Patient Preference and Adherence

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ORIGINAL RESEARCH

Discriminating Low to High Adherent Type 2 Patients with Diabetes by Glycosylated Hemoglobin A1c, Eating Self-Efficacy and Other Psychosocial Determinants: Difference Between Patient and Physician Adherence Models

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Objective: Develop individual discriminant models using clinical and psychosocial variables for physicians and patients with diabetes based on their perceptions of patient adherence.

Methods: This was a cross-sectional research design utilizing a discriminant analysis approach. Type 2 patients on treatment for diabetes for at least 2 years prior to research were selected. Clinical data were obtained from patient records, and psychosocial variables were collected by survey instruments filled out by patients. A final sample of 200 patients was recruited.

Results: We found a positive correlation between patient and physician assessment of patient adherence behaviors. Greater adherence efforts were associated with lower HbA1c. Better quality of the patient-physician relationship was linked to better patient adherence. Increased HbA1c, longer therapy duration and higher BMI described low patient adherence for physicians. Lower HbA1c, female gender and fewer difficulties in marital adjustment characterized high adherence for patients. Dietary self-efficacy as well as emotional and social isolation discriminated mid-level adherers in both models.

Conclusion: This research confirmed that patients and physicians perceived and judged patients' adherence behaviors differently. Physicians and patients associated different clinical and psychological factors with low and high adherence. Further research is recommended to clarify how the quality of the physician-patient as well as the patient-spouse relationship affect dietary efficacy and patient adherence. A randomized, controlled clinical trial approach is recommended to establish the effectiveness of interventions aiming to improve dietary self-efficacy on adherence outcomes.

Keywords: diabetes, adherence, dietary self-efficacy, HbA1c, physician-patient relationship, discriminant analysis

Introduction

Although significant progress has been made in the pharmacological treatment of type 2 diabetes, patient adherence defined as physician-recommended lifestyle changes and behaviors remains a challenge. Shams et al documented the prevalence of medication non-adherence among type 2 patients with diabetes to be 62% and reported that 81% of their sample's glycemic control had been out of range.[1] Gonzalez and associates argued that to increase glycemic control, research must explore determinants of non-adherence with greater focus on situation-specific self-efficacy.[2] Diabetes management self-efficacy was observed to make important contributions to improved glycemic control, well-being and overall illness management behaviors.[3–6] Research identified that diet knowledge was a barrier to enhanced dietary

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efficacy and eating self-efficacy was responsible for improved hemoglobin A1c (HbA1c) outcomes.[5,7,9] Oluma et al also confirmed that keeping a long-term special diet was strongly associated with increased self-efficacy beliefs.[10] Most importantly, higher levels of HbA1c were linked to the number of occasions eating out (i.e., social eating), situations in which strong dietary self-efficacy should guard patients against not exercising nutritional control.[11] Besides eating self-efficacy, improved weight management self-efficacy was also observed to advance glycemic control and keep food regulation in balance.[11] The significant positive relationship between eating self-efficacy and eating self-management was also confirmed.[12] Rucci et al however argued that stand-alone educational interventions not targeting an increase in self-efficacy will result in limited outcomes concerning diabetes management.[6] On the contrary, structured interventions aimed at increasing eating self-efficacy were found to improve glycemic control.[13] In line with the findings above, self-efficacy, especially dietary self-efficacy was regarded as a central measure of this study.

Other factors, such as family and social support, also positively contributed to better diabetes self-management. Those living in a relationship or with family had increased self-efficacy and were found to have better treatment adherence compared with those living alone.[10] Xie et al observed that patients with type 2 diabetes living in a family or cohabiting, and with greater self-efficacy, did more physical work-out than peers living alone.[14] Chan et al reported social support indirectly affecting patients' dietary self-efficacy efforts, but dietary efficacy then exerted a direct influence on glycemic control outcomes.[15] Worse glycemic control was also associated with fewer adherence behaviors because of unsupportive family dynamics.[16,17] Based on these outcomes, the authors concluded that the assessment of the quality of the patient-spouse relationship was supported.

Diabetes duration as well as patients' level of education were also observed as variables that influenced patient self-efficacy and adherence.[6,8,14] Brundisini et al and Nam et al pointed out that a better patient-provider relationship was reported to increase overall diabetes self-efficacy and adherence.[18,19] Brundisini et al also argued that physicians and patients have different views about what actions patients should take to improve adherence.[18] Whether that difference had an impact on patient adherence however has not been studied. Following these results, we decided that a set of demographic variables, diabetes duration as well as the quality of the physician-patient relationship should also be assessed in relation to patient adherence.

As far as the role of type D personality in diabetes is concerned, conflicting results have been reported. Mommersteeg et al found that the prevalence of diabetes was increased in persons showing symptoms of type D personality.[20] They also observed type D personality doubled the risk of diabetes. However, in other studies type D personality was unrelated to developing diabetes and made no meaningful contribution to predicting diabetes at all.[21,22] While type D personality did not correlate with regular biomedical indicators, it showed a 2–3 times increased risk for negative health behaviors.[23] We therefore considered the inclusion of type D personality important to measure in our study.

Finally, the link between emotional distress and adverse health outcomes was also documented.[23] We saw that loneliness was negatively associated with medication adherence in patients with diabetes.[24] Loneliness was also confirmed as an increased risk factor for diabetes.[25] Moreover, loneliness was reported as being an independent cause of diabetes onset.[26] Why loneliness should be investigated was supported by Foti et al who found that about one-fifth of patients with diabetes suffer from severe loneliness during the course of their disease.[27] However, loneliness has not yet been studied in relation to self-efficacy or dietary adherence in patients with diabetes, therefore, we considered the inclusion of a loneliness measure essential to our research.

Considering the above literature, we found that several factors contributed to improved adherence outcomes. Of those, dietary self-efficacy was confirmed a strong determinant. However, the role of type D personality remained unclear, especially in relation to adherence efforts. Loneliness, while linked to medication adherence, and held as an independent likely cause of diabetes, was not studied in association with other factors of adherence, especially with dietary self-efficacy. Whereas the contribution of many psychosocial factors to diabetes adherence were already investigated, we identified the lack of adherence research to evaluate the individual contribution of each variable discussed in the literature review in parallel to levels of patient adherence. We also found a lack of studies to compare how patients and physicians weigh the relative importance of underlying factors of patient adherence. The aim of our research therefore was to build adherence models for patients and physicians with the purpose of evaluating the contribution of each variable to explaining low to high patient adherence behaviors by using a discriminant analysis

approach. Measures selected for this research included the main variables identified in our review to discriminate the two groups. We attempted to develop individual discriminant models for physicians and patients, using the same set of variables, based on their perception of patient adherence.

Materials and Methods

This investigation used a cross-sectional, prospective, correlational/discriminatory research design. Our study was implemented in the diabetes outpatient unit, Department of Medicine, University of Debrecen, Hungary. The Medical Research Council gave ethical approval for the research (# IV/2949- 3 /2021/EKU). This study was implemented in compliance with the Declaration of Helsinki. We recruited study participants during their scheduled clinical check-up. A written informed consent was sought from patients. Patients recorded responses to all instruments on paper. Anonymity was ensured by using no identifier on research instruments, patients were also asked not to place their names or any personal data on questionnaires. Participants filled out research instruments independently in a separate room next to the physician's office, before their regularly scheduled check-up to see their physician. Patients were asked to complete all questionnaires in one go and place the instruments in an unidentified envelope and seal it. Patients were free to consult with investigators, who were not involved in regular patient care, on site should they have needed clarifications concerning research questions. Envelopes were returned into a closed metal ballot box in the waiting area and envelopes were removed only by research staff on a weekly basis.

Sample

We randomly selected a pool of potential participants by using the health records of the University of Debrecen. We identified close to 1000 eligible patients meeting the following inclusion criteria: Confirmed diagnosis of patients with type 2 diabetes at least 2 years prior to research, participant being between 45–70 years of age, being an outpatient, and mentally fit to respond to our research instruments. Out of this large sample, we further randomly selected 250 participants to become research subjects. Prospective participants' names were organized in alphabetical order and a general random number seed between 0 and 1 was assigned to each name by using Microsoft Excel spreadsheet. We then sorted random numbers in ascending order and picked the first 250 names as our recruitment list. A priori sample size calculations showed that with a level of significance set at 5%, statistical power set at 0.80 (20% type II error), effect size set at medium (0.25), a total of 153 subjects were required to ensure sufficient statistical power for the study outcomes. Once the number of patients was achieved in order to ensure sufficient statistical power for data analyses, we did not attempt to recruit more newly randomized subjects to replace those who rejected participation or any participant with missing data. Physicians who participated in this study and provided data for their patients' adherence efforts were those clinically responsible for and supervising the treatment of patients involved in the research. For the discriminant analyses, three distinct groups, using patients' and physicians' evaluation of patient adherence behaviors (low, mid-level and high adherence), were created.

Instruments

For purposes of sociodemographic assessments, we developed a short survey. To measure patient adherence, we developed and used a single item for the purposes of classifying adherence behaviors into "low, medium and high" adherence used for establishing the discriminant groups. Patients were requested to respond to "How frequently do you manage to keep your physician's recommendations?". Physicians who clinically supervised study participants were asked about their patients' general adherence efforts by "How frequently does your patient keep your recommendations?". Both groups used a Likert scale ranging 1–5: 1 = never and 5 = all the time.

Dietary self-efficacy was assessed by the Eating Self-Efficacy Scale (ESES).[28] The ESES has 25 items and explores dietary behavior of subjects. The ESES is designed to assess dietary difficulties both as a function of negative affect and socially challenging situations. Subjects respond on a 7-point Likert scale (1 = no difficulty eating; 7 = most difficulty eating); minimum and maximum scores are 25 and 175, respectively. Higher scores indicate limited confidence in one's ability to manage dietary behaviors. The ESES had displayed a reliability of 0.92 in previous research; reliability was 0.93 in our study.

Emotional and social loneliness was measured with the Emotional/Social Loneliness Inventory (ESLI).[28] The survey includes 15 items to assess loneliness and social isolation. Greater scores signal increased loneliness or isolation. Subjects score on a 4-point Likert scale (0 = rarely true; 3 = usually true); scores range between 0 and 45. Earlier esearch reported reliability between 0.80–0.86; reliability of 0.85 was demonstrated in this study.

Type D personality was recorded by the Type D Personality Scale Hungarian form. The scale assesses both negative affectivity and social inhibition. The scale originally developed by Denollet comprised 14 items, however, Pruebl et al abridged the instrument to 10 items maintaining its cultural validity.[29,30] Therefore, the short version of the scale was used. Subjects score on a 4-point Likert scale (0 = not characteristic; 3 = very characteristic); scores vary between 0 to 30. Greater scores mean greater negative affect and social inhibition. We achieved a reliability of 0.82 in the current research.

The quality of the patient-physician relationship was measured by the *Patient Reactions Assessment*.[28] The scale is comprised of 15 items; subscales measure the quality of the information shared by the physician, emotional behavior of physicians, and the patient's ability to discuss topics with the physician. A 7-point Likert scale is used for scoring (1 = very strongly disagree; 7 = very strongly agree), greater scores imply improved relationship. We measured a reliability of 0.84 in this research.

Finally, the quality of the patient's marital adjustment was measured by the Index of Marital Satisfaction (IMS).[31] The scale includes 25 statements concerning how one partner perceives difficulties in the relationship. Rating is achieved by a 7-point Likert scale (1 = none of the time; 7 = all of the time), score range is transformed to a 0–100 final scale. Greater scores indicate more adjustment problems. Reliability for the instrument was 0.94 in this research.

Statistical Analysis

We employed descriptive statistics to define sample characteristics. The one-sample Kolmogorov–Smirnov test was used to assess normal distribution. Instrument reliability was demonstrated by Cronbach's alpha coefficients. We did not attempt to replace missing data; missing cases were excluded from further analyses. Where we found non-normal distributions, Spearman's rank-order correlation was used. Two individual discriminant analysis models, based on both patients' and physicians' perception of patient adherence behaviors, were developed to discriminate patients on HbA1c, demographic, psychosocial and patient-physician relationship measures to describe profiles of each adherence category (low, middle and high adherence groups). Building the discriminant analysis models followed the suggested method described by Hair et al.[32] Patients' self-report and physicians' assessment of patient adherence scores were classified into three distinct groups using the distribution of these data (low = points 1–3, mid-level = point 4 and high = point 5). Level of significance was 5%, one-tailed tests were applied. We ran statistical analyses using IBM SPSS Statistics for Mac, version 27.0 (IBM Corp., Armonk, NY, USA).

Results

The average age of our sample was 62.8 (± 10.54) years, diabetes duration was an average of 12.1 (± 8.29) years. The final sample of 200 patients was gender balanced (51.5% male and 48.5% female) and the majority completed secondary school as the highest education (17.5% primary school, 57.0% secondary school and 25.5% graduate/postgraduate education). Patients had been receiving treatment for an average 8.4 (± 6.85) years prior to our study. Note that self-reported assessments of patient adherence behaviors showed close to identical distributions for physicians and patients. Table 1 shows the main outcome measures.

Table 2 shows correlation coefficients of demographic variables and main measures. Older subjects experienced greater levels of isolation ($r = 0.334$, $p < 0.001$) and more dietary self-efficacy ($r = -0.235$, $p < 0.001$). Higher education was associated with more complications in the marital relationship ($r = 0.127$, $p < 0.05$), with fewer type D personality traits ($r = -0.199$, $p < 0.001$) and feelings of isolation ($r = -0.250$, $p < 0.001$), but with more difficulties regulating eating behaviors ($r = 0.172$, $p < 0.001$). Longer treatment duration (in years) showed a positive correlation with increased HbA1c measures ($r = 0.262$, $p < 0.001$). Finally, women were associated with type D personality ($r = 0.206$, $p < 0.001$) and reported more complications with the marital relationship ($r = 0.125$, $p < 0.05$).

Table 3 shows the main measures of interest. Self-reported assessment of patients' adherence efforts was positively correlated with that of the physician ($r = 0.339$, $p < 0.001$). Greater self-reported adherence efforts (both patient and

Table 1 Descriptive Statistics of Main Measures

	Mean	SD	Minimum	Maximum
BMI (kg/m^2)	32.30	6.96	23.8	55.5
HbA1C (%)	7.28	1.15	4.9	10.7
Index of Marital Satisfaction[a]	14.09	15.77	0.00	68.00
Patient Reactions Assessment[b]	95.30	12.70	45.00	105.00
Dietary Self-Efficacy[c]	61.29	29.97	21.00	159.00
Emotional and Social Isolation[d]	19.90	14.26	0.00	67.00
Type D personality[e]	34.46	8.56	18.00	67.00
How well do you manage to keep your physician's recommendations?[f]	4.41	0.68	2.00	5.00
How well does your patient manage to keep your recommendations?[g]	4.11	0.89	1.00	5.00

Notes: [a]Quality of the patient-spouse relationship. [b]Quality of the physician-patient relationship. [c]Patient's ability to resist eating excess foods in tempting social situations. [d]Patient's feeling of loneliness. [e]Patient suppressing negative emotions (i.e., anger, irritability or hostility). [f]Overall adherence (patient self-report). [g]Overall adherence (physician about patient).

physician) were negatively correlated with HbA1c measures ($r = -0.388$, $r = -0.314$, $p < 0.001$). Better quality of the patient-physician relationship was positively correlated with patients' adherence efforts. Patients who experienced fewer difficulties with their partners reported better adherence ($r = -0.262$, $p < 0.05$) and enhanced dietary self-efficacy ($r = -0.288$, $p < 0.001$). Greater eating self-efficacy was negatively correlated with HbA1c outcomes ($r = -0.158$, $p < 0.05$).

Finally, Table 4 shows the results of the two discriminant models developed for physicians and patients, separating perceived low, mid-level and high adherence behaviors. Both models were significant (Wilks' lambda $_{\text{physicians}} = 0.75$, $p < 0.001$ and Wilks' lambda $_{\text{patients}} = 0.528$, $p = 0.041$) and achieved correct case classifications of 78.8% (physicians) and 82.5% (patients). The models accounted for 21% (physicians) and 45% (patients) of the variance between the two functions, respectively. Examination of group centroids, how groups are differentiated on the two discriminant functions, showed that the first discriminant function characterized low adherent patients in the physician model whereas high adherent patients in the patient model. The second function was characteristic of mid-level adherence for both groups.

Structure coefficients when squared indicate the proportion of variance accounted for by the discriminant function in the variable. Variables with below 5% shared variance with the discriminant function were not included for interpretation. Therefore, increased HbA1c, longer diabetes duration and higher body mass index (BMI) made up the first function in the physician model. These medical aspects of treatment characterized "low adherence" in the physician model. More predisposition for Type D personality, greater problems with eating self-efficacy, higher emotional and social isolation and better patient-physician relations defined the second function in that model. These psychological aspects of patients' behaviors depicted mid-level adherence for physicians.

As for patients, the first function described high adherence behaviors. Lower HbA1c, female gender and fewer problems in the marital relationship characterized high adherence. In terms of the second function, greater problems with eating self-efficacy, higher levels of education, and less emotional and social isolation characterized mid-level adherence for patients.

Discussion

The aim of this research was to compare how physicians and patients perceived patient adherence behaviors and clinical outcome measures. Physicians' view about patient adherence positively correlated with patients' self-report. The convergence between the two groups was encouraging, but the strength of the correlation remained relatively modest. We suggest additional research to explore why this distance between the two groups exists and what would help to narrow this gap.

Table 2 Correlation Matrix of Demographic Variables and Main Measures

	Age	Education	Treatment Duration	Gender	IMS	PRA	Type D	ESLI	ESES	HbA1C
Age	1.000	−0.170**	0.170**	0.037	−0.042	0.062	0.099	0.334**	−0.235**	−0.062
Education	−0.170**	1.000	−0.067	−0.009	0.127*	0.006	−0.199**	−0.250**	0.172**	0.014
Treatment duration	0.170**	−0.067	1.000	−0.040	0.016	−0.069	0.047	0.082	−0.067	0.262**
Gender	0.037	−0.009	−0.040	1.000	0.125*	0.011	0.206**	0.032	0.016	−0.112
HbA1C	−0.062	0.014	0.262**	−0.112	−0.012	−0.127	−0.049	−0.001	−0.158*	1.000

Notes: *p < 0.05, ** p < 0.001.
Abbreviations: IMS, patient-spouse relationship; PRA, physician-patient relationship; Type D, patient type D personality traits; ESLI, patient emotional and social loneliness; ESES, eating self-efficacy; HbA1c, hemoglobin A1c.

HbA1c outcomes, according to expectations, showed negative correlations with patient adherence; greater patient adherence efforts resulted in lower glycosylated hemoglobin levels. Although indirectly, the quality of the patient-physician relationship also affected HbA1c outcomes. Better patient-physician relations increased patient adherence efforts, and better patient adherence in return lowered HbA1c. These results have been confirmed in earlier research.[20,21] We observed patients' dietary self-efficacy having a direct, positive impact on HbA1c; greater eating self-efficacy resulted in decreased HbA1c. Our finding received support from Masuda and Tomonaga and Yang et al who saw dietary self-efficacy positively influencing glycemic control.[11,12]

The two discriminant models revealed notable differences about physicians' and patients' perceived view of patient adherence. The first discriminant function defined low versus high adherence for physicians and patients. HbA1c was the strongest determinant in both models but in the opposite sense; patients perceived HbA1c positively whereas physicians adversely. The finding is unique and should help physicians address this issue in their communication about HbA1c outcomes with their patients, specifically that patients translate HbA1c results for higher adherence achievements.

The quality of marital adjustment emerged in both models, however, marital satisfaction in the physician model did not pass the 5% threshold value (contribution to discriminant function) we set for a variable to be considered for the discriminant model. Important to note that those with high adherence in the patient model were characterized by fewer problems in the cohabiting relationship. This result coincided with findings reported by Oluma et al and Xie et al who observed the positive impact of living with a partner on improved adherence outcomes.[10,14] We reiterate the critical role of personal and social support; patient adherence is often conditional on external influences, dyadic adjustment being one key aspect. While exploring the dynamics between the patient and her partner (if any) is not part of the routine clinical assessment, our results support that complications in the personal relationship can move high adherence patients to become middle or low adherers. We therefore imply that the quality of the patient-partner relationship should also be evaluated as part of the clinical practice.

As for additional variables under the first function, low adherence in the physician view was associated with indicators of the biomedical model (diabetes duration and BMI). However, these factors characterized mid-level adherence (second function) in the patient model with much lower contribution to that function. These outcomes tell us that physicians focused on quantifiable indicators of the biomedical model whereas patients gave more attention to behavioral issues. As noted earlier, more targeted research may be required to explore why such differences emerged between the two groups, this study could only identify factors that are responsible for the gap.

When considering the first function for patients, gender was a vital part in the patient model; female gender was associated with high adherence. Xie et al also reported female patients exercise less but stay adherent on other dimensions of their regimen.[14] Recall that male gender on the other hand was associated with mid-level adherence for physicians. Our findings supported the gender imbalance in adherence efforts observed earlier. We uphold that male patients may require additional behavioral support compared with females.

Table 3 Correlation Matrix of Main Measures

	How Well Do You Keep Your Doctors' Recommendations	How Well Does Your Patient Keep Your Recommendations?	HbA1C	IMS	PRA	ESES	ESLI	Type D
How well do you keep your doctors' recommendations?	1.000	0.339**	−0.388**	−0.262*	0.273*	−0.288**	0.073	0.036
How well does your patient keep your recommendations?	0.339**	1.000	−0.314**	0.043	0.026	−0.059	0.005	0.006
HbA1C	−0.388**	−0.314**	1.000	−0.012	−0.127	−0.158*	−0.001	−0.049
IMS	−0.262*	0.043	−0.012	1.000	−0.432**	0.393**	0.214**	0.446**
PRA	0.273*	0.026	−0.127	−0.432**	1.000	−0.188**	−0.088	−0.210**
ESES	−0.288**	−0.059	−0.158*	0.393**	−0.188**	1.000	−0.007	0.223**
ESLI	0.073	0.005	−0.001	0.214**	−0.088	−0.007	1.000	0.420**
Type D	0.036	0.006	−0.049	0.446**	−0.210**	0.223**	0.420**	1.000

Notes: *p < 0.05, ** p < 0.001.
Abbreviations: HbA1c, hemoglobin A1c; IMS, patient-spouse relationship; PRA, physician-patient relationship; Type D, patient type D personality traits; ESLI, patient emotional and social loneliness; ESES, eating self-efficacy.

The second discriminant function, which we labeled "psychological determinants," showed more agreement between groups. This function discriminated mid-level adherers in both models. We found dietary self-efficacy, patients' ability to resist excess food intake in tempting social situations, a key determinant of mid-level adherence. Our findings correspond with those of Amer et al, who observed diabetes management self-efficacy to be a strong predictor of diabetes control.[33]

Feelings of emotional and social isolation was characteristic of mid-level adherence. However, the correlation matrix of main measures showed loneliness to be uncorrelated with biomedical or behavioral measures of adherence. Loneliness, on the other hand, had an indirect effect on patient adherence by having been positively correlated with problems in the patient-partner relationship. Patients with greater marital adjustment problems reported less ability to follow their physician's recommendations. While we could not confirm the direct effect of loneliness on diabetes, we saw loneliness being indirectly negatively associated with and a risk factor to adherence similar to prior research outcomes.[25,26]

Type D personality, the variable with the strongest contribution in the physician model (0.537) remained inferior for patients (−0.109). We found type D personality mediating the relationship between adherence behaviors and clinical outcomes in previous research but could not support a direct influence of type D personality on diabetes adherence.[34] Our current findings correspond with those of Martinac et al and Mommersteeg et al who found type D personality indirectly related to diabetes self-management.[21,22] This may however owe to our study population or to the sample size achieved in this research.

Finally, as far as the physician-patient rapport was considered, the two groups showed opposing views. Our results gave support to Brundisini et al who observed similar differences.[18] Better quality of the patient-physician relationship characterized mid-level adherers in the physician model, but surprisingly, it did not reach 5% contribution in the model for patients. We suggest additional research to clarify this unanticipated outcome. Bivariate correlations however confirmed that patients with a good relationship with their physicians enjoyed greater eating self-efficacy and achieved better treatment adherence. These outcomes matched reports of Brundisini et al and Nam et al[18,19]

Limitations

The authors acknowledge that the study sample was drawn from a single location and therefore may not represent the total diabetes population, hence generalizability of results may also be limited. The authors also admit that a single

Table 4 Discriminant Models of Low to High Adherence for Physicians and Patients

Discriminant Functions Related to Adherence Categories			**Discriminant Functions Related to Adherence Categories**		
Physician Model	**Function[a]**		**Patient Model**	**Function[a]**	
	1	2		1	2
Low adherence	0.985	−0.048	Low adherence	−0.145	−0.681
Mid-level adherence	−0.252	0.576	Mid-level adherence	−0.036	0.926
High adherence	−0.352	−0.238	High adherence	0.594	−0.600
Variables Associated with Discriminant Functions and Related to Adherence Categories			**Variables Associated with Discriminant Functions and Related to Adherence Categories**		
Physician Model	**Function[b]**		**Patient Model**	**Function[b]**	
	1	2		1	2
HbA1c (%)	0.671*	0.460	HbA1c (%)	−0.632*	0.219
Diabetes duration	0.341*	0.116	Gender (female)	0.349*	0.264
BMI (kg/m^2)	0.336*	0.134	Index of Marital Satisfaction	−0.248*	0.225
Index of Marital Satisfaction	−0.207*	0.065	Eating Self-Efficacy	−0.407	0.749*
Education	−0.065*	−0.028	Education	−0.136	0.276*
Age	−0.040*	0.036	Emotional and Social Isolation	−0.157	−0.263*
Type D Personality	−0.438	0.537*	Patient Reactions Assessment	0.172	−0.181*
Eating Self-Efficacy	0.277	0.497*	BMI (kg/m2)	−0.154	0.177*
Emotional and Social Isolation	−0.179	0.418*	Type D Personality	0.093	−0.109*
Patient Reactions Assessment	−0.147	0.255*	Age	0.074	−0.091*
Gender (male)	0.020	−0.108*	Diabetes duration	−0.050	0.060*

Notes: [a]Largest absolute value defines what characterizes the specific function. Physician model: Function 1 = low adherence; Function 2 = mid-level adherence. Patient model: Function 1 = high adherence; Function 2 = mid-level adherence. [b]Variables under functions 1 and 2 are associated with the adherence categories in the top table. Values are within-groups correlations between discriminating variables and discriminant functions. Values with asterisk (*) represent variables that are associated with (determine) the specific function. Variables contribute to the discriminant function in the order of their correlation (i.e., greatest to smallest). Negative values represent inverse relationship. That is, greater values of HbA1c (%) defined low adherence for the physician model whereas lower values of HbA1c (%) described high adherence in the patient model.

Abbreviations: HbA1c, hemoglobin A1c; BMI, body mass index.

question measured patient adherence. While the item was used to establish distinct groups for the discriminant procedure, a single measure may not accurately represent adherence behaviors of our study participants. Furthermore, the authors recognize that, compared with a cross-sectional study design, a longitudinal method would be more appropriate in the future to study patient adherence.

Conclusions

This research confirmed that patients and physicians perceived and judged patients' adherence behaviors differently. We recommend further research be applied to clarify reasons behind the disagreement and how improving the quality of the physician-patient as well as the patient-spouse relationship may enhance patient adherence. Furthermore, the authors suggest exploring the impact of these relationships on patients' dietary self-efficacy, to demonstrate how better personal relationships may increase dietary efficacy of patients with diabetes and observe how greater dietary efficacy may contribute to improved long-term adherence. A randomized, controlled clinical trial approach is recommended to establish the effectiveness of interventions aiming to improve dietary self-efficacy on adherence outcomes.

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Disclosure

The authors report no conflicts of interest.

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