

Telemonitoring program in diabetic patients in a public health service in Chile



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Abstract

This article describes a telemonitoring program for diabetic patients with difficult to control blood glucose.

Keywords: *Telemedicine; Chronic Disease; Diabetes.*

Resumen

Programa de telemonitoreo en pacientes diabéticos en un servicio de salud público de Chile

Este artículo describe un programa de seguimiento para pacientes diabéticos no compensados a través de telemonitoreo.

Palabras-clave: *Telemedicina; Enfermedad Crónica; Diabetes.*

Resumo

Programa de telemonitoramento de pacientes diabéticos em um serviço de saúde público do Chile

Este artigo descreve um programa de seguimento de pacientes diabéticos não compensados por meio de telemonitoramento.

Palavras-chave: *Telemedicina; Doença Crônica; Diabetes.*

INTRODUCTION

A health service in the metropolitan region of Chile developed a telemonitoring program for diabetic patients that belong to a chronic patient group with difficulty to control blood glucose.

Considering the importance of this disease, difficulties in compensating patients and the possibilities offered by the telemonitoring, an agreement was reached with these health centers, the National System of Health Services, which watched the realization of this Program of telemonitoring with patients from two of its family health centers of San Bernardo (primary level) and a referral center, secondary level (CRS). This work was carried out between November 2013 and November 2014.

METHOD

Type of study

It is an interventional study based on the telemonitoring. The patients belonged to a referral center and two family health centers and were selected those with greater difficulty in maintaining glycemic control.

Program implementation

In order to carry out the program, first of all, it was conducted a pilot in primary care, from 16 to 30 May 2013 and then, considering the results of this pilot and the evaluation together with the treating teams, proceeded to refine details related to procedures and admission card, as well as to establish referral protocols in case of emergency for the definitive study. The program expanded significantly until August 2014, although some patients remained until November of that year.

Soon it was defined they should recruit 280 patients distributed according to Table 1.

Table 1 - Patients of Telemonitoring Program per health centers

Health Centers	Total
Health Referral Center	80
Family Health Centers 1	50
Family Health Centers 2	150
Total	280

Inclusion and exclusion criteria of patients

Inclusion:

- patients diagnosed with requesting insulin diabetes or insulin dependents, diabetics on treatment with oral hypoglycemic and diabetic patients with hypertension, all under control in the SS;
- patients who voluntarily agreed to participate in the program;
- autonomous or dependent patients with support network.

Exclusión:

- patients whose domicile has no electricity and cell phone coverage;
- patients with concomitant terminal diseases;
- patients with psychiatric disorders uncompensated;
- patients that do not wish voluntarily to undergo this type of intervention.

Subsequently they elaborated care and referral protocols to secondary care patients, where they settled:

- parameters of intervention according to the elevation of glycemia, loss of control or subjective evaluation of the patient;
- frequency of differentiated control for this group, agreed with clinical teams of the center.

These protocols were implemented to define intervention and referral behaviors agreed with treating teams, telephone counseling triggers by the staff of the telemonitoring company and they settled parameters of referral to emergency services.

It was also set a weekly consulting with specialists in diabetes and in cardiology of the telemonitoring company for patients that meeting certain parameters defined in the protocols required it. The suggestions of these specialists were sent to the health teams.

Under these conditions the program officially begins on November 13th, 2013 and its completion date is set to August 31th, although some patients are registered until November 30th.

The evaluation was made considering the number of patients, procedures, communication actions and clinical results, such as measurements of blood glucose and Glycosylated Hemoglobin of entry and the one obtained after three months in the program. With this last record, a hypothesis test was done to compare two paired samples, of

Glycosylated Hemoglobin measures for the same individuals; before and after the programme was implemented.¹

A satisfaction evaluation was also conducted through self-administered surveys with a Likert Scale, which considered the opinion about the quality and technology equipments, the routine control activities, the communication with accompanying professional teams and appreciation of the distance company.

RESULTS

The total number of patients enrolled in the program were 377, which were distributed by center as shown in Table 2.

Table 2 - Total telemonitoring patients. SS Program

Health Center	Patients
Health Referral Center	133
Family Health Centers 1	64
Family Health Centers 2	180
Total	377

Patients divided by sex and age are shown in Table 3 and 4.

Table 3 - Telemonitoring patients divided by sex. SS Program

Sex	N	%
Women	258	68%
Men	119	32%
Total	377	100%

Throughout the program, as indicated in the protocols, patients were monitored with controls of physical parameters (Blood Pressure, Weight and blood glucose), through

Table 4 - Telemonitoring patients divided by age. SS Program

Age	Separated by age groups				Total	
	Women		Men			
	N	%	N2	%2	Number	%
≤ 34	7	3%	4	2%	9	2.4
35-44	18	7%	11	4%	29	7.7
45-54	66	26%	30	12%	96	25.5
55-64	94	36%	41	16%	135	35.8
65-74	58	22%	21	8%	79	21
≥ 75	15	6%	12	5%	27	7.2
	258	100%	119	46%	377	100

messages and control reminders and medications. All patients by monitoring time, the total controls and average per month can be seen in Table 5.

Table 5 - Patients, total controls and average of controls divided by monitoring time. SS Program

Months	Patients	Controls	Monthly Average Controls
<1	32	214	6.7
1 a 2	10	615	61.5
2 a 3	14	2790	199.3
3 a 4	13	2375	182.7
4 a 5	31	10426	336.3
5 a 6	21	7735	368.3
6 or more	256	56512	220.8
Total	377	80667	214.0

Regarding telephone communications with patients, it was made 10,483 calls in this period, divided into: 9,682 calls of Accuhealth and 801 calls to Accuhealth by patients, on average it was made 27.8 calls per patient (Table 6)

Table 6 - Total calls and calls per patient. SS Program

Patients	Calls	AH Patients	Patients AH	Average Call
377	10483	9682	801	27.8

The distribution of these calls by communication type is shown in Table 7.

Table 7 - Types of communications. SS Program

Total Calls	Alerts and Alarms	Omissions	Supplies equipments	Others
10.483	2.894	2.354	3.353	1.882
Percentages (%)	27.6	22.5	32.0	18.0

Meanwhile, it was collected the results of satisfaction surveys of users, on areas of: equipment and technology, routine activities, communications and assessments. Results that correspond to whom answered the survey, 85% of the total of patients. The results show that the evaluations are very positive, as can be seen in Table 8.

Table 8 - Results of satisfaction surveys

About equipments and technologies
61% of patients answered that they strongly agree that it cost little to learn to use the equipment.
26% agree and 13% are indifferent to this question.
87% of patients strongly agree that the devices and / or equipments are easy to handle.
91% of patients strongly agree that the transmission of the data is simple and only 1 patient disagrees.
About routine activities
91% of patients consider that the amount of daily controls was enough to keep their glycemia controlled.
97% of patients report that they strongly agree, that the survey questions were easy to answer.
100% of patients strongly agree that the calls were clear.
97% of patients strongly agree that the information provided by the professionals, helped them learn about their disease.
About communications
97% of patients report that they strongly agree that AccuHealth staff gives an image of trust and honesty.
97% of patients strongly agree that AccuHealth team answers their questions.
100% of patients strongly agree that the calls were clear.
Insights
97% of patients strongly agree that the system helped them.
100% of patients strongly agree that they felt accompanied during the TLM.
97% said they strongly agree that they were more committed to their health.
87% of patients strongly agree that the TLM helped them for the family understand the disease.
100% recommend the TLM.

The most surprising results in this area are spontaneous comments delivered after the patients answer the survey which confirm that in 100% of evaluations they feel accompanied with the system. This result is important since

it is known the value of psychosocial variables in metabolic compensation of type 2 diabetic patients, as a work that has been dedicated to the theme says: "The more benefits for the patient attributed to treatment ensuring this control and while less barriers are perceived to ensure the implementation of the treatment, the greater is the probability that the patient is metabolically compensated. The family support and positive relationships with the health team act indirectly in this final model.²

In relation to clinical results, the first thing that they worked was the blood glucose. This data presents the disadvantage that when a patient is decompensated, the protocol indicates that more blood glucose is necessary to be taken and in this way, the averages incorporate this fact and do not always reflect a comparable result. Anyway, how it is possible to appreciate the evolution through the months, it shows a clear downward trend, as global data.

For this data all results were taken per patient registered whenever blood glucose (by Hemoglucotest method) was taken, then glycemia averages were obtained by patients in correlative month of the program and finally the average month was obtained of all patients. So the global evolution of the program is shown. The averages of blood glucose taken by patient are in Table 9, 10 and Figure 1, show the data of average blood glucose per month.

Table 9 - Average of glycemia per patient. SS Program

Patients	Total measurements	Average months	Average Monthly Measurement
377	80.667	5.3	40.37

As discussed before and since these data are not fully clear for the research, especially for the contingent aspect of blood glucose, in other words, it measures the concentration of glycemia in a transversal register, that is, in a precise minute; it is that it was decided to use a data value more constant and opted for the Glycosylated Hemoglobin, especially because we know that the drop in Glycosylated Hemoglobin reduces the complications of Diabetes Mellitus³.

The data analysis of Glycosylated Hemoglobin (HbA1c) was performed using an evaluation before – after, with patients who provided this information before and after the program.

Table 10 - Average of Glycemia per month. SS Program

Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	June-14	July-14	Aug-14
236.0	212.9	215.1	210.1	205.9	205.4	206.6	204.0	205.7	194.1

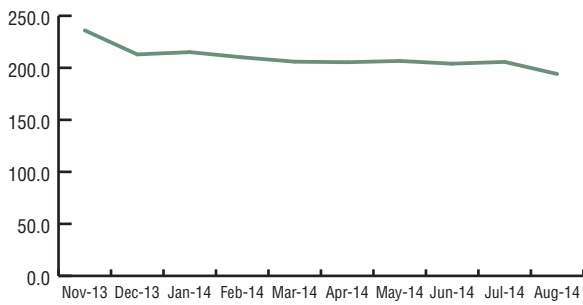


Figure 1 - Average of Glycemia per month. SS Program.

To the hypothesis test it was used “Compare the averages of two paired samples”, which consists in obtaining the average of the difference of each pair among all patients (HbA1c before and after the program) and assessing if it is significant. That is, if the change verified after the program in the average of the difference of HbA1c before – after is significant, with what percentage of confidence and does not obey a random choice.

In order to verify that the difference is significant, it is used the statistical t of student that measures the probability of occurrence of an event in the table of Student’s distribution, which depends on the size of the sample (degrees of freedom).

The patients recorded before and the HbA1c data, their averages per center are in Table 11.

It is possible with these data to obtain the following results of t of student: 3,056 to El Manzano, 4,103 in Joan Alsina and 4,379 in CRS El Pino. With these figures, it is possible to say that the difference observed in the Glycosylated Hemoglobin results are all significant and they have more than 99% of confidence.

Table 11 - Patients per center and data of HbA1c averages

Assistance Center	Controlled Patient	Average HbA1c before	Average HbA1c after	Average of the difference HbA1c Before-After
El Manzano	26	10.83	9.61	-1.21
Joan Alsina	16	9.78	8.79	-0.98
CRS El Pino	56	10.19	8.99	-1.18

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CONCLUSION

The increase in life expectancy, the consequent increase in chronic noncommunicable diseases, the rising cost of health benefits and the explosive development of information technologies are determining that health requires new forms of management.

The traditional system of health care is presential, reactive, with passive patients, focusing on healing, fragmented, data generator and fundamentally dependent and the telemonitoring system is ubiquitous, proactive, requiring active and updated patients, focused on prevention, connected and integrated, more intelligent and above all tends to autonomy.

The SMRP show itself highly efficient and effective in the control of diabetic patients, and the results obtained, highly encouraging, as for the metabolic control, as for the user satisfaction expressed.

In this study, although it can be observed that patients with information Glycosylated Hemoglobin are not all who were in the program and only corresponds to 25%, also their statistical results show significantly positive results in their compensation according to the comparison before and after the Glycosylated Hemoglobin.

Meanwhile, the user satisfaction results show a highly positive evaluation, especially in relation to the perception company that shows among most patients as pointed out in the literature, this perception is crucial in the ability of compensation that the patients have who count on support network.