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# How to reduce avoidable admissions due to acute diabetes complications? Interrelation between primary and specialized attention in a diabetes unit

N. V. García-Talavera Espín<sup>1,2</sup>, A. López-Ruiz<sup>1</sup>, M.<sup>a</sup> Á. Nuñez Sánchez<sup>1</sup>, A. Meoro Avilés<sup>1</sup>,  
C. Sánchez Cañizares<sup>1</sup>, H. Romero López-Reinoso<sup>3</sup>, M.<sup>a</sup> D. López Olivar<sup>1</sup>, M.<sup>a</sup> Á. Lapaz Jorge<sup>1</sup>,  
J. M.<sup>a</sup> Guirao Sastre<sup>1</sup>, F. San Eustaquio Tudanca<sup>1</sup>, J. Soriano Palao<sup>1</sup>; Collaborative Group of the Diabetes  
Unit of the Reina Sofía University Hospital (Murcia, Spain).

<sup>1</sup>Reina Sofía University Hospital. Murcia. Spain. <sup>2</sup>Member of FFIS/IMIB. <sup>3</sup>Murcia – Infante Primary Care centre. Murcia. Spain.

## Abstract

**Introduction:** Type 2 Diabetes Mellitus is a serious health problem. In the year 2030 it will affect 366 million people around the world.

**Objective:** Evaluate the effectiveness of a mixed intervention and reducing the amount and seriousness of acute complications in diabetics from our Health Area.

**Materials and method:** Protocols of action as well as information documents were produced. Diabetes Unit coordinated educational activities in the different support levels of the Area VII of Murcia. Information talks were provided for the people in charge of the Diabetes Unit in every Care Center and Service of the Health Area. Personalized training was provided for patients treated in the different Care levels. The study comprised three stages. Information leaflets were spread and talks offered to the patient regarding in house handling of hypo and hyperglycemia.

**Results:** A reduction of 39% of the emergencies due to acute non complicated diabetes was achieved, as well as a reduction of 47.6% of hospital admissions. There was a reduction of 67.8% of the amount of total hospital stays for the group of patients under 35 years who were admitted into the hospital due to type 1 or 2 diabetes mellitus that didn't show any complications (GRD295).

**Conclusions:** There was a reduction of more than thirty percent in the emergencies due to acute decompensations in the disease and a significant reduction in the avoidable hospital stays in the young adult, thus improving the patients' life quality and reducing the social cost of the diabetic patient.

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Key words: *Diabetes. Hospital stay. Avoidable admissions. Emergencies.*

**Correspondence:** Noelia Victoria García-Talavera Espín.  
Unidad de Diabetes del Área VII-Murcia Este.  
Hospital General Universitario Reina Sofía.  
Intendente Jorge Palacios, 1.  
30003 Murcia. Spain.  
E-mail: noelia.garciatalaveraespín@gmail.com

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## ¿CÓMO REDUCIR LOS INGRESOS EVITABLES POR COMPLICACIONES AGUDAS DE LA DIABETES? INTERRELACIÓN ENTRE ATENCIÓN PRIMARIA Y ESPECIALIZADA EN UNA UNIDAD DE DIABETES

### Resumen

**Introducción:** La diabetes mellitus tipo 2 es un problema de salud grave. En el año 2030 afectará a 366 millones de personas en todo el mundo.

**Objetivo:** Evaluar la eficacia de una intervención mixta y reducir la cantidad y gravedad de las complicaciones agudas de la diabetes en nuestra Área de Salud.

**Material y método:** Se diseñaron protocolos de actuación y documentos de información. La Unidad de Diabetes coordinó las actividades educativas en los diferentes niveles de soporte de la VII Zona de Murcia. Se realizaron charlas de información para los responsables de la Unidad de Diabetes en cada Centro de Atención y Servicio del Área de Salud. Se dio formación personalizada a los pacientes tratados en los distintos niveles de atención. El estudio constó de tres etapas. Se entregaron folletos informativos y charlas al paciente con respecto a la manipulación domiciliar de hipo e hiperglucemia.

**Resultados:** Se logró una reducción del 39% de las emergencias debidas a diabetes aguda no complicada, así como una reducción del 39% de las emergencias debidas a diabetes aguda no complicada, así como una reducción del 47,6% de los ingresos hospitalarios. Hubo una reducción del 67,8% de la estancia hospitalaria total para el grupo de pacientes menores de 35 años que fueron ingresados en el hospital debido a diabetes tipo 1 o 2 que no mostraron ningún tipo de complicaciones (GRD295).

**Conclusiones:** Se observó una reducción de más del treinta por ciento en los casos de urgencias por descompensaciones agudas de la enfermedad y una reducción significativa en las estancias hospitalarias evitables en el adulto joven, mejorando así la calidad de vida de los pacientes y reduciendo el costo social del paciente diabético.

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Palabras clave: *Diabetes. Estancia hospitalaria. Ingresos evitables. Urgencias.*

## Abbreviations

DM: Diabetes Mellitus.  
DM1: Type 1 Diabetes Mellitus.  
DM2: Type 2 Diabetes Mellitus.  
DU: Diabetes Unit.  
PC: Primary Care.  
CIE.9.MC: International Classification of Diseases, Ninth Revision, Clinical Modification.  
CMBD: Minimum Data Set Database.  
HGRS: Reina Sofía University Hospital.  
DEP: Diabetes Education Program.  
IC: Interactive consultation.  
CT: Traditional consultation.  
A1C: Glycated hemoglobin.  
GRD: Groups related to the Diagnosis.

## Introduction

Diabetes Mellitus(DM) is a multiple etiology disease. Its main feature is chronic hyperglycemia with carbohydrates, fats and proteins metabolic disorders due to a deficient secretion of insulin caused by destruction of beta cells of the islets of Langerhans in the pancreas and the subsequent absence of the hormone or its action (due to the increase in peripheral resistance to insulin due to a variety of causes, some of them unknown) or both.<sup>1</sup>

Type 1 Diabetes Mellitus(DM1) comprises most of the cases that are produced by the destruction of the beta cells. DM1 pathogenesis includes a genetic disposition to the disease, as well as triggering factors of environmental nature that can activate mechanisms leading to a gradual loss of the beta cells. Type 2 Diabetes Mellitus(DM2) is the most common type of diabetes, being its main feature a certain degree of insulin hyposecretion and higher contribution to insulin resistance. Most of the patients suffering from DM2 are obese, what worsens insulin resistance. Abdominal obesity is a bigger problem than peripheral obesity.

The mainstays of DM treatment are diabetologic education, diet, exercise, self-control and medication. There are very few health conditions that require such a level of understanding from the patient and its relatives as DM does. This is due to the fact that since the moment of its clinic appearance, the patient becomes the role leader in a drama that is going to accompany him through his whole life.

The education of the diabetic patient must be gradual and continuous, aiming to accomplish the active incorporation of the patient and his relatives to the treatment. He must know about diabetic requirements and individual planning regarding his meals; benefits and harms of physical activity; interaction between diet and physical activity and pharmacological treatment; how to react in an emergency; insulin administration; self-monitoring glycemia methods,

the different types of oral hypoglycemic and its ways of administration to generate a real conscience of the problem enabling him to achieve the changes in his life style that may help him get a better attention of his health condition.<sup>2</sup>

Diabetologic education is composed of three stages:

- *Initial education.* After diagnosis. It enables the patient to carry out immediate attention, which is doubtlessly important in the case of DM1. Information is aimed to diagnosis, basic features of the syndrome, self control of glucose in blood and urine, diet, administration of insulin or oral compounds and severe complications. This is the right moment to convey the relative need for them to take part in the treatment. Planning of the educational and therapeutic program is done by the health team and the patient in a joint way, which will lead to a higher level of responsibility.
- *Deep education.* After the first 3 or 4 weeks, the patient is ready to stretch and deepen his knowledge about diabetes. After the impact of finding out he has a chronic disease for the rest of his life has been overcome, he can realize the difficulties that prevent him from complying with the adequate treatment, which on the other hand stimulates his motivation to learn.
- *Continuous education.* The philosophy behind any diabetologic education program must include continuous training of the patient and the health professionals, as a way of updating (by incorporating the new concepts) and checking the fundamental available information.

There are different ways of training and educating the diabetic patient. *Individual education* has the advantage of providing answers to personal concerns and benefiting from the doctor-patient relationship. It is traditionally appreciated and highly regarded in the health-disease couple. Its disadvantages are that it does not encourage the team work spirit, it is time consuming and more expensive, and it requires better pedagogical training on the side of the educator. *Group education* can reach more patients and promotes interaction and support between them mediated by the professional. It is a very useful way of putting pedagogical methods into practice and a wonderful socialization tool. Among its disadvantages, it is impossible to assist strictly personal and individual needs. Combination of different forms produce successful results in the teaching process. Education must be enjoyable and simple, with a clear and comprehensible language, devoid of extremely technical terms.

Because of its high prevalence and also to the fact of it being a direct cause of death, disability and high public health expenses, diabetes constitutes a priority area of intervention in the health plans of the Autonomous Regions and the Ministry of Public Health and Social Policy in Spain.

In order to deal with the magnitude of this problem called “Diabetes” in a comprehensive fashion, our Diabetes Unit(DU) was created in 2007 in the context of the new Single Management of the Area VII Murcia East. It is coordinated by Endocrinology and composed by Nurses Educators in Diabetes, Nutritionists, Surgeon, Diabetic Foot Nurse, Podiatrist, Ophthalmologist, Psychiatrist, Neurologist, Vascular Radiologist, Anesthetists, Pneumologist, Nephrologist, Cardiologist, Emergency Doctor, Rehabilitator, ten Primary Care(PC) Doctors and ten PC Nurses, whom in turn coordinate the rest of the health professionals in their respective PC Centers and all the Specialized Services of the Reina Sofía University Hospital(HGRS) of Murcia that are related to the assistance to the diabetic patient.

Our general goals are the decrease in mortality and morbidity in the diabetic population. The intermediate goals are the decrease in incidence of acute and chronic diabetic complications.

At the beginning, we observed a high number of cases in the Emergency Service as well as a high number of diabetes related hospital admissions, these both being indirect signs of these complications in diabetic patients. A cycle of improvement in the Area was started, materializing in the “*Protocol of reduction of avoidable admissions due to short term complications in diabetic patients*”, which in turn was contemplated in our Managing Contract from 2007 to 2010. This protocol was developed under the coordination of the DU in our 10 PC centers and Emergency, and Specialized Services of the Hospital, both in ambulatory assistance and hospitalization.

Our general goal consisted in evaluating the effectiveness of a mixed intervention, with educational, self-evaluation and feedback components, in order to reduce the amount and seriousness of acute complications, indicated by emergency assistance cases and avoidable hospital admissions, in diabetic patients from our Health Area.

The specific goals were:

1. Quantifying avoidable admissions in the Hospital Emergency Service, associated to severe diabetic complications, before and after improvement intervention.
2. Quantifying avoidable admissions due to severe complications of diabetes, before and after improvement intervention.
3. Reducing the number of assistance cases in the Hospital Emergency Service due to severe diabetes complications.
4. Reducing the number of admissions to the Hospital associated to severe diabetes complications.
5. Reducing Public Health expenses owing to avoidable admissions due to severe diabetes complications.
6. Improving inter-professional communication regarding diabetes matters in our Health Area.

### *Starting point*

DM nowadays constitutes a serious Public Health issue all around the world, with a high morbimortality rate, both in developed and developing countries. In 2000 there were 175 millions of diabetics in the world, of which 80 or 90% corresponded to DM2. It is calculated that in 2010 there would be 239 millions and 300 millions in 2025. That justifies defining it as a “global pandemic”.

The main goals of diabetes education are providing diabetologic information and knowledge and training to be capable of acquiring the necessary skills and habits. It aims to generate in the patient a real conscience of his problem that enables him to achieve changes in his life style, so as to have a better assistance of his health condition. DM is an example of the need for a therapeutic education process that, along with clinical cares, guarantees the effectiveness in the treatment. At the end of the last century, diabetology accepted the idea that an effective treatment of diabetes requires education and training of the patient.

In Europe, Prof. JPh Assal stood out in what regards teaching actions and their effectiveness to achieve goals and the study of different pedagogical strategies to identify its advantages and disadvantages in the field of health.<sup>3</sup> American groups were developed in a more pragmatic line, highlighting the need to change behaviors and improving acceptance of treatment.<sup>4</sup>

The National Diabetes Program has been developed in Cuba for the last 25 years. It carried out a continuous training of the health personnel and it started on the primary health level, where more than 85% of the people with DM received assistance.<sup>5</sup> It focused on declaring education as the primary function, establishing courses of basic information and publishing information brochures. They desing a Diabetes Education Program(DEP) that was later extended to all the services of the health system and several countries in the region received support to develop their programs. A better quality in PC services was achieved.

Also in Cuba, to evaluate the effect of a 10 year long interactive consultation treatment on the understanding and acceptance of treatment, as well as clinical, biochemical and therapeutical changes achieved in group of patients with DM1, García studied 40 people with DM1 and not more than five years of diagnosis assigned to interactive consultation (IC). Results were compared to those obtained in a control group, with identical general and clinical variables at the beginning of the study that continued with the education process through traditional consultation (CT). Participants in IC showed better results in all the analyzed parameters compared to those in CT.<sup>6</sup>

In the United States 6.3% of the population has DM. In Utah, medical care and training by a clinic doctor trained as “diabetes educator” showed that total cholesterol, low density lipoproteins, glycated hemoglobin (A1C) and triglycerides diminished significantly.<sup>7</sup>

Other observational one year long study proved that systematic efforts aiming to educate the diabetic patient were needed to improve the clinical, economical and human aspects of this disease.<sup>8</sup>

Small groups training with the interactive participation method enables the participants to exchange experiences, learn from the others and reinforce positive criteria and feelings regarding daily care. It turns out to be more effective as compared to the results obtained in traditional educational interventions, just as other authors from different fields of therapeutic education have reported subsequently.<sup>9</sup> In another study results of diabetologic education carried out in groups were compared to those carried out individually. It proved that both were equally effective in achieving glycemic control, although results of the latter were slightly better. However the group education is considered superior from the point of view of the cost-profit analysis.<sup>10</sup>

There have also been some studies comparing diabetic education effectiveness when carried out through the use of telemedicine technologies as when it is done in personal meetings. With both of them good results regarding metabolic control can be achieved and both methods are well accepted by patients. Therefore it is generally considered that telemedicine can be successfully employed as an education tool for diabetic patients.<sup>11</sup>

The link between primary and secondary health assistance has to be dispensed as a comprehensive assistance of the patient. Being a chronic non transmissible disease and given its prevalence and incidence,

DM is one example of it. Improving and strengthening this link is extremely important in order to carry out a comprehensive treatment of these patients.<sup>12</sup> As with other chronic and non transmissible diseases the educational and prevention battle is won in the arena of primary health assistance where more than 80% of the population receives assistance.

## Material and methods

### Study design

The members of the DU created the protocol and the agreed information documents, and coordinated the sequence of educational activities in the different assistential levels of the Area VII Murcia East: in the 10 PC Centers and Emergency Services, in the Hospital Services involved, particularly in the Short Stay Unit and the Internal Medicine Service and the Emergency Service. The protocol was spread through talks given by the coordinators of the DU in each center and service of the Health Area, addressed to both doctors and nurses, and through individual diabetologic education for the diabetic patients assisted in the different assistential levels (fig. 1).

The tools employed for its dissemination were, on one hand, an action protocol for the health professional, based on the current guides of clinical practice in diabetes<sup>13</sup> and aiming to prevent, solve and refer in a coordinated way the acute diabetologic emergencies

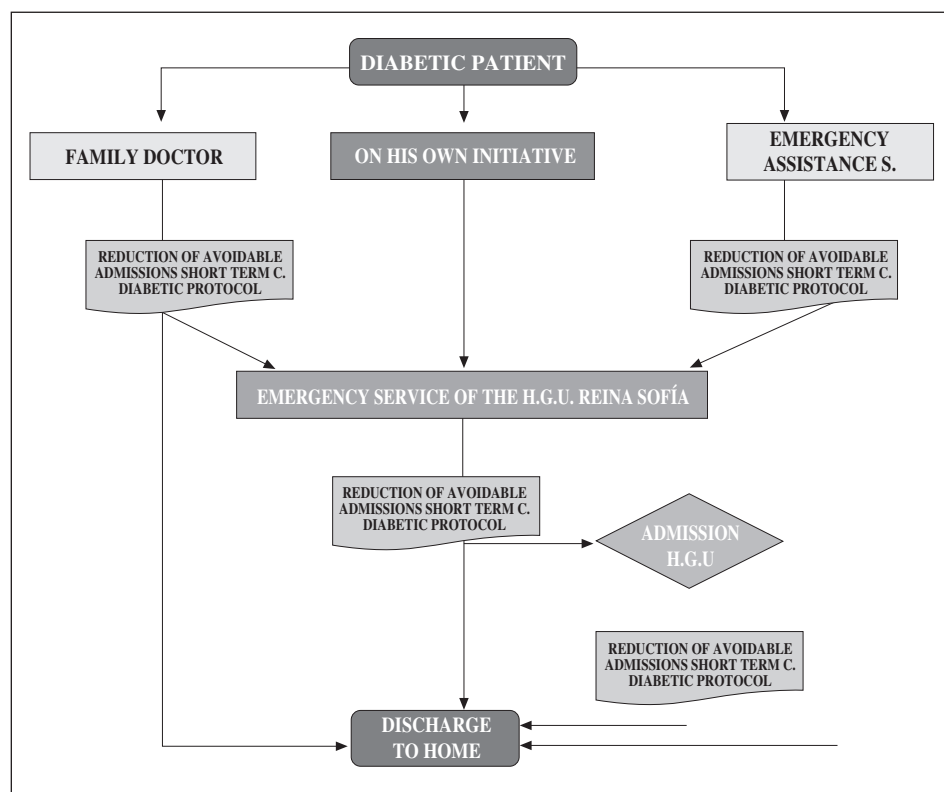


Fig. 1.—Sequence of interactions in the “Protocol of reduction of avoidable admissions due to short term complications in diabetic patients”.

(hypoglycemia and hyperglycemia) in the Health Area. The main idea was that non complicated emergencies would be assisted in the PC Center while complicated emergencies would be assisted in Emergency Service of the Hospital. Specific hospital admission criteria due to acute diabetes decompensation were established. On the other hand, information brochures teaching the patient how to handle at home mild hypoglycemia and hyperglycemia were supplied as tools for the diabetologic education of the patient.

The study was carried out in three stages:

- *First Stage or pre-intervention period (year 2007):* Observational, descriptive and retrospective study, in which information regarding all the diabetic patients assisted in Emergencies or admitted for the evaluation previous to the intervention were collected.
- *Second Stage or intervention period (year 2008):* Creation and dissemination of the protocol, through talks given at the PC Centers and the Hospital Services by the professionals in charge of the DUs, as well as distribution of information material regarding how to handle severe diabetes complications in the PC Centers, Emergency Centers and hospitalization. The trained health professionals, in turn, provided their patients with therapeutic Education regarding how to handle severe diabetes complications.
- *Third Stage or post-intervention stage (years 2009 and 2010):* Collection of information through analysis of the document environment of the Area and statistical comparative analysis of the results, with subsequent dissemination of them.

### Statistical analysis

As search strategy, for both assisted emergencies and hospital admissions related to diabetes, a series of codes were selected from the International Classification of Diseases, Ninth Revision, Clinical Modification (CIE.9.MC).<sup>14</sup> Codes comprehended between the 250.00 up to the 250.93 were employed for the diagnosis related to “diabetes” or “hyperglycemia”, and the ones between the 251.00 up to the 251.99 were added for the diagnosis related to “hypoglycemia”.

The CIE.9.MC codes related to assisted emergencies due to diabetes were used along with the Minimum Data Set Database (CMBD) of the Emergency Service of the HGRS.<sup>15</sup> In the case of admissions related to diabetes, the Groups related to the Diagnosis database (GRD) v.21 was used.<sup>16</sup> For estimation of health expenses the database GRD-State regulation-Year 2007 was applied.<sup>17,18</sup>

Among all the CIE codes related to diabetes, only the codes related to “severe diabetes decompensations: hyperglycemia and hypoglycemia” were regarded as avoidable assistances in the Emergency Service:

- 251.2: Non-specified Hypoglycemia.
- 250.00: DM without mention of complication type 2 or unspecified non decompensated.
- 251.1: Other specified hypoglycemias.

Similarly, only the GRDs related to “severe diabetes complications having a low specific weight (lower than 1)” were regarded as avoidable hospital admissions:

- 294: Patients over 35 years old, admitted due to DM1 or DM2, non complicated (weight GRD v21: 0,9828)
- 295: Patients under 36 years old, admitted due to DM1 or DM2, non complicated (weight GRD v21: 0,841)

The following were the indicators to be measured:

- Number of avoidable admissions in the Emergency Service of the Hospital by codes: 251.2, 250.00, and 251.1.
- Number of hospital admissions/discharges, total stays, average stay and specific weight by GRDs: 294 and 295.

## Results

### *Avoidable diabetologic emergencies*

Three years after establishing the protocol (from 2007 to 2010), a reduction of 39% in emergencies due to severe diabetes decompensations non complicated or avoidable was observed (codes 250.0, 251.1 and 251.2). The reduction of 52.2% in the code 250.00, that comprehends simple hyperglycemic decompensations, was the most marked. The second most marked reduction was that of 33.7% in the codes 251.1 and 251.2 that comprehend non complicated hypoglycemias (table I, fig. 2).

### *Avoidable admissions due to severe diabetes decompensations*

For the GRD 295, our action protocol implied, after three years of operation (from 2007 up to 2010), a reduction of 47.6 % both in the number of avoidable admissions/discharges. Also in the specific weight for GRD 295 (-16% and -16.4% between 2007-2008, -33% and -26.4% between 2008-2009, and -1.6% and -0.8% between 2009-2010, respectively).

We also achieved a 67.8% reduction in the number of total hospital avoidable stays for GRD 295 (-17% between 2007-2008, -39% between 2008-2009, -26.3% between 2009-2010), reaching 1.59 days reduction in the average stay for GRD 295 between 2007-2010, which means 2,55 days less of stay than the country's average (5, 10 days) (table II, fig. 3a).

**Table I**  
Avoidable diabetologic emergencies

Code and diagnosis	Observed values					Total
	May-Dec 2007	May-Dec 2008	Jan-Jun 2008	Jan-Jun 2009	Jan-Jun 2010	
<b>250.0:</b> DM without mention of complication type 2 or unspecified non decompensated	23	10	6	9	11	59
<b>251.1:</b> Other specified hypoglycemias	15	6	13	9	6	49
<b>251.2:</b> Non-specified Hypoglycemia	74	65	62	50	52	302
<b>Total</b>	<b>112</b>	<b>81</b>	<b>80</b>	<b>68</b>	<b>69</b>	<b>410</b>
	Expected values					
<b>250.0:</b> DM without mention of complication type 2 or unspecified non decompensated	16.1	11.7	11.5	9.9	9.8	59
<b>251.1:</b> Other specified hypoglycemias	13.4	9.7	9.6	8.2	8.1	49
<b>251.2:</b> Non-specified Hypoglycemia	82.5	59.7	58.9	50.8	50.1	302
<b>Total</b>	<b>112</b>	<b>81</b>	<b>80</b>	<b>68</b>	<b>69</b>	<b>410</b>
<b>Real significance</b>	<b>p = 0.2006 (NS)</b>					

DM: Diabetes Mellitus; NS = Statistically non significant for the Chi-Square Test.

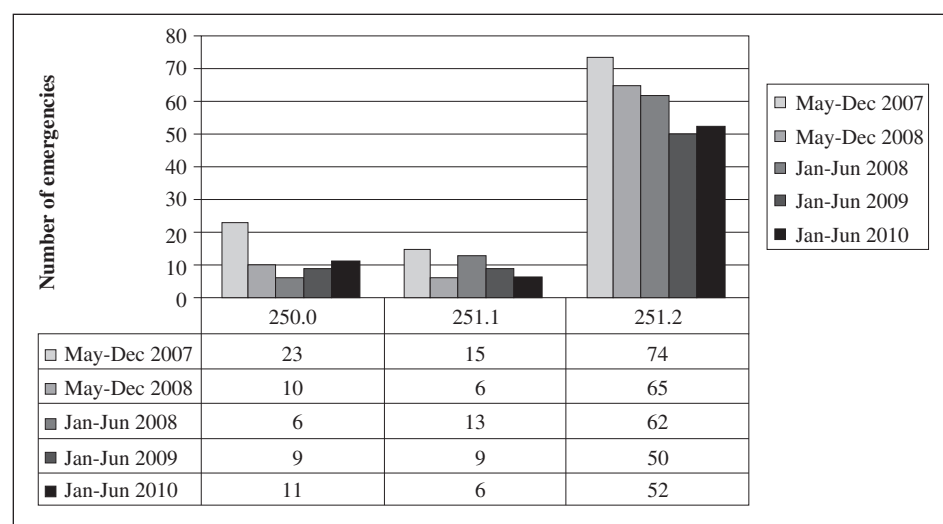


Fig. 2.—Avoidable diabetologic emergencies.

All of this implied a saving of 36,920 euros per year (1,846.05 euros per case).<sup>18</sup>

Similarly, for the GRD 294 our protocol implied a reduction of 27% and 28% in the number of avoidable stays/discharges between 2007 and 2010, and in the specific weight for GRD 294 (-23/-22% between 2007-2008, -4/-6% between 2008-2009, and 0/2% between 2009-2010, respectively).

We also achieved a 23.4% reduction in the number of avoidable total hospital stay with GRD 294 (-7% between 2007-2008, -12% between 2008-2009, -5% between 2009-2010), reaching 0.62 days less of average hospital stay than the country's average (6.51 days) (table II, fig. 3b).

Therefore, the result of our intervention in the GRD 294 implied a saving of 71,924 euros per year (2,766.34

euros per case).<sup>18</sup>

Considering the total expenses resulting from admissions due to severe diabetes complications in GRDs 294 and 295, our protocol implied a saving of 108,844 euros per year, which adds up a total saving of 326,532 euros in 3 years (2007-2010).

## Discussion

Current prevalence in the Region of Murcia, according to DINO study,<sup>19</sup> is of around 11% of the general population over 19 years old. Therefore, with the available prevalence data, in our health area, with a total population of 200,662, it is estimated that there are 15,000 diabetic patients over 18 years old.

**Table II**  
*Patients admitted due to DM1 for type 2, non complicated*

**A. Patients under 36 years old admitted due to DM1 or DM2, non complicated**

<i>Observed values</i>					
<i>GRD 295 weight v.21*</i>	<i>Number of discharges</i>	<i>Total stay (days)</i>	<i>Average stay (days)</i>	<i>Weights sum</i>	<i>Total</i>
0.841 Jan-Jun 2007	21	87	4.14	17.66	129.8
0.841 Jan-Jun 2008	18	73	4.06	14.77	109.83
0.841 Jan-Jun 2009	12	38	3.17	9.85	63.02
0.841 Jan-Jun 2010	11	28	2.55	9.25	50.8
<b>Total</b>	<b>62</b>	<b>226</b>	<b>13.92</b>	<b>51.53</b>	<b>302.65</b>
<i>Expected values</i>					
0.841 Jan-Jun 2007	26.6	96.9	6.0	22.1	129.8
0.841 Jan-Jun 2008	22.5	82.0	5.1	18.7	109.83
0.841 Jan-Jun 2009	12.9	47.1	2.9	10.7	63.02
0.841 Jan-Jun 2010	10.4	37.9	2.3	51.5	50.8
<b>Total</b>	<b>62</b>	<b>226</b>	<b>13.92</b>	<b>51.53</b>	<b>302.65</b>
<b>Real Significance</b>	<b>P = 0.0000</b>				

**B. Patients over 36 years old admitted due to DM1 or DM2, non complicated**

<i>Observed values</i>					
<i>GRD 294 weight v.21*</i>	<i>Number of discharges</i>	<i>Total stay (days)</i>	<i>Average stay (days)</i>	<i>Weights sum</i>	<i>Total</i>
0.9828 Jan-Jun 2007	48	269	5.6	47.17	369.77
0.9828 Jan-Jun 2008	37	252	6.63	36.57	332.20
0.9828 Jan-Jun 2009	35	218	6.23	33.68	292.91
0.9828 Jan-Jun 2010	35	206	5.89	34.40	281.29
<b>Total</b>	<b>155.00</b>	<b>945</b>	<b>24.35</b>	<b>151.82</b>	<b>1276.17</b>
<i>Expected values</i>					
0.9828 Jan-Jun 2007	44.91	273.81	7.06	43.99	369.77
0.9828 Jan-Jun 2008	40.35	245.99	6.34	39.52	332.20
0.9828 Jan-Jun 2009	35.58	216.90	5.59	34.85	292.91
0.9828 Jan-Jun 2010	34.16	208.29	5.37	33.46	281.29
<b>Total</b>	<b>155.00</b>	<b>945.00</b>	<b>24.35</b>	<b>151.82</b>	<b>1276.17</b>
<b>Real Significance</b>	<b>P = 0.9950 (NS)</b>				

\*Highly significant for the Chi-Square Test  
NS = Statistically non significant for the Chi-Square Test.

In 2007, there were 350 cases of assistance due to diabetes in the Emergency Service of the HGRS because of diabetes decompensation, of which 153 cases (44%) required hospital admission. This entails a high number of admissions related to diabetes, above the country's average.

Comprehensive assistance to the diabetic patient has not only proved capable of reducing the rate of chronic complications, but also of hospital admissions due to severe complications and average stay adjusted by GRD.<sup>20-22</sup>

Achieving this goal requires making the most of the available health resources, and rationalizing them, as well as an effective and efficient coordination between the different health levels, through multidisciplinary DUs, that must follow certain preventive, healing and rehabilitation aspects of the disease.

The approach, through education programs at an interdisciplinary level, applicable to the whole health area and in all its assistential levels, is similar to other designs, just as showed by international studies that have proved that the DU improve the patient control.<sup>23-28</sup>

PC has a strategic role in the assistance to the diabetic patient, given the high prevalence, chronicity and socio-sanitary implication of this disease, particularly in the case of patients with DM2, since the nature of the cares they require make this assistance level the most suitable for them. At the same time, the Specialized Assistance levels plays a primary role in ensuring an adequate assistance to the diabetic patient in his complications, particularly the more unstable patients, as is the case with DM1, and always in coordination with the PC in order to achieve a permanent assistance.

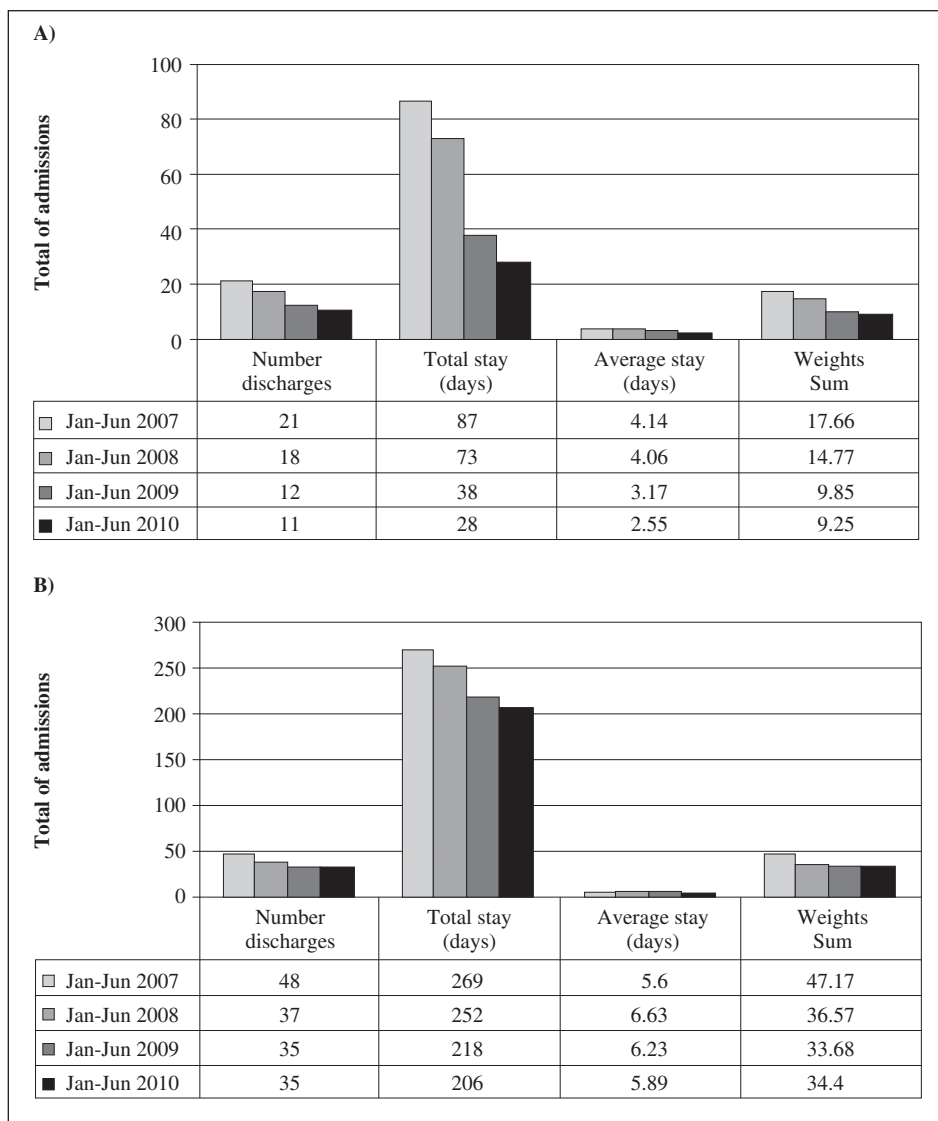


Fig. 3.—Admissions related to diabetes (a) in patients under 36 years old (GRD 295) and (b) in patients over 36 years old (GRD 294).

Most of the authors likewise consider indispensable that the diabetic patient takes active part in his own care and relate the lack of self-care with the higher number of assistances due to diabetologic emergencies.<sup>29</sup> In order to achieve a suitable level of self-care in the diabetic patient it is essential, to provide him with the therapeutic education that may work as a mainstay of the comprehensive health assistance, that at a structural level is represented by the figure of Nursing Specialized in Diabetologic Education, which after being incorporated to the health plans has achieved an improvement in the diabetes control.<sup>30</sup> For this reason, our DU was created with two hospital nurses specialized in Diabetologic Education, but also, and no less important, with ten PC nurses responsible of Diabetologic Education who in turn coordinate the other nurses at their center or service. In this sense, it is proved that assistance carried out by the PC Nurse improves the patient's satisfaction and the efficiency in the diabetes

global care. Approaching the issue of Diabetologic Education addressed to the community that depends on health center has proved to be effective in reducing the number of emergencies related to diabetes.

Even so, there are some authors that have shown an increase in severe hypoglycemia cases after implementation of the DEPs aiming to achieve the current and growingly ambitious goals of glycemic control, particularly in adult diabetics.<sup>31</sup> However, in our work we have been able to reduce both the emergencies related to hyperglycemia (53,2%) and the emergencies related to hypoglycemia (33,7%) in just three years. This difference is explained by the existence of the DUs in our area, which consider PC and Diabetologic Therapeutic Education as the strong point of our assistance, allowing a comprehensive and multidisciplinary assistance of the diabetic patient, in all the stages of his life and his disease.

As to the contents of this education, hypoglycemia is regarded as the main restricting factor to achieve an



optimum diabetes control, both because it is the most common severe complication in the hypoglycemic treatment and because of its negative repercussion in patients' quality of life.<sup>32</sup> Therefore, we believe that any intervention in diabetes must include a reduction of hypoglycemia among its goals, both in the number of emergency assistance and in the severity and amount of admissions due to that cause, as we have presented in our study with the 27% reduction in the avoidable admissions because of GRD 294, of which around one third are patients with DM2 that enter the hospital with a secondary diagnosis of "adverse effect of insulin and anti-diabetic agents".

Apart from the individual education, other of our strong points has been the fact of carrying out talks on diabetologic survival education addressed to groups of patients that had been previously assisted due to glycemia decompensation, in emergency service, ambulatory service or hospital admissions. This way of carrying out diabetologic education in groups has proved to be efficient in preventing acute and chronic diabetic complications.<sup>33</sup>

Our results are of a high socio-sanitary relevance given the great economic repercussion of diabetes, because of its prevalence, and the complications and restrictions that it entails. In our study a total saving has been estimated of 326,532 euros in 3 years (2007-2010) with the reduction of avoidable admissions due to diabetes. This expenses reduction due to admissions related to severe diabetes complications has been achieved by other authors, through establishment of protocols of therapeutic education in diabetes, including the use of telephone assistance and telemedicine as actual advances in the means of communication between the health professional and the patient.<sup>34</sup> Besides, other models of diabetologic education employing informatic systems to encourage decisions related to diabetes, both for patients and health professionals, have proved to be effective in reducing avoidable emergencies and admissions due to diabetes.<sup>35</sup>

## Conclusions

A DEP must be focused in the person, not in the disease, and it must be based on the principles of interactive participation and group support to the decision making process of each individual. It has been proved that those programs are effective in increasing understanding of the disease, developing skills necessary to cope with the treatment and changing behaviors.

The interactive work of the PC and the DU enables, through the use of educational protocols of action, a reduction of more than a third of the number of emergencies related to severe decompensation of the disease and a significant reduction of the yearly hospital admissions of the young adults, improving life quality and reducing the social cost associated to the diabetic patient, as well as the reduction of sanitary expenses resulting from avoidable admissions.

This interactive work improved interprofessional communication regarding diabetes in the Health Area VII of Murcia East.

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– *Hospital:* Dr. J Soriano Palao (Internal Medicine), Dr. R Soriano Sánchez, Dr. A Meoro Avilés, Dr. C del Peso, Dr. MT Gallego García, MC Lozano Gomariz (Endocrinology), C Gutiérrez García, S Tomas Navarro (Diabetes Educator), Dr. I Selles, (Ophthalmology), Dr. J Cabezuelo Romero (Nephrology), Dr. I Marín (Cardiology), Dr. ML Martínez Navarro (Neurology), Dr. J Rodado (Psychiatry), Dr. J García Medina (Vascular Radiology), Dr. C Sánchez Cañizares (Urgencias), Dr. E Buendía Pérez (General Surgery), MB Guillermo Vila (Diabetic Foot Nurse), A Cavaría (Podiatrist), Dr. MJ Avilés (Neurology), Dr. C Sánchez Álvarez, M Nicolás Hernández, AI Zomeño Ros, NV García-Talavera Espín, MB Gómez Sánchez, T Monedero Saiz (Nutrition Unit), Dr. MT Antequera Lardón (Farmacia), MA Nuñez Sánchez (Biochemistry), Dr. JM Guirao Sastre (Quality Unit), Dr. F San Eustaquio Tudanca (Clinical Documentation Service).

– *Primary Care:* Dr. MA Muñoz Tomás, JC Martínez Alburquerque (Vistabella), Dr. J Brotons Román, H Romero López-Reinoso, P García Ortín (Infante), Dr. MA Regojo Almela, MR Gómez Montiel (Beniaján), Dr. J Alcántara Nicolás, Dr. D García Fuentes, MI Salinas Atenza (Santomera), Dr. P Villalba Martín, C Saura García (Puente Tocinos), Dr. MA Cervantes Cuesta, P Brocal Ibáñez (El Carmen), Dr. A Villalobos Templado, JL Gea Martínez (Beniel), Dr. MA Rodríguez Sánchez, MJ Campillo Fernández (Alquerías), Dr. MJ Delgado Aroca, JM Olivares (Monteagudo), Dr. S Pérez García-Ripoll, PA Martínez Robles (Llano de Brujas-Casillas).

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