decisions may reflect personal styles of decision-making, as opposed to singular clinical actions and these styles may be applied differently depending on patient complexity. The objective of this study is to examine clusters of physician decision-making for type 2 diabetes, overall and in the presence of a mental health co-morbidity.

Method—This randomized balanced factorial experiment presented video vignettes of a “patient” with diagnosed, but uncontrolled type 2 diabetes. “Patients” were systematically varied by age, sex, race and co-morbidity (depression, schizophrenia with normal or bizarre affect, eczema as control). Two hundred and fifty-six primary care physicians, balanced by gender and experience level, completed a structured interview about clinical management.

Results—Cluster analysis identified 3 styles of diabetes management. “Minimalists” (n=84) performed fewer exams or tests compared to “middle of the road” physicians (n=84). “Interventionists” (n=88) suggested more medications and referrals. A second cluster analysis, without control for co-morbidities, identified an additional cluster of “information seekers” (n=15) who requested more additional information and referrals. Physicians ranking schizophrenia higher than diabetes on their problem list were more likely “minimalists” and none were “interventionists” or “information seekers”.

Conclusions—Variations in clinical management encompass multiple clinical actions and physicians subtly shift these decision-making styles depending on patient co-morbidities. Physicians’ practice styles may help explain persistent differences in patient care. Training and

Correspondence address Dr. Felicia Trachtenberg, New England Research Institutes, Inc., 480 Pleasant Street, Watertown, MA 02472, USA. ftrachtenberg@neriscience.com.

Conflicts of Interest

The authors declare no conflicts of interest.

continuing education efforts to encourage physicians to implement evidence-based clinical practice should account for general styles of decision-making and for how physicians process complicating comorbidities.

Keywords

Cluster analysis; co-morbidity; diabetes; patient complexity; person-centered healthcare; physician decision-making

Introduction

Even after decades of federal investment, disparities in health and healthcare persist in the US [1,2] for major causes of mortality and morbidity, such as cardiovascular disease [3] and diabetes [4,5]. Higher disease burden often follows demographic markers such as race, ethnicity, socioeconomic status and geographic region; however, people with serious mental illness also are at increased risk of mortality from physical illnesses, including higher rates of cardiovascular disease and diabetes [6-9]. The persistence of these disparities suggests the need for novel ways to conceptualize their causes. We extend previous work on one contributing factor-variation in clinical management - by examining *styles* or *types* of physician decision-making for type 2 diabetes, overall and in the presence of a mental health co-morbidity. Most previous research on clinical decision-making has not only focused just on singular clinical actions as opposed to overall physician styles, but also has focused on just one medical condition whereas patients often present with several conditions (co-morbidities) simultaneously.

Variation in physician clinical management, including for diabetes, has been shown to occur by patient demographic characteristics [5,10-13], providers' individual attributes (gender, level of experience, specialty) [14-17], practice environments [18-22] and healthcare systems [23,24]. Yet a study focusing on diabetes diagnosis and management found that, while patient, physician and organizational factors explained some of the variability in physician decisions, these factors together accounted for one-fifth of the total variance [25]. This suggests room for considering additional ways to conceptualize variation in medical practice.

Examining differences in *styles* of management is one promising way forward. Whereas physician decision-making is typically measured according to individual clinical actions - either the presence of a specific diagnosis or the implementation of a specific treatment defined by practice guidelines - broader patterns of decision-making may underlie these individual actions. A few prior studies suggest the potential of this approach. For example, an early study [26] found 6 clusters of physician practice behaviors: technical, health behavior, addiction, patient activation, preventive services and counseling. Another study [27] used cluster analysis to identify 4 primary care physician styles of interaction with patients: person-focused, biopsychosocial, biomedical and high physician control. A factorial experiment examining variation in the diagnosis of coronary heart disease (CHD) [28], utilizing a factorial design similar to the current study, also used cluster analysis and identified 3 clusters depicting styles of CHD management that were robust to control for

physician, patient and organizational characteristics: “minimalists” who took fewer actions, “talkers” who were more focused on gathering medical history and giving advice and those focusing specifically on the “cardiac” issues at hand [28]. We hypothesize that these clusters identified in the CHD study may be reproducible across a spectrum of diseases, with the “cardiac” cluster representing a “interventionist” group that is more likely to take action. Additionally, we hypothesize that physicians may not only have personal preferences in their decision-making style, but that these styles may vary by physician attitudes or practice culture, as well as shift depending on the patient at hand, for example, when confronted with a patient with co-morbid mental illness.

We extend previous work by examining clinical management of an increasingly prevalent chronic condition (type 2 diabetes) when the patient presents with a complicating mental illness. A recent study with primary care physicians revealed that they designated more than two-thirds of their patients with diabetes as complex and patients with co-morbid depression and anxiety had a higher likelihood of being considered complex by their physicians [29]. We use data from a video vignette factorial experiment wherein a wide array of outcome data were collected, ranging from additional information physicians would seek in a medical history, to tests they would order and medications they would prescribe. Rather than examining how patient or provider characteristics would influence individual outcomes, we conducted cluster analysis to identify *types* or *styles* of management behavior physicians exhibited.

Methods

Data were collected from 256 primary care physicians in Massachusetts, USA, in 2010 as part of a randomized factorial experiment designed to simultaneously measure the effects of patient attributes (age, gender, race and comorbidity) and physician characteristics (gender and years of clinical experience) on the management of diabetes. The purpose of the comorbidity analysis was to examine whether the presence of a stigmatizing mental health comorbidity influenced diabetes management. A full factorial of $2^3(4) = 32$ combinations of patient age (35 vs. 55), gender (male vs. female), race (black vs. white) and comorbidity (schizophrenia with bizarre affect [SBA] vs. schizophrenia with normal affect [SNA] vs. depression vs. eczema [as a control]) were used for video scenarios. One of the 32 combinations was shown to each physician.

To be eligible for selection, physicians had to: (a) be internists or family practitioners with MD degrees (international medical graduates were included); (b) have graduated from medical school between 1965-1989 or 1990-2006 (to stratify by levels of experience) and (c) be currently working in primary care in Massachusetts more than half-time. A letter of introduction was mailed to prospective participants and screening telephone calls were conducted to identify eligible physicians. An appointment was scheduled with each eligible participant for a one-on-one, structured interview, lasting one hour. Physicians were recruited into 4 strata, including 2 genders and 2 levels of experience. The 256 interviews (32 vignettes x 4 combinations of physician attributes x 2 replications) were conducted over a period of 9 months in 2010. IRB approval for the study was obtained and signed informed consents were collected from each participating physician. Each physician subject was

provided a stipend (\$200) to partially offset lost revenue and to acknowledge their participation. Among eligible physicians, 78% completed an appointment.

The medical condition (type 2 diabetes) was selected because it is among the most common problems presented to primary care providers and along with its complications, continues to be a major cause of morbidity and mortality in the United States of America [30,31]. Additionally, estimated prevalence rates of diabetes among people with schizophrenia are 15-25% [32-34], 2-4 times the prevalence rates observed in the general population.

The vignette script was developed from several tape-recorded role-playing sessions with experienced clinical advisors in primary care and psychiatry. Two clinical psychiatrists and a primary care provider attended the filming to help ensure clinical authenticity. Physicians were directed to consider the patient in the video as they would any other patient in their practice and 89% of physicians reported that the patient's clinical presentation was very or reasonably typical of the patients they currently see. A critical benefit of vignettes is that they hold patient styles of presentation constant, allowing for the manipulation of several variables at once and for the measurement of unconfounded effects, thereby "isolating physicians' decision-making from other factors in the environment" [35]. Physicians are also accustomed to vignettes as part of their medical education and training, as well as credentialing programs.

Each patient-actor reported the same symptoms (feeling "kind of tired a lot" and "just sort of off"; a 6-pound weight gain), had the same test results suggesting poorly controlled diabetes (an increase in HbA1c from 7.8 to 8.2, a morning glucose test result of 204, blood pressure of 140/90) and self-reported the same behaviors (compliance with diabetes medication and reduced smoking). Each actor portrayed all 4 of the co-morbidity conditions. The differences by co-morbidity were verbally embedded in the off-camera physician-actor voiceover and visually depicted in the patient-actor affect. Patient-actors presenting with depression appeared with a flat affect and those presenting with SBA appeared with modest symptoms that would be consistent with use of anti-psychotic medications (disheveled appearance, delayed responses, somewhat distracted, making less eye contact). Each patient reported having seen a specialty physician in the previous week for treatment of the co-morbidity and continuation of medication for the co-morbidity.

We took 3 precautionary steps in an attempt to minimize possible threats to external validity, or the possibility that physicians would behave differently in the experiment than in everyday life. First, considerable effort was devoted to ensuring the clinical authenticity of the videotaped presentation, as described above. Second, the respondents viewed the vignette in the context of their practice day (not at a professional meeting or in their home), in the midst of encounters with real patients. Third, the physicians were specifically instructed at the outset to view the patient as one of their own patients and to respond as they would typically respond in their own practice.

After viewing the vignette, physicians were asked to "create a problem list that lists the issues you would address in this visit given what you saw of the patient in the vignette," in order of priority. To assess management decision-making, physicians were next asked a

series of structured interview questions regarding how they would treat the patient in terms of additional information they would request, physical examinations they would perform, tests they would order, medications they would prescribe, lifestyle advice they would provide, other physicians with whom they would consult on the case and physicians to whom they would refer the patient. Responses were recorded *verbatim* by interviewers and coded after the interview was completed. Coding was conducted by a lead coder (the study Principal Investigator) with input from 2 clinical consultants (a practicing primary care physician with expertise in treating diabetes and a practicing psychiatrist with substantial research experience). The lead coder used a pre-specified code list to categorize each response. Responses that did not fit clearly into a category were tagged and reviewed with clinical consultants to reach consensus. Analyses include the percent who said they would take a given type of action, based on the most common actions reported.

The present study examines clusters of physician decision-making styles rather than singular clinical actions in order to determine whether different styles of physician decision-making exist and whether they may be applied differently depending on patient co-morbidities. This technique for grouping similar physicians into clusters was used in an attempt to explain the variation that remains after accounting for effects of patient and physician factors on diabetes management. Although patient co-morbidity was not associated with individual clinical actions in a previous analysis from this study, the focus on clusters allows for an examination of potential variation in broader styles of management by co-morbidity.

Statistical Analysis

Clusters were defined using physicians' responses to all outcomes pertaining to their management of the patient (Table 1) using the same methodology as in the similarly designed study of CHD [28], whose findings we hypothesize to replicate for diabetes treatment. Since many of these items are correlated and measure unobserved, or latent, phenomena, an alpha factor analysis [36] (PROC FACTOR, SAS version 9.2) with varimax rotation was used to determine the latent structure of the data and provide orthogonal (uncorrelated) factors to represent that structure and serve as a basis for further analysis described below [37]. Items that did not load onto a single factor (absolute factor loading <0.3) were excluded from further analysis. Items that did load cleanly onto a single factor were passed to a clustering procedure. In order to examine practice styles beyond simple demographics, the clustering analysis was performed using the residuals after accounting for any predicted differences between physicians based on the study's design variables (patient and physician characteristics) and standardizing these residuals to have a standard deviation of 1 (in order to account for differences in the scales used between the items) [28]. Despite a previous analysis showing few differences in individual clinical actions by design variables, using model residuals insures that any differences between clusters will be, by definition, independent of the experimental design variables.

To identify an appropriate number of clusters for inclusion, a hierarchical clustering approach (PROC CLUSTER, SAS version 9.2) was used in which each physician begins as his/her own cluster and physicians are grouped into clusters according to the similarity of their responses. In this procedure, the average linkage was used to measure distances

between responses. The pseudo F and t^2 statistics were used to select the appropriate number of clusters for the analysis by choosing the number of clusters that corresponded to the maximum of the pseudo F statistic and (local) minimum of the pseudo t^2 . After determining the number of clusters, physicians were assigned to clusters by means of a non-hierarchical, k-means method (PROC FASTCLUS, SAS version 9.2), which minimizes within-cluster distances between individuals, relative to the between-cluster distances.

Differences in individual patient management outcomes between clusters were tested by analysis of variance (ANOVA) in order to characterize the distinguishing features of each cluster. Additional ANOVA models and chi-square tests were employed in an attempt to determine whether differences between the clusters reflect only the styles of the individual physicians or whether the clusters could be explained by the following physician characteristics or practice cultures: size and ownership of practice (for/not-for profit), clinical and administrative autonomy [38,39], physician satisfaction [38,39], physicians' perceptions of practice support for patient care [40], use of electronic medical records (4-point Likert scale), use of resources (programs or tools; 0 - 11 count), use of clinical guidelines (yes/no) and attitude towards a patient's ability to self-manage (4-point Likert scale).

Since the effects of the design factors have already been accounted for prior to performing the clustering analysis, any differences between clusters is, by definition, independent of the experimental design variables, including co-morbidity. Thus, the clusters identified can be considered to describe the practice styles of primary care physicians treating type 2 diabetes regardless of patient comorbidity or other characteristics. In order to test for differences in physician styles applied by co-morbidity, a second similar cluster analysis was performed, but without control for the design variable of co-morbidity in computation of the standardized residuals. The outcome of prescription of anti-psychotic medications was excluded from this analysis, as this outcome was specific to the schizophrenia co-morbidity and not part of typical psychosocial care for diabetes. As the patient management outcomes in this analysis were not adjusted for the potential effect of co-morbidity, the practice style clusters identified by this secondary analysis could vary by comorbidity. This possible difference in distribution was tested by chi-square test. Additionally, a Fisher exact test was used to test for a potential difference in practice style cluster distribution by whether the physician ranked schizophrenia higher or lower on their problem list compared to diabetes. A higher ranking indicated a belief that schizophrenia was the more important or immediate problem, which may have affected the recommended diabetes care.

Additional cluster analysis was attempted separately for each co-morbidity, but only a less informative 2-cluster solution per co-morbidity was supported by the data, likely due to limitations in sample size for each co-morbidity. Thus, results are limited to combined analysis. In all analyses, a p-value ≤ 0.05 was accepted for statistical significance. No formal adjustment for multiple testing was performed, but consistency of results across multiple outcomes was emphasized.

Financial support for this study was provided entirely by a grant from the National Institute of Mental Health, which had no further role in the study.

Results

The 256 physician respondents were by design balanced by sex and level of experience (4-20 years vs. 21-45 years). Physicians were an average of 48.5 ± 10.1 years old (mean $\pm$ SD) and mainly White (67.7%). Patient management was divided into 8 categories: information requested, examinations, tests ordered, medications prescribed, advice offered, referrals suggested and specialist consultations requested (Table 1), as well as time to patient follow-up. Within each category, management actions conducted by at least 60% of respondents were requesting information on health behaviors; conducting vascular and abdominal exams; ordering a non-diabetes endocrine test, hematologic profile and renal test and providing advice on diet, exercise and smoking. We first conducted a factor analysis to identify underlying structures in the data related to how the numerous outcomes measures we collected were associated with one another. Fifty-five variables were included in the factor analysis (Table 1). Six latent factors were identified based on analysis of the factor analysis scree plot and 29 variables loaded cleanly onto one of the 6 factors (defined as an absolute factor loading of 0.3 or greater on a single factor; in bold on Table 1). The remaining 26 variables were cross-loaded and therefore excluded from ongoing analysis, because each of these variables measures more than one concept, implying that they are psychometrically weak for the purpose of cluster analysis.

Among the 256 physicians, 3 fairly equally sized clusters of management decisions were identified (Table 2). Table 2 displays the physician actions that significantly differed ($p < 0.05$) between clusters. Cluster 1 (“minimalists”) represents 33% of the sample ($n=84$) and these physicians were the least likely to engage in a range of management decisions compared to physicians in the other 2 clusters. They were less likely to perform exams (e.g., abdominal, head, neck, skin) and order tests (e.g., chem. panel, liver function) and somewhat less likely to offer advice (diet, smoking). Cluster 2 (“middle of the road”) represents 33% of the sample ($n=84$), with physicians in this cluster reporting moderate rates of performing exams, test ordering and advice offering. These physicians were not likely to prescribe medications or suggest referrals. Cluster 3 (“interventionists”) represents 34% of the sample ($n=88$), with physicians in this cluster reporting a broad range of actions. Compared to physicians in the other clusters, physicians in Cluster 3 “interventionists” were more likely to prescribe medications (e.g., anti-hyperglycemic, anti-hypertensive) or suggest referrals (e.g., nutritionist, ophthalmology).

A second cluster analysis was performed, without control for co-morbidities (Table 3). This analysis revealed a trend towards variation in the distribution of physician styles among clusters by co-morbidity ($p = 0.13$, chi-square test). Four clusters were identified in this secondary analysis; the first 3 were comparable in interpretation to the overall clusters identified above. However, substantially fewer physicians fell in Cluster 3 “interventionists” in this analysis ($n=28$; 11%) while more were grouped into Cluster 1 “minimalists” ($n=100$; 39%) and Cluster 2 “middle of the road” ($n=113$; 44%). Compared to the “interventionists” in the original clustering, these “interventionists” were more likely to prescribe smoking cessation drugs. A small fourth cluster was identified consisting of “information seekers” (Cluster 4, $n=15$; 6%) who were more likely than the other clusters to ask for additional information (e.g., current medications, adherence, stress) and also to suggest referrals.

Clustering differed by patient co-morbidity (Figure 1). Physicians viewing “patients” with depression were over-represented in Cluster 3 “interventionists.” On the other hand, those with “patients” presenting with schizophrenia with bizarre affect were under-represented in Cluster 3 “interventionists” but over-represented among Cluster 1 “minimalists”. Physicians viewing vignettes with “patients” presenting with either type of schizophrenia were under-represented in Cluster 4 “information seekers”. Moreover, there was a significant difference in the distribution of clusters between physicians who ranked schizophrenia higher *versus* lower than diabetes on their problem list ($p = 0.002$, Fisher exact test; Figure 1).

Physicians ranking schizophrenia as the more important problem were over-represented among the “minimalists” of diabetes care and were not among the small number of “interventionists” or “information seekers”.

There were a few physician characteristics associated with the identified clusters when not controlling for patient co-morbidity (Table 4). “Interventionists” reported the longest intervals until patient follow-up (32 days), with “information seekers” wishing to see the patient again sooner (17 days). “Minimalists” reported the least use of practice supports (e.g., tracking reports, electronic reminders, electronic tools), with the most use reported by “information seekers”. Physicians whose knowledge of clinical guidelines did not affect their decisions for this case were more likely to be among the “minimalists” and less likely to be “interventionists”. Finally, physicians in for-profit practices were both more likely to be among the “interventionists” and “minimalists”.

Discussion

In this first study exploring clusters of physician decision-making for type 2 diabetes in the presence of a mental health co-morbidity, we found variations in physician decision-making that encompass multiple clinical actions. Using exploratory cluster analysis, we identified 3 fairly equally sized clusters of management decisions: “minimalists”, “middle of the road” physicians and “interventionists.” These decision-making styles may help explain variation in patient care that extends beyond demographic predictors. Compared to diagnostic decisions, longer-term management of patient care (such as is required for a chronic condition) may especially reflect individual physician preferences and/or training. Differing practice styles may be particularly prevalent in the absence of a single correct practice, which “tends to be the rule rather than the exception in the real world of clinical practice” [41].

Additionally, physicians subtly shifted their style of case management depending on mental health comorbidity, especially when the physician had high concern about the co-morbidity. Our secondary analysis, without control for co-morbidity, suggested fewer physicians in the “interventionist” cluster and identified an additional small cluster of “information seekers”. Identification of this additional cluster argues against the possibility that physician decision-making style is simply a unidimensional construct measuring only “aggressiveness in intervention”. Use of cluster analysis techniques allowed for an unbiased identification of potential factors affecting physician decision-making, without any pre-conceived or pre-specified component.

Our results showing that physician decision-making styles vary by presence and perceived importance of a mental health co-morbidity are in line with evidence that suggests that people who are labeled mentally ill are less likely to benefit from the full range of available healthcare services [42,43]. For patients with depression, prior research has found increased counseling and history-taking, but decreased time conducting physical examinations [44,45] and poorer lab monitoring [46,47]. Our results show that physicians viewing “patients” with depression were over-represented among those who intervened more by prescribing medications and suggesting referrals. This may reflect a familiarity with the relatively common association of diabetes and depression. As Callahan [45] notes, the challenge of treating patients with emotional distress is to recognize and treat the emotional symptoms while continuing to fulfill competing medical demands, a key principle of person-centered healthcare. It appears that this may be occurring in patients with diabetes and co-morbid depression.

On the other hand, “patients” presenting with schizophrenia, especially those with bizarre affect and those for whom schizophrenia was perceived to be the more important issue compared to diabetes, received less care for their diabetes. They were considerably more prevalent among “minimalists” and less prevalent among both “information seekers” and “interventionists”, which partly explains the decreased size of the “interventionist” cluster. Providers may limit their interactions with these more stigmatized patients, thereby gathering less information. They may also limit prescribing medications due to stereotypes and attitudes about patients’ abilities to effectively adhere to a treatment regimen [48]. It is also possible that due to competing demands of a complicating co-morbidity, the physician may delay measures to address diabetes in order to address the mental health concern. Our results are consistent with the label of schizophrenia as an “epidemic within an epidemic” [49]. Compared with the general population, people with schizophrenia have been shown to have a 40% increased risk of death from medical causes [50] and people with major mental disorders lose 20-30 years of life expectancy [51].

The physician practice styles we identified were associated with a few practice and physician characteristics. In particular, the “interventionists” who would do more at a single visit waited the longest interval until follow-up, which may itself be a practice style preference or may relate to the organizational system. Not surprisingly, those who were “information seekers” also wished to see the patient again sooner (perhaps with the intention of taking more management actions at the follow-up visit) and had the most reported use of practice resources (which may help with or, alternatively, insist on information gathering). Those who were “minimalists” were the least likely to report use of clinical guidelines, which may have suggested additional care, in the case management. The finding that physicians in for-profit practices were more likely to be among both the “interventionists” and “minimalists” is difficult to interpret given these clusters are on opposite ends of the spectrum, but it may suggest more variability among for-profit practices. Alternatively, this finding may simply be an artifact of multiple statistical testing, especially since the finding was not consistent across clusterings.

As with any study, there is a trade-off between internal and external validity. Unlike other studies that used cluster analysis to identify physician styles of interaction with patients

[26,27], we could not through use of video vignettes study interactions, only actions without incorporating patient feedback about preferred types of care. However, the use of vignettes allowed for standardization of presentation and measurement of unconfounded effects. Another limitation of this study was the lack of context and knowledge of the patient-physician relationship. Prior research has found that physician-patient familiarity affects what happens during the medical interview and that return visits tend to be less technically oriented and more person-centered with more emphasis on health behaviors and active involvement of patients in their own care [52]. Although the vignette clearly indicated that the physician in the voiceover had seen the patient previously, physician respondents may have made variable assumptions regarding what may have been accomplished in past visits, possibly reflecting what they personally would have done previously.

A strength of this study was the identification of clusters of physician behaviors that were robust to physician and patient characteristics. The clusters identified through this study of diabetes are relatively similar to those identified in a similarly designed study of vignette presentations of coronary heart disease: “minimalists,” “talkers” (those gathering medical history and giving advice) and those focusing specifically on the “cardiac” issues at hand [28], which we believe directly correspond to the “interventionists” identified in the present study. Although we did not identify a cluster of “talkers”, the “information seekers” are somewhat similar and the overall similarities support the robustness and reproducibility of the finding that physicians may employ general styles of practice in their management across a range of different disease conditions, though application of their style can vary from patient to patient according to perceived treatment needs. This robustness and reproducibility of the findings is especially heartening given the small sample size relative to the number of outcomes items used in this exploratory factor analysis.

The question remains as to what causes a physician to follow a particular treatment style. One possible factor identified by previous studies is physician tolerance for uncertainty and risk taking [53,54] and it would be of interest to directly measure whether these factors are associated with cluster membership. Identification of other factors that govern adoption of practice style should be a focus of further research, but our study shows that one factor is the presence of a mental health co-morbidity and physician prioritization. This is especially relevant to management of type 2 diabetes. Indeed, Grant *et al.* found that over two-thirds of such patients may be viewed by their primary care physicians as “complex” with challenging clinical care [29]. This same study showed that patients with diabetes and mental health co-morbidities of depression and anxiety were more likely classified as “complex” and the authors concluded that substantial advances in the quality of diabetes care require focus on complicating co-morbid conditions [29].

Efforts to influence physician decision-making (e.g., training, re-credentialing) must account for not only styles of decision-making (rather than singular clinical actions), but also how physicians process the presence of mental health co-morbidities in making decisions in a short period of time. Future research should focus on whether the effect seen for mental health co-morbidities in this study extends to other types of co-morbidities. When encouraging physicians to implement the most recent evidence-based clinical practice, training and continuing education efforts should consider that physicians may approach

clinical management with different tendencies or styles of treatment that may subtly shift for complex cases. Accounting for different treatment styles may help disseminate messages to a broader audience.

Acknowledgements

This work was made possible by Grant Number R01MH081824 from the National Institute of Mental Health. The funding agreement ensured the authors' independence in designing the study, interpreting the data, writing and publishing the report. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the National Institute of Mental Health or the National Institutes of Health. The authors thank Karen Lutfey PhD, for her leadership in conceptualizing the study, securing funding and directing data collection as Principal Investigator from 2009-12.

References

1. Dankwa-Mullan I, Rhee KB, Williams K, Sanchez I, Sy FS, Stinson N Jr, Ruffin J. The science of eliminating health disparities: summary and analysis of the NIH summit recommendations. *American Journal of Public Health*. 2010; 100(Supplement 1):S12–18. [PubMed: 20147660]
2. Institute of Medicine. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Healthcare*. The National Academies Press; Washington, DC: 2003.
3. National Institutes of Health. *Fact Sheet: health Disparities*. 2010
4. Centers for Disease Control and Prevention. *National Diabetes Fact Sheet: national estimates and general information on diabetes and prediabetes in the United States*. U.S. Department of Health and Human Services CfDCaP. , editor. Atlanta: 2011. p. GA2011
5. McKinlay JB, Marceau LD, Piccolo RJ. Do doctors contribute to the social patterning of disease? The case of race/ethnic disparities in diabetes mellitus. *Medical Care Research and Review*. 2012; 69(2):176–193. [PubMed: 22156837]
6. Expert Group. *Schizophrenia and Diabetes 2003' Expert Consensus Meeting, Dublin, 3-4 October 2003: consensus summary*. *British Journal of Psychiatry Supplement*. 2004; 47:S112–114. [PubMed: 15056604]
7. Kilbourne AM, Post EP, Bauer MS, Zeber JE, Copeland LA, Good CB, Pincus HA. Therapeutic drug and cardiovascular disease risk monitoring in patients with bipolar disorder. *Journal of Affective Disorders*. 2007; 102(1-3):145–151. [PubMed: 17276514]
8. Kilbourne AM, Cornelius JR, Han X, Pincus HA, Shad M, Salloum I, Conigliaro J, Haas GL. Burden of general medical conditions among individuals with bipolar disorder. *International Journal of Bipolar Disorders*. 2004; 6(5):368–373.
9. Hennekens CH, Hennekens AR, Hollar D, Casey DE. Schizophrenia and increased risks of cardiovascular disease. *American Heart Journal*. 2005; 150(6):1115–1121. [PubMed: 16338246]
10. Arber S, McKinlay JB, Adams A, Marceau LD, Link CL, O'Donnell AB. Patient Characteristics and Inequalities in Doctors' Diagnostic and Management Strategies relating to CHD: A Video-simulation Experiment. *Social Science and Medicine*. 2006; 62(1):103–115. [PubMed: 16002197]
11. Welch LC, Lutfey KE, Gerstenberger E, Grace M. Gendered uncertainty and variation in physicians' decisions for coronary heart disease: the double-edged sword of "atypical symptoms". *Journal of Health and Social Behavior*. 2012; 53(3):313–328. [PubMed: 22933590]
12. LaVeist TA, Arthur M, Morgan A, Plantholt S, Rubinstein M. Explaining racial differences in receipt of coronary angiography: the role of physician referral and physician specialty. *Medical Care Research and Review*. 2003; 60(4):453–467. [PubMed: 14677220]
13. Lutfey KE, Ketcham JD. Patient and provider assessments of adherence and the sources of disparities: evidence from diabetes care. *Health Service Research*. 2005; 40(6 Part 1):1803–1817.
14. Shackelton-Piccolo R, McKinlay JB, Marceau LD, Goroll AH, Link CL. Differences between internists and family practitioners in the diagnosis and management of the same patient with coronary heart disease. *Medical Care Research and Review*. 2011; 68(6):650–666. [PubMed: 21680578]

15. Adams A, Buckingham CD, Lindenmeyer A, McKinlay JB, Link C, Marceau L, Arber S. The influence of patient and doctor gender on diagnosing coronary heart disease. *Sociology of Health and Illness*. 2008; 30(1):1–18. [PubMed: 18254830]
16. Eva KW, Link CL, Lutfey KE, McKinlay JB. Swapping horses midstream: factors related to physicians' changing their minds about a diagnosis. *Academic Medicine*. 2010; 85(7):1112–1117. [PubMed: 20592506]
17. Elstad EA, Lutfey KE, Marceau LD, Campbell SM, von dem Knesebeck O, McKinlay JB. What do physicians gain (and lose) with experience? Qualitative results from a cross-national study of diabetes. *Social Science and Medicine*. 2010; 70(11):1728–1736. [PubMed: 20356662]
18. Shackelton R, Link CL, Marceau L, McKinlay J. Does the culture of medical practice affect the clinical management of diabetes by primary care providers? *Journal of Health Services Research and Policy*. 2009; 14(2):96–103. [PubMed: 19299263]
19. Kralewski J, Dowd BE, Kaissi A, Curoe A, Rockwood T. Measuring the culture of medical group practices. *Health Care Management Review*. 2005; 30(3):184–193. [PubMed: 16093884]
20. Kralewski JE, Dowd BE, Heaton A, Kaissi A. The influence of the structure and culture of medical group practices on prescription drug errors. *Medical Care*. 2005; 43(8):817–825. [PubMed: 16034296]
21. Siegrist J, Shackelton R, Link C, Marceau L, von dem Knesebeck O, Bönke M, Roland M, Campbell S, McKinlay JB. Work stress of primary care physicians in the US, UK and German health care systems. *Social Science and Medicine*. 2008; 71(2):298–304. [PubMed: 20494505]
22. Ketcham JD, Lutfey KE, Gerstenberger E, Link CL, McKinlay JB. Physician clinical information technology and health care disparities. *Medical Care Research and Review*. 2009; 66(6):658–681. [PubMed: 19564640]
23. von dem Knesebeck O, Bönke M, Siegrist J, Marceau L, Link C, Arber S, Adams A, McKinlay J. Country differences in the diagnosis and management of coronary heart disease - a comparison between the US, the UK and Germany. *BMC Health Services Research*. 2008; 8:198. [PubMed: 18823556]
24. von dem Knesebeck O, Gerstenberger E, Link C, Marceau L, Roland M, Campbell S, Siegrist J, de Cruppe W, McKinlay J. Differences in the diagnosis and management of type 2 diabetes in 3 countries (US, UK, and Germany): results from a factorial experiment. *Medical Care*. 2010; 48(4):321–326. [PubMed: 20355263]
25. Marceau L, McKinlay J, Shackelton R, Link C. The relative contribution of patient, provider and organizational influences to the appropriate diagnosis and management of diabetes mellitus. *Journal of Evaluation in Clinical Practice*. 2011; 17(6):1122–1128. [PubMed: 20630007]
26. Callahan EJ, Bertakis KD. Development and validation of the Davis Observation Code. *Family Medicine*. 1991; 23(1):19–24. [PubMed: 2001776]
27. Flocke SA, Miller WL, Crabtree BF. Relationships between physician practice style, patient satisfaction, and attributes of primary care. *Journal of Family Practice*. 2002; 51(10):835–840. [PubMed: 12401151]
28. Lutfey KE, Gerstenberger E, McKinlay JB. Physician Styles of Patient Management as a Potential Source of Disparities: Cluster Analysis from a Factorial Experiment. *Health Service Research*. 2012; 48(3):1116–1134.
29. Grant RW, Wexler DJ, Ashburner JM, Hong CS, Atlas SJ. Characteristics of “complex” patients with type 2 diabetes mellitus according to their primary care physicians. *Archives of Internal Medicine*. 2012; 172(10):821–823. [PubMed: 22636827]
30. Center for Disease Control and Prevention. National Diabetes Fact Sheet: General information and national estimates on diabetes in the United States, 2005. Atlanta, GA: 2005. U.S. Department of Health and Human Services, Center for Disease Control and Prevention.
31. National Institute of Diabetes and Digestive and Kidney Diseases. National Diabetes Statistics Fact Sheet: General information and national estimates on diabetes in the United States, 2005. U.S. Department of Health and Human Services, National Institute of Health; Bethesda, MD: 2005.
32. Dixon L, Weiden P, Delahanty J, Goldberg R, Postrado L, Lucksted A, Lehman A. Prevalence and correlates of diabetes in national schizophrenia samples. *Schizophrenia Bulletin*. 2000; 26(4):903–912. [PubMed: 11087022]

33. Goff DC, Sullivan LM, McEvoy JP, Meyer JM, Nasrallah HA, Daumit GL, Lambert S, D'Agostino RB, Stroup TS, Davis S, Lieberman JA. A comparison of ten-year cardiac risk estimates in schizophrenia patients from the CATIE study and matched controls. *Schizophrenia Research*. 2005; 80(1):45–53. [PubMed: 16198088]
34. Lambert JS, Crilly JF, Maharaj K, Olson D, Wiener K, Dvorin S, Costea GO, Bushey MP, Dietz MB. Prevalence of diabetes mellitus among outpatients with severe mental disorders receiving atypical antipsychotic drugs. *Journal of Clinical Psychiatry*. 2004; 65(5):702–706. [PubMed: 15163259]
35. Veloski J, Tai S, Evans AS, Nash DB. Clinical vignette-based surveys: a tool for assessing physician practice variation. *American Journal of Medical Quality*. 2005; 20(3):151–157. [PubMed: 15951521]
36. Kaiser HF, Caffrey J. Alpha Factor Analysis. *Psychometrika*. 1965; 30:1–14. [PubMed: 14293189]
37. Abdi, H. Factor Rotations in Factor Analyses.. In: Lewis-Beck, M.; Bryman, A.; Futing, T., editors. *Encyclopedia of Social Sciences Research Methods*. Sage; Thousand Oaks, CA: 2003.
38. Williams ES, Konrad TR, Linzer M, McMurray J, Pathman DE, Gerrity M, Schwartz MD, Scheckler WE, Van Kirk J, Rhodes E, Douglas J. Refining the measurement of physician job satisfaction: results from the Physician Worklife Survey. SGIM Career Satisfaction Study Group. *Society of General Internal Medicine. Medical Care*. 1999; 37(11):1140–1154. [PubMed: 10549616]
39. Konrad TR, Williams ES, Linzer M, McMurray J, Pathman DE, Gerrity M, Schwartz MD, Scheckler WE, Van Kirk J, Rhodes E, Douglas J. Measuring physician job satisfaction in a changing workplace and a challenging environment. SGIM Career Satisfaction Study Group. *Society of General Internal Medicine. Medical Care*. 1999; 37(11):1174–1182. [PubMed: 10549620]
40. Bonomi AE, Wagner EH, Glasgow RE, VonKorff M. Assessment of chronic illness care (ACIC): a practical tool to measure quality improvement. *Health Service Research*. 2002; 37(3):791–820.
41. Cook DA. Medical decision making: what do we trust? *Journal of General Internal Medicine*. 2010; 25(4):282–283. [PubMed: 20217269]
42. Corrigan P. How stigma interferes with mental health care. *The American Psychologist*. 2004; 59(7):614–625. [PubMed: 15491256]
43. Corrigan, PW., editor. *On the Stigma of Mental Illness: Practical Strategies for Research and Social Change*. American Psychological Association; Washington, DC: 2005.
44. Callahan EJ, Bertakis KD, Azari R, Robbins J, Helms LJ, Miller J. The influence of depression on physician-patient interaction in primary care. *Family Medicine*. 1996; 28(5):346–351. [PubMed: 8735062]
45. Callahan EJ, Jaen CR, Crabtree BF, Zyzanski SJ, Goodwin MA, Stange KC. The impact of recent emotional distress and diagnosis of depression or anxiety on the physician-patient encounter in family practice. *Journal of Family Practice*. 1998; 46(5):410–418. [PubMed: 9597999]
46. Katerndahl D, Calmbach WL, Becho J. Effect of comorbid depression on outcomes in diabetes and its relationship to quality of care and patient adherence: a statewide primary care ambulatory research and resources consortium study. *The Primary Care Companion for CNS Disorders*. 2012; 14(3)
47. Rush WA, Whitebird RR, Rush MR, Solberg LI, O'Connor PJ. Depression in patients with diabetes: does it impact clinical goals? *Journal of the American Board of Family Medicine*. 2008; 21(5):392–397. [PubMed: 18772293]
48. Lutfey K, Freese J. Toward Some Fundamentals of Fundamental Causality: Socioeconomic Status and Health in the Routine Clinic Visit for Diabetes. *American Journal of Sociology*. 2005; 110(5): 1326–1372.
49. Fenton WS, Chavez MR. Medication-Induced Weight Gain and Dyslipidemia in Patients with Schizophrenia. *American Journal of Psychiatry*. 2006; 163(10):1697–1704. [PubMed: 17012676]
50. Harris E, Barraclough B. Excess mortality of mental disorder. *British Journal of Psychiatry*. 1998; 173:11–53. [PubMed: 9850203]

51. Colton CW, Manderscheid RW. Congruencies in increased mortality rates, years of potential life lost, and causes of death among public mental health clients in eight states. *Preventing Chronic Disease*. 2006; 3(2):A42. [PubMed: 16539783]
52. Bertakis KD, Azari R, Callahan EJ, Robbins JA, Helms LJ. Comparison of primary care resident physicians' practice styles during initial and return patient visits. *Journal of General Internal Medicine*. 1999; 14(8):495–498. [PubMed: 10491235]
53. Allison JJ, Kiefe CI, Cook EF, Gerrity MS, Orav EJ, Centor R. The association of physician attitudes about uncertainty and risk taking with resource use in a Medicare HMO. *Medical Decision Making*. 1998; 18(3):320–329. [PubMed: 9679997]
54. Gerrity MS, DeVellis RF, Earp JA. Physicians' reactions to uncertainty in patient care. A new measure and new insights. *Medical Care*. 1990; 28(8):724–736. [PubMed: 2385142]

Figure 1.

Percentage of physicians falling in each cluster by (A) patient co-morbidity ($p=0.13$) and (B) ranking of schizophrenia higher/lower than diabetes in the physician listing of problems ($p=0.002$). SNA = schizophrenia with normal affect; SBA = schizophrenia with bizarre affect

Table 1

Proportion of physicians (n=256) reporting each action to be taken for the diabetes patient

Information Requested		Examinations		Tests Ordered	
Health Behaviors	0.63	Vascular	0.66	Non-Diabetes Endocrine	0.89
Current Health Status	0.59	Abdominal	0.63	Hematologic Profile	0.78
Home Environment/Social History	0.52	Cardiovascular	0.54	Renal	0.61
Current Symptoms	0.50	Vitals	0.53	Glucose	0.53
Current Mental Health Status	0.39	Lungs	0.49	Lipid	0.42
Current Medications	0.32	Neurologic	0.48	Chem Panel	0.40
Medical History	0.29	Thyroid	0.44	Liver Function	0.28
Adherence	0.19	Head and Neck	0.42	Cardiac	0.18
Stress Level/Management	0.17	Cardiac	0.42	Other	0.11
Mental Health History	0.09	Diabetes Foot Exam	0.27		
Health Services Contact	0.09	Psychological	0.27		
Health Literacy	0.04	Skin	0.26		
		Lymph Node	0.24		
		Diabetes Eye Exam	0.11		
		Visual Assessment	0.10		
Medications Prescribed		Advice Offered		Referrals Suggested	
Antihyperglycemic	0.48	Diet	0.87	Nutritionist	0.20
Antihypertensive	0.38	Exercise	0.75	Diabetes Educator	0.05
Antidepressant	0.11	Smoking	0.63	Ophthalmology	0.05
Smoking Cessation	0.10	Diabetes	0.21	Smoking Cessation	0.03
Antipsychotic	0.02	Psychosocial	0.15	Podiatry	0.02
		Weight Loss	0.12	Consultations Requested	
		Drug/Alcohol Use	0.04		
				Mental Health	0.41
				Podiatry	<0.01

Actions in bold had factors loadings >0.3 in the initial factor analysis and were therefore used in further cluster analysis.

Table 2

Physician actions (proportions) with significant differences between clusters (p 0.05 for the 3-way comparison), from the cluster analysis controlling for patient co-morbidity

	Cluster 1: Minimalists	Cluster 2: Middle of the Road	Cluster 3: Interventionists
n	84	84	88
Information Requested			
Adherence	0.19	0.10	0.28
Examinations			
Abdominal	0.43	0.73	0.74
Head and Neck	0.20	0.49	0.57
Lymph node	0.06	0.38	0.28
Neurologic	0.35	0.48	0.60
Skin	0.04	0.38	0.35
Tests Ordered			
Chem Panel	0.29	0.49	0.42
Hematologic Profile	0.63	0.90	0.80
Liver Function	0.19	0.37	0.27
Non-Diabetes Endocrine	0.85	0.96	0.88
Medications Prescribed			
Antihyperglycemic	0.44	0.31	0.69
Antihypertensive	0.32	0.17	0.64
Smoking Cessation	0.11	0.00	0.18
Advice Offered			
Diet	0.79	0.86	0.97
Smoking	0.55	0.60	0.74
Referrals Suggested			
Nutritionist	0.08	0.08	0.41
Ophthalmology	0.00	0.02	0.13

Table 3

Physician actions (proportions) with significant differences between clusters, from cluster analysis *not* controlling for patient co-morbidity

	Cluster 1: Minimalists	Cluster 2: Middle of the Road	Cluster 3: Interventionists	Cluster 4: Information Seekers
n	100	113	28	15
Information Requested				
Adherence	0.14	0.15	0.36	0.53
Current Medications	0.26	0.32	0.39	0.67
Health Behaviors	0.52	0.71	0.68	0.67
Health Services Contact	0.03	0.13	0.04	0.20
Stress Level/Management	0.10	0.19	0.04	0.73
Examinations				
Abdominal	0.35	0.85	0.79	0.60
Diabetes Eye Exam	0.07	0.02	0.21	0.80
Head and Neck	0.20	0.60	0.57	0.27
Lymph Node	0.06	0.38	0.32	0.27
Neurologic	0.34	0.55	0.50	0.80
Psychological	0.20	0.32	0.11	0.60
Skin	0.05	0.42	0.29	0.40
Tests Ordered				
Chem Panel	0.20	0.50	0.68	0.47
Hematologic Profile	0.59	0.94	0.75	0.87
Liver Function	0.11	0.42	0.21	0.40
Non-Diabetes Endocrine	0.83	0.97	0.79	0.93
Medications Prescribed				
Anti-depressant	0.05	0.12	0.25	0.27
Anti-hyperglycemic	0.31	0.55	0.89	0.40
Anti-hypertensive	0.22	0.40	0.89	0.33
Smoking Cessation	0.03	0.01	0.75	0.00
Advice Offered				
Diet	0.77	0.93	0.96	0.93
Psychosocial	0.15	0.11	0.14	0.53
Smoking	0.54	0.65	0.82	0.73
Weight Loss	0.07	0.12	0.29	0.13
Referrals Suggested				
Nutritionist	0.11	0.15	0.46	0.60
Ophthalmology	0.01	0.01	0.32	0.13

Table 4

Distribution of clusters by physician and practice characteristics

	Clusters controlling for patient co-morbidity				Clusters not controlling for patient co-morbidity			
	Cluster 1: Middle of the Road N=84	Cluster 2: Interventionists N=88	Cluster 3: Minimalists N=84	p-value	Cluster 1: Middle of the Road N=113	Cluster 2: Interventionists N=28	Cluster 3: Minimalists N=100	Cluster 4: Information Seekers N=15
Ownership of practice, N (%)				0.47				0.008
For profit, N=104	29 (28%)	39 (38%)	36 (35%)		38 (36%)	17 (16%)	47 (45%)	3 (3%)
Not for profit, N=133	47 (35%)	44 (33%)	42 (32%)		66 (50%)	9 (7%)	47 (35%)	11 (8%)
Knowledge of guidelines affected decisions for this case, N (%)				0.07				0.002
Yes, N=190	56 (29%)	62 (33%)	72 (38%)		87 (46%)	26 (14%)	64 (34%)	13 (7%)
No, N=64	22 (34%)	15 (23%)	27 (42%)		25 (39%)	1 (2%)	36 (56%)	2 (3%)
Use of practice resources (e.g., tracking reports, reminders), mean of 0-4 scale	2.95	3.09	2.81	0.23	3.04	3.22	2.70	3.53
Time until follow-up with patient, mean in days	22.6	25.4	25.1	0.55	25.5	32.1	22.5	17.3
								0.04

Chi-square test for categorical predictors, ANOVA for continuous predictors; time until follow-up on log-scale, with back-transformed means; the following did not differ significantly between clusters: size of practice, general use of clinical guidelines (yes/no), job evaluation or financial compensation based on adherence to clinical guidelines (yes/no), frequency of use of electronic medical records, use of patient support resources, perceptions of practice support for patient care, clinical and administrative autonomy, physician satisfaction or attitude towards the patient's ability to self-manage.