

## Behavior of variables associated with the control of chronic diseases in patients receiving health education

### Comportamiento de variables asociadas al control de enfermedades crónicas en pacientes que reciben educación sanitaria

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#### Abstract:

The high prevalence of chronic diseases such as hypertension and diabetes in Mexico highlights the need for action by health professionals. Educational intervention by healthcare personnel contributes to reduce morbidity and mortality from chronic degenerative diseases. The aim of this study was to evaluate the behavior of variables associated with the control of chronic diseases in patients receiving health education by comparing them before and after the educational intervention. The sample consisted of 11 Mexican outpatients who attended the Polyclinic of Integral Pharmaceutical Care. The patients' educational needs were identified by means of a semi-structured interview and a knowledge test regarding their disease and treatment, and the degree of adherence to treatment was determined using the Morisky-Green test. An educational program was designed based on the identified educational needs, tailored to the patients' ages, with activities based on participatory methods and techniques and grounded in the theoretical model of personal development and social skills, as well as the transtheoretical model of behavior. Qualitative variables such as knowledge, attitude and behavior and clinical variables were evaluated at baseline, and again at 6 and 12 months after the intervention. The results demonstrated that educational interventions based on theoretical models and using participatory methods and techniques have an impact on therapeutic adherence and control of arterial hypertension, diabetes and bronchial asthma. These findings underscore the value in the prevention of complications associated with these chronic diseases.

#### Keywords:

Chronic diseases, healthcare professionals, health education

#### Resumen:

La elevada prevalencia de enfermedades crónicas como hipertensión y diabetes en México son indicadores de la necesidad de actuación del profesional sanitario. La intervención educativa por parte del personal de salud ayuda a reducir la morbilidad y mortalidad de enfermedades crónico-degenerativas. El objetivo del presente trabajo fue evaluar el comportamiento de las variables asociadas al control de enfermedades crónicas en pacientes que reciben educación sanitaria mediante su comparación antes y después de la intervención educativa para la mejora de estas. La muestra estuvo conformada por 11 pacientes mexicanos ambulatorios que acudieron a la Policlínica de Atención Farmacéutica Integral. Se identificaron las necesidades educativas del paciente mediante entrevista semiestructurada y test de conocimiento sobre la enfermedad y el tratamiento, de igual manera se determinó el grado de adherencia al tratamiento utilizando el test de Morisky-Green, se diseñó un programa educativo a partir de las necesidades educativas identificadas, adaptado a las edades de los pacientes, con actividades basadas en métodos y técnicas participativas y teniendo en cuenta el modelo teórico de desarrollo personal y habilidades sociales, así como el modelo transteórico del comportamiento. Se evaluaron variables cualitativas como el conocimiento, la actitud y la conducta y variables clínicas antes de la intervención educativa, 6 y 12 meses de intervención. Los resultados demostraron que las intervenciones educativas basadas en modelos teóricos y utilizando métodos y técnicas participativas tienen incidencia en la adherencia terapéutica y el control de la hipertensión arterial, la diabetes y

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el asma bronquial por lo que pueden ser de gran valor para la prevención de las complicaciones asociadas a estas enfermedades crónicas.

**Palabras Clave:**

*Enfermedades crónicas, profesional sanitario, educación sanitaria*

## INTRODUCTION

The high prevalence of chronic diseases such as diabetes and hypertension in Mexico and the along with their high global mortality rates highlights the urgent need for action by healthcare professionals; pharmacists play a key role due to their expertise in pharmacotherapy and their accessibility to patients in the personalized management of these health conditions.<sup>1-3</sup>

The present research aimed to evaluate the behavior of variables associated with chronic disease control in patients who received health education by comparing outcomes before and after the intervention.

## MATERIALS AND METHODS

A prospective, randomized study on healthcare systems and services was conducted in 11 Mexican outpatients from communities surrounding the School of Medical Sciences (ICSA) of the Universidad Autónoma del Estado de Hidalgo (UAEH), 4 with type II diabetes, 4 with arterial hypertension, and 3 with bronchial asthma, who attended the Integrated Pharmaceutical Care Programme (PAFI) of the ICSA of the UAEH during the period January-February 2023.

The research was approved by the ethics committee of the institution (UAEH-DI-29-ICSA-FAR-CF2/Comiteei.icsa2021/29), the division of research, development, and innovation of the UAEH (UAEH-DIDI-DI-ICSA-Farm-2024-227) and was carried out in compliance with the international standards for research and experimentation on human beings, established in the Helsinki declaration.<sup>4</sup>

Patients were selected to participate in the study based on the following inclusion, exclusion, and elimination criteria:

- Inclusion criteria: any patient with a clinical diagnosis of type II diabetes mellitus and/or arterial hypertension and/or bronchial asthma, diagnosed in the 12 months before the study, whose ages ranged from 18 to 65 years, with pharmacological and non-pharmacological treatment instituted at least 3 months before starting this investigation, who could read and write and who agreed to be included in the service.

- Exclusion criteria: Pregnant patients and patients with mobility problems.

- Withdrawal criteria: Patients who moved, died, or stopped attending the Health Education service.

Patients gave written informed consent at the time of the interview. A semi-structured interview and knowledge test about the disease and treatment, both instruments validated by

experts, were used to identify the patient's educational needs.<sup>5</sup> The degree of adherence to treatment was determined using the Morisky-Green test.<sup>6-7</sup>

An educational program was designed based on the educational needs identified in the patients with activities adapted to the average age of the patients, their sociocultural level, and taking into account the theoretical model of personal development and social skills, as well as the transtheoretical model of behavior.<sup>8-9</sup> (Appendix 1)

The programmed activities used participatory methods and techniques, and were distributed to supplement the educational sessions to complement the education. (Appendix 1)

Qualitative variables such as knowledge, attitudes and behaviors and clinical variables were evaluated: levels of glycemia, triglycerides and cholesterol, as well as BMI (body mass index), frequency of daytime and nighttime symptoms in asthmatics and blood pressure; at baseline, before starting the educational intervention, 6 and 12 months after starting the intervention.

To measure glycemia, cholesterol and triglyceride levels, the Accutrend Plus® measuring device was used and the measurement was performed on an empty stomach.

It was established whether the patient had glucose, cholesterol, and triglyceride levels within the limits established as normal according to the NOM-015-SSA2-2018 and the American Diabetes Association (ADA).<sup>10-11</sup>

For BMI calculation, patients were weighed and measured. The measurement was performed without shoes using the SECA digital clinical scale with calibrated altimeter, and the values obtained were used to calculate BMI.

Blood pressure was measured with a calibrated OMRON X2 Basic upper arm blood pressure monitor. 3 measurements were taken, with 3-minute intervals between each measurement, and the mean value was calculated to establish whether the pressure was within normal limits.

The frequency of daytime and nocturnal symptoms made it possible to establish the type of asthma presented by the patient at the time of evaluation, taking into account the following criteria established in the literature:

- Mild intermittent asthma:

Frequency of daytime symptoms < 1 day per week.

Frequency of nocturnal symptoms < 2 times per month.

- Mild persistent asthma:

Frequency of daytime symptoms > 1 day per week, not daily.

Frequency of nocturnal symptoms > 2 days per month

Moderate persistent asthma:

Frequency of daytime symptoms daily

Frequency of nocturnal symptoms > 1 time per week.

- Severe persistent asthma:

Frequency of continuous daily diurnal symptoms

Frequency of frequent nocturnal symptoms.<sup>12</sup>

The data analysis was performed with the support of the statistical package STATA 14; Microsoft Office 2019 was used for the elaboration of the document in Word and Excel for the construction of the database necessary for the statistical analysis.

Qualitative variables (age, sex, diagnosis, time of disease evolution, and behavior of hypertension and diabetes mellitus control indicators before and after the intervention) were represented by estimation of proportions, and the Chi2 test was used for the analysis.

Descriptive statistics were performed for quantitative variables (weight, BMI, glucose, cholesterol, triglycerides, and blood pressure). These variables were analyzed using an ANOVA test, after checking the normality of the data.

## RESULTS

The sample was predominantly male and ranged in age from 23 to 64 years (54.5%) (Table 1). Patients with type II diabetes and arterial hypertension (36.4%) were the most frequent (Figure 1), with an evolution of the disease around 11-20 years (45.5%) (Figure 2).

Before starting the health education program, 36.4% of the patients were overweight, with were classified as overweight, with a mean BMI of 27.3, 18.2% had hypertension (130/90 mmHg), 27.3% had elevated blood glucose (121.6 mg/dL) and 100% had unchanged cholesterol and triglycerides.

At 6 months after the intervention, only 9.1% maintained a mean BMI of 25.4 (overweight) lower than the initial value of the indicator, blood pressure (126/87 mmHg) and glucose (116.6 mg/dl) were elevated, and cholesterol and triglycerides, although unchanged, showed a statistically significant decrease at 6 months.

By the twelfth month, following the completion of the educational program (Intervention 12), the results were even better, since only 9.1% of the patients remained overweight, but blood pressure and glucose levels were reduced in 100% of the

sample. Cholesterol and triglycerides remained unchanged before and after the interventions (Tables 2 and 3).

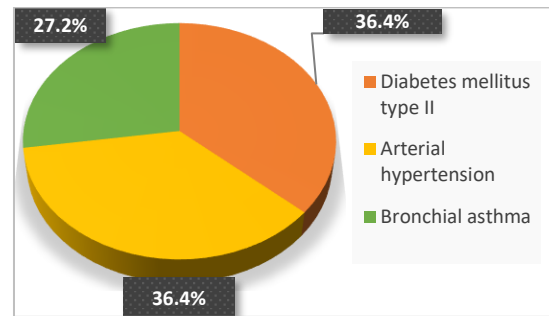


Figure 1. Chronic diseases suffered

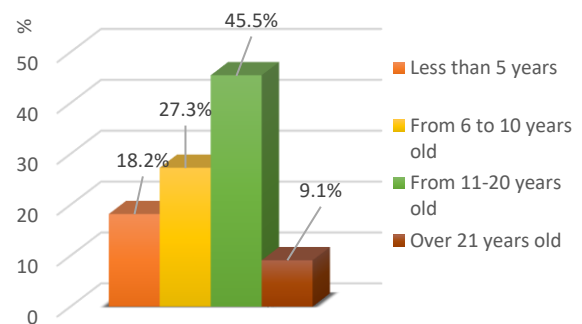


Figure 2: Time course of the disease

Table 1. Behavior of age and sex in the sample

Age group (years)	Sex				Total	
	Masculine		Feminine		No.	%
	No.	%	No.	%		
23-43	3	27.27	3	27.27	6	54.54
44-64	3	27.27	1	9.1	4	36.36
Over 65	-	-	1	9.1	1	9.1
Total	6	54.5	5	45.5	11	100

$\chi^2 = 0.9596$ ,  $P = 0.619$ ,  $p > 0.05$

Chi<sup>2</sup> test

Table 2. Behavior of hypertension and diabetes mellitus control indicators

Indicators of hypertension and diabetes mellitus control.	Before the intervention		After the intervention			
	Home		6 months		12 months	
	No.	%	No.	%	No.	%
Elevated BMI (overweight BMI >25)	4	36.4	1	9.1	1	9.1
High blood pressure (>120/80 mmHg)	2	18.2	1	9.1	-	-
Elevated blood glucose (>100mg/dL)	3	27.3	1	9.1	-	-
Elevated cholesterol (>200 mg/dL)	-	-	-	-	-	-
Elevated triglycerides (>150mg/dL)	-	-	-	-	-	-

Source: data taken from the data collection sheet and surveys conducted.

$\chi^2 = 2.6317$ ,  $P = 0.0268$ ,  $p \leq 0.05$ , Chi<sup>2</sup> test

**Table 3.** Mean values of control indicators in hypertensive and diabetic patients

Indicators of hypertension and diabetes mellitus control.	Before the intervention Home		After the intervention			
			6 months		12 months	
	$\bar{X}$	$\sigma$	$\bar{X}$	$\sigma$	$\bar{X}$	$\sigma$
Elevated BMI (overweight BMI >25)	23 <sup>a</sup>	3.2	25.4 <sup>b</sup>	2.7	25.4 <sup>b</sup>	2.7
High systolic pressure (>120 mmHg)	130 <sup>a</sup>	11.2	125.7 <sup>b</sup>	10.4	121.2 <sup>c</sup>	9.4
high diastolic pressure (>80 mmHg)	90.3 <sup>a</sup>	9.7	87.4 <sup>b</sup>	7.0	84.5 <sup>c</sup>	4.3
Elevated blood glucose (>100mg/dL)	121.6 <sup>a</sup>	12.6	116.6 <sup>b</sup>	10.8	111.6 <sup>c</sup>	9
Elevated cholesterol (>200 mg/dL)	161.5 <sup>a</sup>	17.0	152.5 <sup>b</sup>	7.3	152.5 <sup>b</sup>	7.3
Elevated triglycerides (>150 mg/dL)	132.0 <sup>a</sup>	10.1	122.7 <sup>b</sup>	8.9	122.7 <sup>b</sup>	8.9

**BMI:** Body Mass Index,  $\bar{X}$ : mean,  $\sigma$ : standard deviation. One-way ANOVA test.  $F=22,747$ .  $P= 0.0396$ . Different letters indicate significant differences for  $p \leq 0.05$ . a: mean value of the pre-intervention. b y c: mean value of the after-intervention

**Table 4.** Behavior of indicators of bronchial asthma control

Indicators of bronchial asthma control	Before the intervention Home		After the intervention			
			6 months		12 months	
	No.	%	No.	%	No.	%
<b>Frequency of daytime symptoms</b>						
<1 day a week	1	33.3	1	33.3	-	-
>1 day per week, not daily	2	67.7	-	-	-	-
Daily symptoms	-	-	-	-	-	-
Continuous symptoms	-	-	-	-	-	-
<b>Total</b>	3	100	1	33.33	-	-
<b>Frequency of nocturnal symptoms</b>						
<2 times a month	1	33.3	1	33.3	-	-
>2 days per month	2	67.3	-	-	-	-
1 time per week	-	-	-	-	-	-
Frequent	-	-	-	-	-	-
<b>Total</b>	3	100	1	33.3	-	-

$\chi^2= 6.6663$ ,  $P= 0.155$ ,  $p> 0.05$

Chi<sup>2</sup> test

**Table 5.** Knowledge, Behavior, Attitude, Attitude and Adherence behavior

Knowledge, behavior, attitude, and adherence	Before the intervention Home		After the intervention			
			6 months		12 months	
	No.	%	No.	%	No.	%
Lack of adherence to treatment	3	27.3	3	27.3	1	9.1
Positive behaviour	7	63.6	8	72.7	10	90.9
Negative behaviour	4	36.4	3	27.3	1	9.1
Positive attitude	8	72.7	9	81.8	10	90.9
Negative attitude	3	27.3	2	18.2	1	9.1
No knowledge	-	-	-	-	-	-
Knowledge Little	4	36.4	2	18.2	-	-
Knowledge Good	7	63.6	2	18.2	1	9.1
Knowledge Very good	-	-	7	63.6	10	90.9

Concerning the asthmatic patients, before the intervention, mild persistent asthma prevailed in 66.7% of the sample. After 6 months of intervention, improvement was observed in the patients; only 33.3% presented mild intermittent asthma, and at 12 months, 100% of the patients controlled their daytime and nighttime symptoms (Table 4).

At the beginning of the interventions, non-adherence was observed in 27.3% of the sample, but positive behavior (63.6%), positive attitude (72.72%), and a good level of knowledge about the disease and treatment (63.63%) prevailed. (Table 5).

At 6 months after the intervention, although non-adherence was maintained in 27.3% of the sample, positive behavior (72.7%)

and positive attitude (81.8%) increased, and knowledge about the disease and treatment went from good to very good in 63.6% of the sample. (Table V).

At 12 months post-intervention, non-adherence is reduced (9.1%), positive attitude and behavior increase (90.9%), and knowledge about the disease and treatment goes from good to very good in 90.9% of the sample. (Table 5).

## DISCUSSION

The prevalence of type II diabetes mellitus in males agrees with the reports of Kautzky et al. in 2023.<sup>13</sup>

González et al. in 2018 refer that the non-transmissible chronic degenerative diseases that are most prevalent in patients are: hypertension and diabetes mellitus type II, due to the late diagnosis of these pathologies.<sup>14</sup>

Studies carried out by Córdova et al. in 2008, in one of the specialty medical units (UNEME), report changes in the prevalence and time of evolution of chronic degenerative diseases in Mexico, indicating a considerable increase in pathologies such as arterial hypertension and diabetes mellitus type II.<sup>15</sup>

In the sample studied, patients with years of disease evolution between 11 and 20 years prevailed, similar to that described by Pérez et al. in 2009, in a study conducted to evaluate the influence of educational interventions in patients with type II diabetes mellitus.<sup>16</sup>

The values of the control indicators of hypertension and type II diabetes mellitus decreased considerably after the first 6 months of intervention, similar to the results obtained by Pérez et al. in 2009.

Pérez describes in the study carried out in a diabetic care center in Cárdenas, Cuba, that the interventions carried out during 6 months in this type of patient were very effective.<sup>16</sup>

Estrada et al. in 2012, described the interventions carried out in hypertensive patients during 6 months and the satisfactory results obtained, because the patient correctly perceives the information provided by the health personnel, from the first intervention.<sup>17</sup>

Daytime and nocturnal symptoms, indicators of asthma control, were also reduced until their total disappearance after 12 months of intervention; this could be due to the fact that the educational intervention modified the patient's lifestyle.

This result is similar to that described by Cano et al. in 2013, in the study, educational interventions were performed quarterly, providing general information to the patient about the disease, treatment, as well as about asthma triggers and how to control them.<sup>18</sup>

The lack of therapeutic adherence by patients is a major concern in the control of chronic diseases, so educational interventions were carried out using participatory techniques that reinforced adherent behavior to pharmacological and non-pharmacological treatment of patients.

Similar results to those described were obtained by Rangel et al. in 2017, who demonstrated the effectiveness of educational

interventions for the improvement of therapeutic adherence in a group of diabetic and hypertensive patients.<sup>19</sup>

## CONCLUSION

The results demonstrate that educational interventions by health professionals based on theoretical models and using participatory methods and techniques have an impact on the control of arterial hypertension, diabetes, and bronchial asthma and can be of great value for the prevention of the complications associated with these chronic diseases.

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**Appendix 1.** Educational program

No.	Activities	Educational Objectives	Contents	Human and material resources	Date and duration	Methods and Techniques	Grouping	Evaluation
1	Educational chat	Identify risk factors and complications associated with diabetes, asthma, and hypertension.	Diabetes, asthma, and hypertension. Risk factors and complications	1 pharmacist Projector Video Internet access Computer Triptych Board Flipchart	02/17/23  1 hour	<b>Problem method:</b> Problematic exposure <b>Technique or dynamics of presentation and animation:</b> Presentation by cards <b>Exploration technique:</b> Detection of expectations	G11	Alphabet soup  Questionnaire
2	Video discussion	Identify attitudes that can complicate diabetes, asthma, and hypertension	Diabetes, asthma, hypertension, and their complications	1 pharmacist Board Flipchart Felt pens Projector Video Computer Internet access	03/17/23  1 hour	<b>Discussion method</b> Small group discussion <b>The technique or experiential dynamics</b> Of animation Collective tale <b>Audiovisual technique</b> Video discussion	G11	The graffiti or wall of shame
3	Dramatization	Demonstrate how to measure indicators of control of diabetes, hypertension, and asthma	Indicators of good control in diabetes, hypertension, and asthma	1 pharmacist Glucometer Weighing scale Calibrated sphygmomanometer Triptych on good control	04/17/2023  1 hour	<b>Situations method:</b> Simulation <b>Exploration techniques:</b> Learning in pairs	G2	Questioning ball

No.	Activities	Educational Objectives	Contents	Human and material resources	Date and duration	Methods and Techniques	Grouping	Evaluation
4	Educational chat	Selecting the right foods that make up a good plate of food	Healthy eating. The plate of good food.	1 pharmacist Board Projector Healthy Eating Flyer	05/17/2023  1 hour	<b>Problem method:</b> Heuristic conversation Heuristic conversation <b>Techniques of expression, communication, and improvement of interpersonal relationships.</b> Abstraction or summary technique	G11	The stars
5	Narration of anecdotes	Exchange experiences about eating habits	Healthy eating habits	1 pharmacist	06/17/2023  1 hour	<b>Situations method:</b> Incidents <b>Techniques or dynamics of analysis and deepening:</b> Association chain	G5 y G6	The best and the worst
6	Roleplay	Identify healthy and unhealthy eating habits	Healthy and unhealthy eating habits	2 pharmacists A table with healthy and unhealthy dishes	07/17/2023  1 hour	<b>Situations method:</b> Roleplay <b>Techniques of expression, communication, and improvement of interpersonal Relationships:</b> agree and disagree	G5 y G6	The graffiti or wall of shame

No.	Activities	Educational Objectives	Contents	Human and material resources	Date and duration	Participatory Methods and Techniques	Grouping	Evaluation
7	Dramatization	Demonstrate how to prepare healthy foods	Recipes to prepare healthy food	1 pharmacist 1 nutritionist A booklet with recipes to prepare healthy food Ingredients to prepare the recipes	08/17/2023 1 hour	<b>Situations method:</b> Simulation <b>Scan technique:</b> Learning in pairs	G11	Questioning ball
8	Brainstorm	Design a healthy eating plan applying the knowledge acquired.	Healthy eating habits Personal control plan	1 pharmacist 1 nutritionist Board Flipchart Felt pens	09/18/2023 2 hours	<b>Discussion method:</b> Small group discussion <b>Creativity technique:</b> Brainstorming	G5 y G6	The faces
9	Agree and disagree	Discuss with patients the importance of complying with non-pharmacological and pharmacological treatment	The importance of adherence to non-pharmacological and pharmacological treatment	1 pharmacist Board Flipchart Felt pens	10/17/2023 1 hour	<b>Situations method:</b> Simulation <b>Creativity technique:</b> Bonus Technique Technique Consequences and Sequels (C and S)	G11	The graffiti or wall of shame
10	Narration of anecdotes	Exchange experiences on adherence to pharmacological and non-pharmacological treatment.	Benefits and Risks of adherence to pharmacological and non-pharmacological treatment.	1 pharmacist	11/17/2023 1 hour	<b>Situations method:</b> Cases and incidents <b>Scan technique:</b> Exploration of ideas. <b>Creativity technique:</b> Bonus Technique: Basic Priorities	G11	The best and the worst
11	Video discussion	Discuss strategies for adherence to pharmacological and non-pharmacological treatment.	Strategies for adherence to pharmacological and non-pharmacological treatment.	1 pharmacist Board Projector	12/08/2023 1 hour	<b>Discussion method:</b> Small group discussion <b>Techniques or dynamics of analysis and deepening:</b> Association chain	G5 y G6	The faces

<b>12</b>	Roleplay	Integrate the knowledge acquired in the solution of situations of the practical life of the diabetic, the hypertension, and asthma	I know how to live with diabetes, hypertension, and asthma	1 pharmacist Board flipchart Felt pens	01/17/2024 1 hour	Discussion method: Small group discussion Creativity technique: Brainstorming	G5 y G6	The best and the worst
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