

## ***Influencia de la depresión, los estilos de comunicación y la adhesión al tratamiento sobre los niveles de glucosa en personas con diabetes***

José Eduardo Rondón\*, Irama Cardozo y Rosa Lacasella.  
Instituto de Psicología, Universidad Central de Venezuela, Venezuela.

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### Resumen

El objetivo de esta investigación fue analizar la influencia de la depresión, el estilo de comunicación (asertivo, pasivo o agresivo) y la adhesión al tratamiento sobre los niveles de glucosa en la sangre en sujetos con diabetes tipo 2. Por medio de un muestreo no probabilístico de tipo propositivo se seleccionó una muestra de 278 pacientes diagnosticados con diabetes tipo 2 (mínimo 1 año de diagnóstico), con edades entre 19 y 77 años, sin amputaciones ni comorbilidad con nefropatía o retinopatía diabética. Se utilizó un tipo de investigación no experimental, con un diseño transeccional-causal. Las relaciones fueron planteadas en un diseño de ruta basado en el análisis de regresión múltiple. Como instrumentos, se emplearon los *Autoinformes de Actitudes y Valores en las Interacciones Sociales (ADCAS)*, el *Cuestionario Tridimensional para la Depresión (CTD)*, y el *Instrumento para Medir el Estilo de Vida en Diabéticos (IMEVID)* –para evaluar la adhesión al tratamiento–, todos validados en población venezolana, además de la HbA1c –para medir el nivel de glucosa–. Los resultados muestran que las correlaciones entre las variables fueron bajas (con puntuaciones entre  $r = -.12$  y  $r = -.33$ ;  $p < .05$ ), a excepción de dos, que pueden ser consideradas como moderadas: depresión y comunicación asertiva, con un  $r = -.47$ ,  $p < .05$ ; y comunicación agresiva y comunicación asertiva, con un  $r = -.44$ ,  $p < .05$ . Con el análisis posterior del modelo de regresión se observó que ninguna variable fue significativa para la predicción de los niveles de glucosa. En cuanto a la adhesión al tratamiento, la variable que más aporta a la predicción es la depresión. Y, con respecto al estilo de comunicación, se observó una correlación negativa, moderada y significativa entre depresión y asertividad. No se encontró relación entre la depresión y la comunicación agresiva ni pasiva. En conclusión, solo fueron corroboradas dos de las relaciones planteadas en el análisis de ruta. Se sugiere confirmar estos hallazgos en futuras investigaciones.

*Palabras clave:* depresión, estilos de comunicación, adhesión al tratamiento, diabetes mellitus tipo 2.

## ***The influence of depression, communication styles and treatment adherence on glucose levels in diabetics***

### Abstract

The aim of the present research was to analyze the influence of depression, passive-assertive-aggressive communication styles and adherence to treatment over the glucose levels of subjects with Type 2 diabetes mellitus. Participants were 278 patients with a minimum of one year of having been diagnosed, selected through a purposive non-probability sampling, with ages ranging from 19 to 77 years old, with no amputations, nor comorbidity with nephropathy or diabetic retinopathy. A non-experimental investigation was developed through a cross-sectional design, establishing relationships between variables in a path analysis through multiple regression analyses. The instruments used were the *Cuestionario Tridimensional para la Depresión (CTD)*, for its Spanish acronym) [Three-Dimensional Questionnaire for Depression]; the *Autoinformes de Actitudes y Valores en las Interacciones Sociales (ADCAS)*, for its Spanish acronym) [Self Reports of Attitudes and Values in Social Interactions], and the *Instrumento para Medir el Estilo de Vida en Diabéticos (IMEVID)*, for its Spanish acronym) [Instrument to Measure Diabetic Lifestyles] used to evaluate adherence to treatment. All of these instruments had been validated for the Venezuelan population. In addition, HbA1c was used to measure glucose level. Significant correlations between variables demonstrated

\* Av. Neveri con calle Edison, Centro Comercial Los Chaguaramos, piso 2, ofic. 2-10, Caracas, Distrito Capital – Venezuela. +58 212 6052829, [bernard85@gmail.com](mailto:bernard85@gmail.com)

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to be low (oscillating between  $r = -0.12$  and  $r = -0.33$ ), except for two of them considered to be moderate (depression-assertive communication  $r = -0.47$ ,  $p < 0.05$ ; and aggressive communication-assertive communication  $r = -0.44$ ,  $p < 0.05$ ). Likewise, from the path analysis, it could be seen that none of the variables were statistically significant for the prediction of glucose levels. In regards to treatment adherence, the variable that contributed the most to the prediction was depression. Concerning the communication styles, negative, moderate and significant associations were observed between depression and assertiveness. No relationship was found between depression and aggressiveness and passiveness. In conclusion, only two of the established relationships through the path analysis were corroborated. Confirmation of these findings is suggested for future investigations. *Key words:* Depression, communication styles, treatment continuance, diabetes mellitus type 2.

## ***Influência da depressão, dos estilos de comunicação e da adesão ao tratamento sobre os níveis de glicose em pessoas com diabetes***

### Resumo

O objetivo desta pesquisa foi analisar a influência da depressão, do estilo de comunicação (assertivo, passivo ou agressivo) e da adesão ao tratamento sobre os níveis de glicose no sangue em sujeitos com diabetes tipo 2. Por meio de uma amostragem não probabilística de tipo propositivo, foi selecionada uma amostra de 278 pacientes diagnosticados com diabetes tipo 2 (no mínimo um ano de diagnóstico), com idades entre 19 e 77 anos, sem amputações nem comorbidade com nefropatia ou retinopatia diabética. Utilizou-se um tipo de pesquisa não experimental com um desenho transversal-causal. As relações foram apresentadas em um desenho de rota baseado na análise de regressão múltipla. Como instrumentos, foram empregados os Autoinformes de Actitudes y Valores en las Interacciones Sociales (ADCAS), o Cuestionario Tridimensional para la Depresión (CTD) e o Instrumento para Medir el Estilo de Vida en Diabéticos (IMEVID) — para avaliar a adesão ao tratamento —, todos validados em população venezuelana, além da HbA1c — para medir o nível de glicose. Os resultados mostram que as correlações entre as variáveis foram baixas (com pontuações entre  $r = -.12$  e  $r = -.33$ ;  $p < .05$ ), com exceção de duas, que podem ser consideradas como moderadas: depressão e comunicação assertiva, com um  $r = -.47$ ,  $p < .05$ ; e comunicação agressiva e comunicação assertiva, com um  $r = -.44$ ,  $p < .05$ . Com a análise posterior do modelo de regressão, observou-se que nenhuma variável foi significativa para a previsão dos níveis de glicose. Quanto à adesão ao tratamento, a variável que mais contribui para a previsão é a depressão. E, com respeito ao estilo de comunicação, observou-se uma correlação negativa, moderada e significativa entre depressão e assertividade. Não foi encontrada nenhuma relação entre a depressão e a comunicação agressiva nem passiva. Em conclusão, apenas duas das relações apresentadas foram corroboradas na análise de rota. Sugere-se confirmar essas descobertas em pesquisas futuras.

*Palavras-chave:* adesão ao tratamento, depressão, diabetes mellitus tipo 2, estilos de comunicação.

### INTRODUCTION

Diabetes mellitus is one of the most prevalent, chronic, non-transmittable diseases. It constitutes a risk for cardiovascular diseases and other complications that increase mortality risks (World Health Organization, 2014). Above all, in Venezuela, according to the Annual Mortality Yearbook published by the Ministry of the People's Power for Health (2014) this pathology holds the fifth place among the 25 main causes of death that were diagnosed for 2012. Data shows that diabetes represents the seventh cause of death for people between the ages of 45 and 74 years. It is the fourth cause of death for people above the age of 75.

The panorama is even less happy if one considers the World Health Organization report for 1999 (cited by Pérez, Bautista and Bazaldúa, 2008). These authors state that by 2025 there will be a world-wide duplication in the number of people with diabetes (120 to 240 million people). This is predicted for developed cities because of the increase

in longevity and life styles characterized by poor nutrition and sedentary routines.

A diabetes diagnosis is usually stressful for a patient because of the habit changes that are necessary to stop the disease's progress and the implied health decline. Because of this, fear and uncertainty accompany these diagnoses. The changes in habits regarding diet, the constant glucose-level revisions, and the need for physical exercise, among other requirements, can lead to depression and changes in social relationships. This is because the person may avoid certain social activities, and this, too, may be a health risk. This may constitute a source of additional stress and indicates that the subject may require an adaptation process in his or her daily life. This may imply the development of abilities for living with the illness without difficulties (Ortiz & Myers, 2014; Ortiz, Baeza-Rivera & Myers, 2013; Ponce, Velázquez, Márquez, López, & Bellido, 2009; Oblitas, 2004).

The demands related to the control of diabetes that imply diet and life-rhythm changes include the incorporation of new routines, the reduction of certain pleasant activities, and in

addition, the complications of having diabetes (retinopathy, nephropathy, cardiopathia and sexual dysfunction, among others). These problems are related to a tendency toward depression (Fabián, García & Cobo, 2010). Diverse studies show that there is a frequent correspondence between diabetes mellitus and depressive symptoms (Hermanns, Ehrmann & Kulzer, 2015; Constantino-Cerna, Bocanegra-Malca, León-Jiménez & Díaz-Vélez, 2014; Doyle, Halaris & Rao, 2014; Molina, Acevedo, Yáñez, Dávila & González, 2013; Lyketsos, 2010; Pineda, et. al., 2004).

The direction of the relationship between diabetes and depression is still not clear; it is considered that diabetes can cause depression due to its impact on the person's life, but also because the presence of depression may be a risk factor for having diabetes (Dalzochio, Bonho, Feksa & Berlese, 2014; Lyketsos, 2010; Colunga, García, Salazar-Estrada & Ángel-González, 2008). Although the results are not conclusive, different studies (Young-Hyman, De Groot, Hill-Briggs, González, Hood & Peyrot, 2016; Constantino-Cerna et.al, 2014; De Jonge, et.al, 2014; Campayo et.al, 2010; Colunga, et.al, 2008) have shown the correspondence between both conditions. This indicates that people with diabetes are at a risk for depression two or three times greater than healthy people. This risk is associated with factors such as the time the disease has been developing, the self-care carried out by the patients, and the complications associated with the disease. Linked to all this, Escandón, Azócar, Pérez and Matus (2015), and Saur and Steffens (2010) indicate that depression has a negative impact on treatment adherence in patients with chronic illnesses such as diabetes, and on health-related behaviors like exercise, the elimination of smoking, and weight control. The association of diabetes with depression is an impediment in the development of self-control behaviors.

On the other hand, Schmitt, Reimer, Kulzer, Haak, Gahr and Hermanns (2015) indicate that high depression levels predict diminished glucose control, and that this may be related to the anxiety associated with diabetes, and not with the depression itself. It is important to clarify this issue.

Depression usually generates a change in life habits like food-intake, hygiene, and social behavior. All this causes a poor expression of feelings and ideas, and is associated with a weak adherence to treatment and thus less control over the disease (Young-Hyman et al., 2016; Rodrigues, Egidio & Cardoso, 2014; Jiménez & Miguel-Tobal, 2003). Nonetheless, there is also evidence of a deficit in social skills that implies greater risk-vulnerability for depression (Santos, De Oliveira & Sardinha, 2012). People with diabetes have to deal with a number of pressures and social "temptations" in order to succeed with their diets. Furthermore, they must be in constant communication with health professionals.

Therefore, it is fundamental to have an adequate repertoire of social skills in order to face these demands. In this sense, communication problems with the medical staff and the family, and the existence of social problems represent an important obstacle to treatment continuity and glucose control (Camacho, Lucero, Agazzi, Fernández & Ferreira, 2013). It is necessary to investigate the impact of patients' participation in decisions about how to manage their condition. This requires solid behavioral skills in assertive communication (Maidana et al., 2016). Nonetheless, it is necessary to study exactly how this impacts patients' communication styles with their associates and the health-care staff with respect to treatment continuation in order to determine indicators for social intervention in this regard.

On the other hand, Oliveira and Trujillo (2017) consider that it is necessary to educate, not only the diabetes patient, but also his or her family members and friends with regard to the healthy behaviors that are required to control the condition in order to prevent complications. The role of the patients' relationship with their social setting is important in achieving treatment continuation and glucose control. Communication styles have an important role in social relationships. There are three communication styles: assertive, passive and aggressive. An assertive person behaves in a way that is neither passive nor aggressive, and is able to express his or her needs, desires, opinions, feelings and beliefs respectfully, directly, and honestly. This is a non-aggressive, and thus a non-invasive and respectful recognition of the other person's rights. It is also non-passive, that is, the person does not hold back, and respects his or her own rights (Ortega & Calero, 2015; Valls, 2009; Stuart & Laraia, 2006).

A passive person has great difficulty in managing the pressure implied in not adhering to his or her treatment. He / she lacks the necessary tools for communicating their needs and the personal limitations inherent to the disease. On the other hand, an aggressive person has less control over his diabetes because it has been found that both worrying and the inadequate expression of anger can alter the glucose levels in the blood (Rodríguez & García, 2013; Santos, De Oliveira & Sardinha, 2012; Ramos & Arnaud, 2011; Méndez & Beléndez, 1994). Understanding the relation between communication style, treatment continuation and glucose control can be valuable for handling diabetic patients' social abilities and their impact on control.

In this way it has been shown that people with greater social support tend to have greater treatment continuation and greater glucose control (Moral & Cerda, 2015; Azzollini, Bail & Vidal 2012; Gomes-Villas, Foss, Foss de Freitas & Pace, 2012; Rondón, 2011), and people who look for help have greater treatment continuation (Garay, Santiago &

Malaraca, 2011). This is closely associated with the use of strategies for dealing with the problem that imply looking for social support (Rondón & Lugli, 2013). Thusly, one would expect that a person who uses an assertive communication style would have greater a probability of handling his or her health problem, by searching for and achieving the social support that would help in handling his or her condition.

The set of life-style changes required from the diabetes patient for glucose control tends to interfere in the harmonic development of good treatment continuation. In the same way, sustained stress and psychological problems such as depression, feelings of inferiority, shame, hopelessness and sadness, that is, in general *feeling bad*, can lead to lessened continuation (Kaltman et al., 2016; Rodríguez & García, 2013; Ramos & Arnaud, 2011). However, findings regarding this are contradictory (Braz, Silva, Gois, Braz, Santos & Silva, 2012). Thusly, a lowered treatment continuation, either pharmacological or not, could translate into poor glucose control, but there are controversial findings about this. It is therefore necessary to clarify the relationship between treatment continuation and glucose control (Rodríguez & García, 2013; Gomes-Villas et al., 2012).

Taking into account that the prevalence of depression in diabetes patients is three times greater than in the general population, it can be considered as an important problem that must be taken into account in the study of treatment adherence and glucose control in these patients. In the same way, communication styles can be associated with

depression and the management of behaviors implied in treatment adherence. Thus, a revision of these variables is relevant for understanding the relation between psychological factors and the disease. The importance lies in the need to generate intervention programs that might help control the condition and, at the same time, that might help bettering the patient’s life-style. Consequently, the purpose of this research is to analyze the influence of depression, assertive-passive-aggressive communication styles, and treatment adherence on glucose levels in the blood (HbA1c) in subjects with type 2 diabetes.

Hypothesis: Based on the theoretical background described above, a route model is proposed (See Figure 1). In the model, the variables to be studied and the relationships proposed are presented, in order to respond to the research objectives.

METHOD

Design

According to Kerlinter and Lee (2002) this research is *non experimental* because there is no direct control over the independent variables. A transectional-causal design was used because of the need to describe the causal relationships between variables at a given time (Hernández, Fernández & Baptista, 2006). In this case, these variables

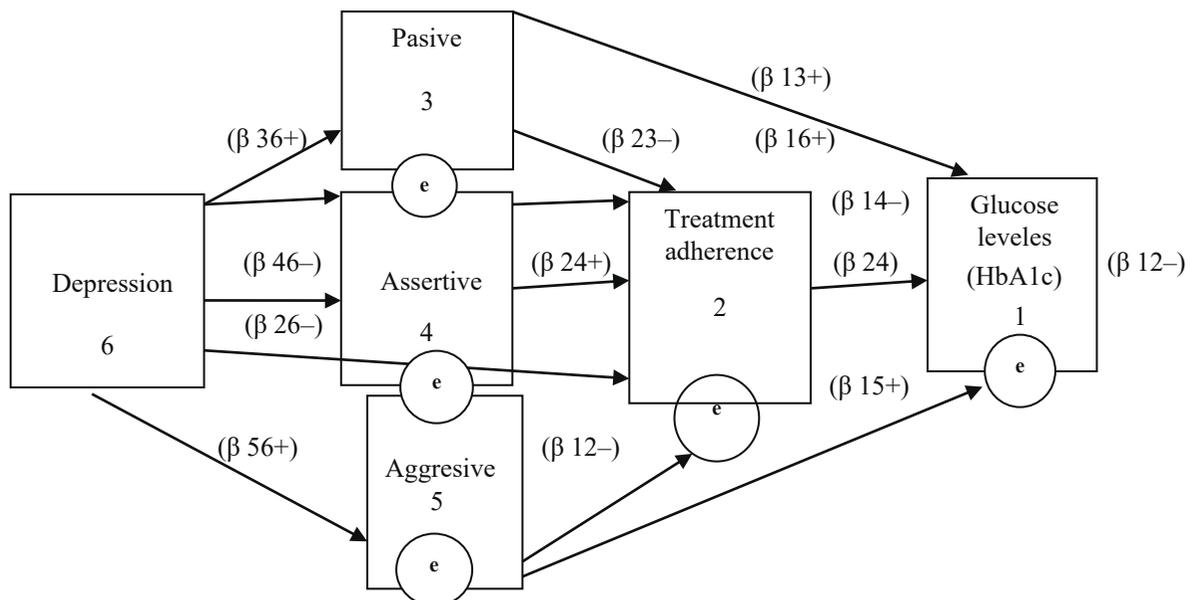


Figure 1. Proposed Path Diagram. Each arrow represents the proposed asymmetric relation among the two variables. The beta coefficients show the size and direction of the effect (positive or negative). The numbers indicate the implied variables; “e” represents the “error term”.

are depression, communication styles and treatment adherence with regard to blood glucose levels of people with type 2 Diabetes Mellitus.

Given that a specific type of relationship between depression, communication styles (passive, assertive-aggressive), treatment adherence and glucose levels is proposed, a path analysis was used. According to Angelucci (2007) it can be seen as an extension of the multiple regression model, with the difference that it works with more than one dependent variable. Also relationships of the type “X causes Y” and “Y causes Z” are incorporated.

### Participants

This research used non-probabilistic purposive sampling, according to Kerlinger and Lee (2002). There were 278 male and female patients aged between 19 and 77 years with diagnosis of type 2 diabetes. They had been diagnosed with the disease for at least one year, and did not show comorbidity with diabetic nephropathy (in dialysis) and diabetic retinopathy (blindness), or amputations of any member.

The following table (see Table 1) presents the sample’s socio-demographic data

Table 1

*Participants’ socio-demographic data*

	Participants
Women	159
Men	119
Mean age	59 years
Mean educational level	Complete high school
Time with the condition	10 years

### Instruments

*Three-dimensional questionnaire for depression - CTD.* This instrument was developed by Jiménez and Miguel-Tobal (2003) to evaluate depression based on the theoretical model of the three response systems (cognitive, physiological and motor). The original version has four factors explaining 61, 41% of the total variance, having a test-retest reliability of 0.56 and a Cronbach's alpha for the general population of 0.92. The Venezuelan adaptation was used in patients with chronic diseases carried out by Cardozo, Guarino and Rondón (2016). It has three dimensions consisting of 32 items, 11 on the motor scale, 12 on the cognitive scale and 9 on the physiological scale. The answer scale goes from 0 to 4 where 0 represents the answer “almost never” and 4 the answer “almost always”. Ratings range from 0 to 128. A high score indicates a higher level of depression. Reliability indices on all scales are greater than 0.75. The

internal consistency index of the total test is 0.85. The correlations between scales oscillate between 0.37 and 0.49, and the correlations between the three scales and the total test are between 0.70 and 0.81. The validity criterion was explored using the correlation index with the Trait Anxiety Inventory (IDARE), given the relationship between depression and anxiety that has been widely reported in the literature (Moscoso, 2014; Agudelo, Casadiegos & Sánchez, 2009; Páez, Jofré, Azpiroz & De Bortoli, 2009; Agudelo, Buena-Casal & Spolberger, 2007), there was a correlation index of 0.70. Regarding structural validity, the analyses show that the questionnaire has a factor structure that explains 31.94% of the total variance.

*Attitude and Value Self Reports in Social Interactions - ADCAS.* This questionnaire was created in 1992 by E. Manuel García Pérez and Ángela Magaz Lago. Their purpose is to identify the subjects’ attitudes and value systems regarding social relations, and to establish their attitude and value profiles in social interactions. These profiles include passive, aggressive, assertive, and passive-aggressive (García & Magaz, 2000). They evaluate the following dimensions: a) self-assertiveness which is the degree or level of respect and consideration that one has for one’s own sentiments, ideas and behaviors, and b) hetero-assertiveness which is the degree or level of respect and consideration toward the sentiments, ideas, and behavior of other people. According to the authors, the dimension self-assertiveness has a Cronbach’s alpha of 0.90 and hetero-assertiveness measures 0.85. It has a discriminant validity above 75%, when comparing the results of the test with the criteria of psychologists that are specialized in the area. Different combinations of both dimensions generate four communication styles (García & Magaz, 2000). Rondón’s, Cardozo’s and Lacasella’s (2014) adaptation for the Venezuelan population with chronic diseases was employed, in which there are four options (*never or almost never, sometimes, frequently, and always or almost always*), as in the original version. There was an internal consistency index for the questionnaire as a whole of 0.92 (Cronbach’s alpha). For the dimension of hetero-assertiveness it was 0.89 (14 items), and for the dimension self-assertiveness it was 0.85 (19 items). The two factors explain 35.20% of the variance.

*Instrument for measuring life-style in diabetics (MEVID), adherence to treatment.* This instrument was elaborated by López-Carmona, Arisa-Andraca, Rodríguez-Moctezuma and Munguia-Miranda (2003). It is designed for self-administration and measures treatment continuation as a life-style in patients with diabetes mellitus type 2. According to the authors, Cronbach’s alpha for the instrument’s total valuation is 0.81 and the test-retest correlation coefficient is 0.84; it explains 60.4% of total variance with eight factors.

For this study, Rondón's et al. (2014) adaptation for the Venezuelan population with chronic illness was used. As in the original version, the correction consists of assigning scores of 0, 2, and 4 to the three answer options, in which 4 corresponds to desirable behavior. In this adaptation a new factor structure was established with eight factors that explain 59.56% of the variance. The total questionnaire has an internal consistency (Cronbach's alpha) of 0.60. The following factors were identified: continuation 0.72 (three items), alcohol consumption 0.92 (two items), tobacco 0.97 (two items), nutritional style 0.48 (four items), emotion 0.34 (three items), exercise 0.22 (four items), information 0.29 (two items), and quantity of food 0.29 (three items). Larger scores mean greater treatment continuation.

*Glucose levels.* These were evaluated using the glycosylated hemoglobin (HbA1c), which is a blood analysis that gives information about mean glucose levels in diabetic patients in the three months before the measurements were taken. This test measures how much glucose has adhered to the red blood and other cells. There is a direct relationship between the values of this test and the appearance of microvascular complications in the patients. A written report for each patient was obtained from the laboratory for the last month. According to the Latin-American Association for Diabetes (2013) the HbA1c is the best indicator for glucose control. A parameter of less than 7 on the HbA1c is considered adequate for a person with diabetes.

### *Procedure*

Interviews were carried out with 500 men and women diagnosed with Type 2 diabetes mellitus. They were patients who attended several health centers in Caracas. Of all the people interviewed, 278 were selected because they complied with the criteria described in the section "participants". The purpose of the research was discussed with them. It was required that their glycosylated hemoglobin marker should not be older than one month. Their written consent was obtained, thus complying with the study's ethical parameters. The questionnaires were applied in an interview format both individually and in groups by previously trained, last-year students. Data collection lasted from about January to September, 2015. Once the questionnaires were completed, codification and analysis were carried out using the statistical package SPSS 19.

### *Data Analysis*

Descriptive statistics were obtained to show how the study's variables were performing and to comply with the requirements for the multiple regressions and thus carry out the path analysis. Central tendency, dispersion, and

the distribution characteristics statistics were calculated. Later, using the Pearson  $r$  coefficient, correlations were found among the variables. Lastly, a path analysis was carried out, calculating the multiple regressions using the "step by step" method for each endogenous variable of the mentioned model (passive, assertive, and aggressive styles, treatment continuation, and glucose levels).

Multiple correlation coefficients, the determination coefficient, and the  $b$  and  $\beta$  coefficients for each of the involved predictor variables for the regression model were obtained, and finally the proposed model was contrasted with the resulting one.

### *Ethical considerations*

It must be emphasized that during the whole process of the study the principle of confidentiality was observed. Data were anonymous, and furthermore, at the end, the directors of the health institutions where these data were obtained, received general information about the results.

## RESULTS

The following are the descriptive statistics for the studied variables. These include the correlations, and finally the path analysis related to the objective of the study.

*Description of the variables:* The analyses of the descriptive statistics of central tendency (mean, median and mode), dispersion (standard deviation, minimum and maximum), and distribution characteristics (asymmetry and kurtosis) are presented. The purpose is to describe the participants' depression, treatment continuation and blood glucose levels (HbA1c), and in addition, the assumed normal distribution of the variables. It is important to mention that passive, assertive and aggressive communication styles are not included in these analyses because they are variables that move in a dichotomous continuum (See Table 2).

These statistics show that the variables have a tendency toward a normal distribution, with small distortions that, in agreement with the statistician K. Smirnov, are significant at  $<0.05$ . Nevertheless, it is important to note that this test is very sensitive to asymmetries, and for that reason a continuation of the analysis is considered justified.

*Associations between the variables:* In order to corroborate the assumption of low multicollinearity among the variables, and thus, carry out the path analysis, bivariate correlations were calculated. It was expected that these values would be low. The correlations among the variables are shown in Table 3. It can be seen that all the correlations are low, with the exception of two of them that are moderate

Table 2  
Descriptive statistics of the study's variables

Variables	Mean	Median	Mode	Standard deviation	Asymmetry	Kurtosis	Minimum	Maximum
HbA1c	7.74	7.5	6	2.05	.82	.75	4.07	15.4
Treatment adherence	56	56	55	5.34	-.51	.03	39	67
Depression	29	25	9	19.28	1.08	1.21	0	98

Table 3  
Correlations among the variables

Variables	Depression	Treatment adherence	Aggressive	Assertive	Passive
HbA1c	.14	-.14	.01	-.12	-.5
Depression		-.33	0	-.47	.04
Treatment adherence			0	.22	.04
Aggressive				-.44	-.1
Assertive					-.2

Note:  $p < 0.05$  Aggressive com.: No (0) Yes (1); Assertive com.: No (0) Yes (1); Passive com.: No (0) Yes (1)

(depression – assertive communication, aggressive communication- assertive communication).

*Path analysis.* In order to verify the relationships established between the study's variables, a path analysis was carried out. The level of alpha significance was considered to be  $< 0.05$ . Multiple correlation coefficients, the coefficient of determination, and the  $b$  and  $\beta$  coefficients were obtained for each of the prediction variables involved in the regression model.

*Glucose Levels (glycosylated hemoglobin - HbA1c).* In Table 4 a low and positive multiple correlation (0.20) can be seen. It shows the best lineal combination of the variables “treatment continuation”, “assertiveness”, “aggressiveness”, “passivity” and “depression”. The adjusted coefficient of determination was 0.02. That is, the model explains 2% of the total variance, but the result is not significant ( $F=2,22$ ;  $gl=5$ ;  $p > 0,05$ ). In evaluating the dimensions of the direct effect of each of the variables separately on the glucose

levels (HbA1c) using the  $\beta$  coefficient, it was found that none of the variables had significant predictive value.

*Treatment adherence.* Table 5 shows a multiple, moderate, and positive correlation (0.35) with the assertiveness, aggression, passivity and depression variables. The adjusted determination coefficient was 0.11 which significantly explains 11% of the total variance ( $F=9,34$ ;  $gl=4$ ;  $p=0,000$ ). The dimensions of the direct effect of each of the variables on treatment continuation were calculated separately, determined by  $\beta$  coefficient. It was found that the variable that most contributed to prediction of treatment continuation was depression, with a low, negative, and significant correlation ( $\beta = -0,29$   $p < 0,05$ ). The other variables included in the model did not have a significant effect by themselves on the prediction of this outcome.

*Assertiveness, aggression and passivity.* In Table 6 a multiple, moderate, and positive correlation (0.48) can be observed between the variables “assertiveness” and “depression”. The adjusted determination coefficient was

Table 4  
Summary of the model and  $B$  y  $\beta$  coefficients for the variable “Glucose levels” (HbA1c)

Predicted variable: glycosylated hemoglobin (HbA1c)					
R	R 2	R 2 Corrected	ET	Durwin Watson	
.2	.04	.02	2.03	1.8	
	Non-standardized coefficients		Standardized coefficients		
	B	E. T	Beta	t	p
Adherence	-.04	.02	-.10	-1.50	.13
Aggression	-.24	.37	-.05	-.65	.51
Assertiveness	-.45	.34	-.11	-1.32	.19
Depression	.01	.01	.06	.88	.38
Passivity	-.74	.61	-.08	-1.21	.23

Table 5  
Summary of the model and B & Beta coefficients for the variable treatment continuation

Predicted variable: Treatment adherence					
R	R 2	R 2 Corrected	ET	Durwin Watson	
0,35	0,12	0,11	5,05	1,8	
	Non-standardized coefficients		Standardized coefficients		
	B	E. T	Beta	t	p
Aggression	-0,31	0,92	-0,02	-0,34	0,74
Assertiveness	0,96	0,84	0,09	1,14	0,25
Depression	-0,08	0,02	-0,29	-4,31	0,00
Passivity	1,72	1,51	0,07	1,14	0,26

Table 6  
Summary of the model and the coefficients for the variables assertiveness, aggression, and passivity

Predicted variable: Assertiveness					
R	R 2	R 2 Corrected	ET	Durwin Watson	
0,48	0,23	0,22	0,44	1,8	
	Non-standardized coefficients		Standardized coefficients		
	B	E. T	Beta	t	P
Depression	-0,01	0,00	-0,48	-9,00	0,00
Predicted variable: Aggression					
R	R 2	R 2 Corrected	ET	Durwin Watson	
0	0	0	0,4	2	
	Non-standardized coefficients		Standardized coefficients		
	B	E. T	Beta	t	P
Depression	0,00	0,00	0,00	0,09	0,93
Predicted variable: Passivity					
R	R 2	R 2 Corrected	ET	Durwin Watson	
0,04	0	0	0,21	1,9	
	Non-standardized coefficients		Standardized coefficients		
	B	E. T	Beta	t	P
Depression	0,00	0,00	0,04	0,71	0,48

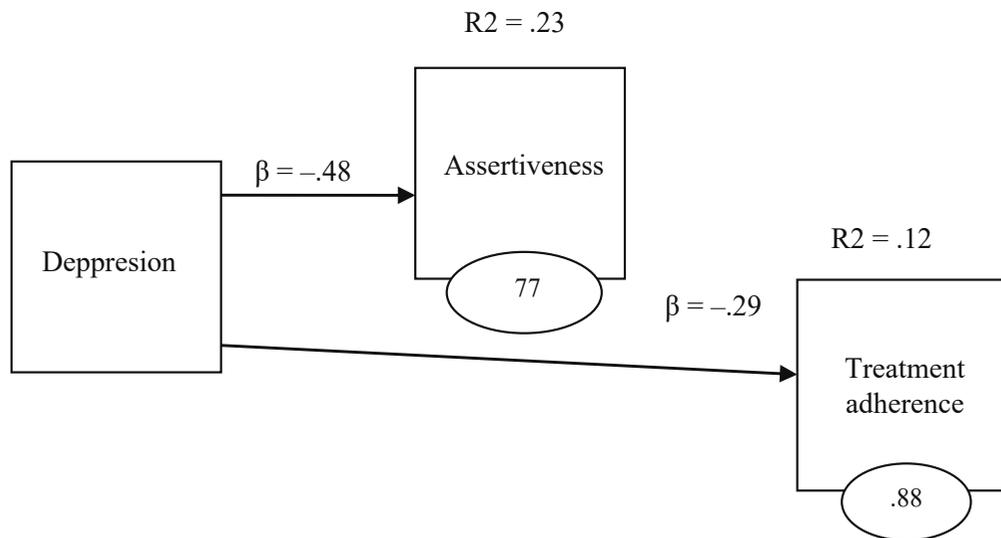


Figure 2. Resultant Path Diagram

0.22. That is, the model significantly explains 22% of the total variation ( $F=81,1$ ;  $gl=1$ ;  $p=0,000$ ). Using  $\beta$  coefficient, the magnitudes of the direct effect were calculated. It was found that depression has a negative, moderate, and significant correlation with assertiveness ( $\beta = -0,48$   $p < 0,05$ ).

No correlation was observed in the prediction of the variable depression and aggression (0). The adjusted determination coefficient was 0. That is to say, the model does not explain the variance.

Similarly, no correlation was observed in the prediction of depression and passivity (0.04). The adjusted determination coefficient was 0. That is to say, the model did not explain the variance.

In conclusion, only two of the initial relations were corroborated. The following model can thus be provided (See Figure 2)

## DISCUSSION

Given the above results, it would be convenient to recall the main objective of this investigation, which was to analyze the influence of the variables depression, assertive-passive-aggressive communication style and treatment continuation on blood glucose levels (glycosylated hemoglobin-HbA1c) in subjects with type 2 diabetes. A path model for this analysis was proposed.

### *Behavior of the sample's descriptive indicators*

*Sex:* The majority of the research participants were female. This is coherent with the findings of authors such as Calderón, Vargas and Lozano (2015), and Rondón and Lugli (2013) that show a higher prevalence of type 2 diabetes mellitus in females; this prevalence is supported by data reported in Venezuela's 2012 mortality yearbook.

*Age:* The mean age of this sample is about 59 years. This finding is consistent with other research (Pan-American Health Organization -Organización Panamericana de la Salud, 2016; Rondón, 2015; Rondón & Lugli, 2013; Camejo, García, Rodríguez, Carrizales & Chique, 2012; Patilla, 2011). Also, type 2 diabetes mellitus is often diagnosed after the age of 45. It can be mentioned, however, that these statistics are beginning to change in Latin America, according to the National Statistics Report (2014) and a study done by Aguilar-Salinas, Gómez and Gómez (2011). In Mexico, for example, the mean age for a diagnosis of this disease is decreasing and is now frequently found in people under 40 years old. Thus, further studies are recommended.

*Educational Level:* Most of the participants in the present research have a complete high school education. According to the research by Rondón and Lugli (2013) and Rondón

(2015), conducted in Venezuela, the educational level of the samples used is mainly within this range. This factor is important because it would partially explain why people with lower educational levels tend to report more diseases, since they cannot fully understand their biological and / or social vulnerability (De la Cruz-Sánchez, Feu & Vizuete-Carizona, 2012). It should be noted that in Venezuela, according to the National Statistics Institute (2014), the number of literate people is increasing, which could indicate, although not guarantee, a higher educational level of the population, which in turn is a better predictor for the risk of disregarding one's care needs with respect to diabetes.

### *Analysis of the variables in this study*

*Glucose Levels (glycosylated hemoglobin - HbA1c):* The mean glycosylated hemoglobin was 7.74. This indicator, which is a little above the parameters estimated as normal (7% according to the Latin American Diabetes Association, 2013), shows a good adjustment of this organic condition.

*Treatment adherence:* According to the mean measurement of treatment adherence (55), it can be stated that in this particular sample there is a quite acceptable level of treatment adherence. This result supports indirectly the findings obtained by Patilla (2011) and by Marín and Mubayad (2012), in which the importance of treatment adherence is highlighted, not only in terms of the follow-up of medical prescriptions that affects diabetes control as such. It also points to the possibility of reducing the anxiety and depression levels commonly associated with this condition.

*Depression:* This sample shows low depression levels and also a very marked difference between the measurements of central tendency. These indicate a distribution with marked asymmetry. Similar results were found in the research by Patilla (2011) Marín and Mubayad (2012), Benítez et al. (2011) in relation to the depression levels observed in their respective samples.

### *Analysis of the associations between variables*

An analysis of all possible associations that could be established between the variables yielded the following results regarding the relationship between depression-assertive communication and assertive communication-aggressive communication:

- With respect to the association between assertive - aggressive communication, the findings show that greater assertiveness is related to less aggressiveness. This makes sense as assertive behavior is a skill characterized by the appropriate and sincere expression of feelings, ideas, own opinions and desires, as well as respect for oneself and others. It is incompatible with aggressive behavior

(Martínez, Justicia & Fernández, 2016, Castaños, Reyes, Rivera & Díaz, 2011, Valls, 2009, García & Magaz, 2000). Assertiveness is the midpoint in a continuous spectrum between passive and aggressive behavior. Assertive behavior conveys a sense of self-confidence, but also respect for the other person. Assertive people speak clearly. Assertive people feel free to reject an unreasonable proposition. In addition, they share their own criteria with others (Ortega & Calero, 2015, Stuart & Laraia, 2006).

- Regarding the association between depression and assertive communication, it is evident that this has been highlighted in other studies (Arancibia, Behar, Marín, Inzunza & Madrid, 2016, Patilla, 2011). It is common to find that depression usually generates an alteration in life-habits, food intake and hygiene, as well as a decrease in social behaviors. This may favor the inadequate expression of feelings and ideas and, consequently, lead to a lower treatment adherence, and therefore to a lessened control of the condition (Rodríguez et al., 2014; Jiménez & Miguel-Tobal, 2003). There is also evidence that the presence of a deficit in social skills implies greater risk - vulnerability to depression (Santos, De Oliveira & Sardinha, 2012). People with passive behaviors regarding their diabetes could have difficulties in facing social pressure, since they lack the skills that would allow them to address their communicational needs in an appropriate way. Therefore, the person may handle their situation inadequately. Likewise, the insufficient expression of anger on the part of these patients could alter their blood glucose levels, so an assertive communication style would favor the decrease, or at least the adherence, of minimum levels. Examining these relationships can be a powerful ally for the management of the patients' social skills (Rodríguez & García, 2013, Santos, De Oliveira & Sardinha, 2012, Ramos & Arnaud, 2011, Méndez & Beléndez, 1994). Thus, it will lead to an improvement in their quality of life.

#### *Path Analysis*

The variables under study were analyzed using a path analysis model. Taking an alpha level of  $<0.05$  as the level of significance, it was found that the variables with the highest relational, associative and predictive factors were depression, treatment adherence, and an assertive communication style, in the following senses:

- *Depression affects moderately, negatively, and significantly the assertive communication style.* That is to say, people with lower levels of depression will have a more adequate social communication repertoire. They will defend their right to a better quality of life, eating habits, exercise, and community respect for their decisions (Ledón, 2014; Patilla, 2011). Throughout their experience with the

condition, people develop different symptoms, especially anxiety and depression (Nagel, Azócar, Pérez & Matus 2015, Pereira, et al., 2009; Ledón, 2012), and it is precisely through the training of social skills that improvements have occurred on their quality of life. The challenge that these people must face is how to communicate to their loved ones their needs and fears about the biological change that is taking place in their lives; how to cope with those changes (cardiovascular, gastrointestinal, dermatological); how to face the doubts, the difficulties of the reconstruction of their body images, self-esteem and general meaning of life (Ledón, 2012). In addition, their relationships with their family and friends (primary caregivers) can be affected by the possible complications and the necessary lifestyle changes. Disagreements or arguments appear that lead to physical, economic and emotional exhaustion. For example, changes in diet and other aspects of the patients' lifestyle can generate resistance to change in the rest of the family members and affect their compliancy with treatment. Eventually, this is attributed to a lack of empathy and their feeble awareness of the condition that both the patient and his or her family share. For this reason, the social repertoire approach is emphasized. Thus, people who have this condition can become responsible for their own health processes, and consequently, can adequately resolve the demands it makes on them.

- *Depression affects treatment adherence in a low, negative, and significant way.* The Learned Helplessness model proposed by Seligman (1975) establishes that a person who is depressed is characterized by a decrease in his response rate. Thus, for a person with diabetes, it can be thought that treatment adherence would imply a set of diminishing behaviors. This idea has been supported with most of the research done in the area (Kaltman et al., 2016, Sánchez-Cruz, Hipólito-Lóenzo, Mugartegui-Sánchez & Yáñez-González, 2016, González et al., 2015; Cerda, 2015; Marín and Mubayed, 2012; Patilla, 2011). These sources suggest that people with depression have fewer follow-up medical prescriptions, or less commitment to their recommended treatment. They also show poor glucose control, and consequently, a progressive deterioration in both their physical and psychological health. Therefore, their quality of life also tends to diminish. It should be noted that there is a difference between monitoring medical prescriptions and commitment to treatment, in the sense that the latter is a larger set of behaviors that integrates other relevant aspects such as diet and physical exercise.

The triangle formed by medication, nutrition and exercise (Marco, 2014) constitutes a fundamental support for the well-being of a person with a diabetic condition. It allows him / her to have a social life, a family, work, and an optimal

personal life. An appropriate glucose control is reflected in other indicators of biological health and in turn, is relevant for both a rewarding quality of life and the prevention of complications (González et al., 2015). In the case of diabetic patients, important complications related to the progress of the condition are blindness, renal insufficiency, foot ulcers, amputations, and relevant cardiovascular problems. These lead, on the one hand, to a decrease in the country's labor force, and on the other, to an increase in health expenditures, often difficult to cover. Diabetics with unhealthy lifestyles do not use as frequently the personal resources available to them, such as self-satisfaction, firmness, perseverance in decision-making and emotional self-control. Likewise, anxiety and depression are common (Naranjo, López & Valladares, 2016). Treatment adherence, along with other measures, could be considered to be one of the least expensive approaches from both financial and sanitary viewpoints. But then again, the most effective strategy for controlling the condition is to involve the patient in his / her treatment. Thus, greater physical, psychological and social well-being are obtained.

Finally, it is important to consider some conceptual, methodological and technological implications related to this field of research. **The conceptual implications** are associated with the development of a possible model which unifies the references used. The biopsychosocial model, in which this work is framed, has a very broad perspective, but it does not have a theoretical model with which to contrast the findings. This, of course, leads to considerations not only related to the theoretical framework but to problems regarding the definition of the variables within that theoretical framework or approach. Possibly, this may lead to explanations to improve the articulation of the phenomenon of diabetes and its related variables. This includes the physical, psychological and social points of view. **Methodological:** It is necessary to do more longitudinal and cross-sectional studies in order to observe how the variables considered in this study behave. However, one of the limitations of this research was that the type of sampling used was "non-probabilistic and of "intentional type", which makes it difficult to generalize the findings to the whole population. Probabilistic sampling is recommended for future research. Likewise, it is necessary to carry out experimental research to corroborate the relationships between the variables. **Technological:** A variable that necessarily stands out when addressing the condition of diabetes is the quality of life in health issues. Diabetes, according to the International Diabetes Federation (2011), is a chronic disease that affects people's quality of life, and is associated with economic outlays at a national level, as well as with high mortality. It is indispensable, on the one hand, to do

research that highlights the psychological variables related to this condition, such as those reviewed here: depression, communication styles, treatment adherence, sex, age, and social support. On the other hand, it is important to develop programs aimed at improving these people's quality of life.

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