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Cost-Effectiveness Of Drug Compliance In Type 2 Diabetes Mellitus Patients.

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ABSTRACT

Type 2 diabetes mellitus affects 15% of the population around the world, causing health complications and increasing the treatment's costs. Being a chronic outpatient treatment disease, patient compliance is higher importance to achieve therapeutic success. The present study measure the cost effectiveness of the compliance of this disease. An observational, cross-sectional, pharmaco-economic study was performed. A National program to stimulate treatment adherence was taken as intervention stage. Compliance was measure by Morisky-Green test and details of the events in each patient's health (medication, consultations, hospitalization and concomitant treatments) were used to determinate the direct costs for Ministry of Public Health. Effectiveness was measured by percentage of glycated hemoglobin (HbA1c). The sample obtained was 55 patients, which were grouped into 31 compliant and 24 non-compliant. The cost-effectiveness of compliance was 466 US$ / compliant effective patient and 1,807 US$ / non-compliant effective patient. The cost-effectiveness of hypoglycemic drug therapy compliance is significantly lower (almost 4 times) than non-compliance. Type 2 Diabetes Mellitus patients that have no therapy adherence are not able to maintain protective levels of HbA1c. In addition, for the Ministry of Public Health, the lack of adherence requires more budget to accomplished the health goals.

Keywords: Cost-effectiveness, adherence, pharmacotherapy compliance, Type 2 Diabetes Mellitus.

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INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) is a chronic disease, with outpatient treatment features which leads to severe complications, like increase risk of heart disease and stroke. Diabetic neuropathy of the feet combined with reduced blood flow, increase the risk of foot ulcers and amputation. Diabetic retinopathy is a leading cause of blindness, 2% of patients go blind, and 10% develop severe visual impairment. Also, diabetes a major cause of kidney failure and between 10 and 20% of patients with diabetes may die from that cause. For all its complications, diabetes has a significant economic impact on patients, their families, and the health systems of the majority of countries [1].

In Paraguay, the Ministry of Public Health (MOH) organizes and coordinates the care and treatment of patients with diabetes, through its technical unit, the National Diabetes Program (NDP). Diabetes mellitus inadequately treated, leads to decreased quality of life of people in working age and therefore in Paraguay, the Congress in 2002, created the National Diabetes Program by the Law # 2035, which in its Article 6 says: "The Ministry of Public Health through its technical unit, ensure and regulate the supply of insulin and oral anti-diabetics and all the elements necessary for administration of medications and self-control, for free for diabetic people with limited economic resources" [2].

According to World Health Organization (WHO) data, in Paraguay in 2010 up to 8% of total deaths for all ages were for diabetes. The prevalence of T2DM was 9.8% in men and a similar proportion (9.4%) in women. The death rate adjusted by age per 100,000 inhabitants for cardiovascular disease and diabetes were: 269.3 for men and 227.9 for women [3]. According to the Department of Biostatistics of MOH, morbidity (outpatient nationwide) for diabetes is increasing in Paraguay (in 2007 8,837 cases, in 2008 of 10,571, and in 2009 13,859 cases). 79% of the cases correspond to both sexes and to the people over 50 years old. In 2010 they were 1,109 deaths a cause of diabetes (91% belonged to the age group 50 and older, both sexes) [4].

Compliance to the treatment is a dynamic concept that can affect all phases of the clinical process. The therapeutic failure is especially common in chronic diseases, when the patient is uncontrolled in the elderly, and in patients who have prescribed several medications (polypharmacy). These three conditions are usually encountered in outpatients. There is no single method that alone allows assessing all aspects of compliance. The methods to measuring compliance are divided into direct and indirect process. While direct methods include laboratory test; indirect methods are simple and inexpensive, so they are widely used in clinical studies, they include self reported questionnaires by patients, among which we can mention one of the most used and validated for studies with diabetic and hypertensive patients, the Morisky-Green Test [5].

Compliance is also very important from the economic point of view, because having compliance is a major achievement of therapeutic goals, and therefore fewer complications for the patient and for the health system, with consequent cost savings of the treatments. There is an inverse relationship between compliance and healthcare costs in patients with T2DM, the better the compliance, lower the costs of patient care [6]. On the other hand the better the pharmacotherapy compliance of patients with TDM2, the better blood glucose control and decreasing health resources are used [7].

Being a chronic outpatient treatment disease, patient compliance is higher importance to achieve therapeutic success, and such the treatment is based on five pillars, the pharmacotherapy is one of them, and the Paraguayan State allocates significant financial resources for treatment of T2DM.

The objective here was to know what the MHO spent for treatment of compliant patients who reach the goal of glycemic control and what is spend for the treatment of non-compliant that also reach the same goal.

METHODS

Observational, cross-sectional, pharmacoeconomic study, conducted through an interview with the patients whose main objective was to find the cost-effectiveness of pharmacotherapy compliance versus non-compliance. Analyzed costs were direct medical costs paid by the MOH and a follow up of one year.

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The sampling was no probabilistic of consecutive cases, and recruitment of patients was conducted by the National Diabetes Program, including patients who regularly attended to consultation and that accomplished with the inclusion criteria: 50 years old or older, both sexes, who agreed to participate in the study, with a history of a regular consultation on NDP in the pass (at least 3 times in year) and a clinical record completed and updated, containing at least: the result of recent percentage of HbA1c (no more than four months prior to conducting the interview) and the dates of consultation by the patient.

In order to calculate the sample size and considering that no previous studies were available at Paraguay regarding the cost-effectiveness of the compliance or non-compliance of pharmacotherapy, we proceeded to perform an exploratory pilot study with 10 patients, 5 for the compliant group and 5 for the non-compliant group. The sample size was estimated using the Student t statistic with the following data: values: alpha (α) unilateral = 0.05, Beta (β) = 0.20, being standardized effect (S/E) = 0.81, which determined a sample size of 21 patients for each group, whose calculation is shown in Table 1.

Table 1 - Sample size calculation based on data from exploratory study

Group	n	Average	DE	S/E
Compliant	5	11.58	1.02	0.81
Non-compliant	5	57.49	19.50	

A questionnaire was used to record the data, which was previously validated during exploratory study. It contains the Morisky-Green test in order to determine compliance or non-compliance (8). See Table 2.

Table 2 - Morisky-Green test incorporated in the questionnaire

1. (Correct answer: NO)		YES		NO
2. Do you take these medications at the indicated hour? (Correct answer: YES)		YES		NO
3. When you feel good you stop taking your medication? (Correct answer: NO)		YES		NO
4. Do you leave taking medications if you dislike them? (Correct answer: NO)		YES		NO

We also used the clinical records of patients surveyed, provided by the NDP, in search of the value of HbA1c percentage and frequency of patient consultations in the year 2011. Costs were structured into a form as seen in Table 3, were considered the costs of MOH at December 31st, 2016.

Table 3 – Costs Form per patient

Cost description	unitary cost	# event/year	cost/year
Consultation at NDP			
Consultations, others			
Medication provided by NDP			
Medications, others			
Exams at NDP			
Exams, others			
Treatment, others			
Hospitalization per day			
	Total MOH spending per patient by year		

Also it was used an informed consent form to the patient, which was read to the patients who agreed to participate in the study and who were asked to sign it, as a proof of acceptance.

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RESULTS

The sample obtained in this study was 55 (fifty five) patients, which were distributed as follows: analyzing responses to the Morisky-Green test included in the questionnaire, it was determined that 56% were compliant (n = 31) and 44% were non-compliant (n = 24). The sample consisted of 40 women (73%) and 15 men (27%) (randomized stratification sample followed the female/male ratio present in the NDP population. The average age of patients was 62±5.8 years, with maximum and minimum ages of 81 and 54 years. Data related to HbA1c percentage obtained from medical records of patients interviewed was classified according to the parameter set by the NDP (effectiveness of HbA1c level= <7 %), and its results showed that 51% of patients (n = 28) achieved the effectiveness goal in glycemic HbA1c level while 49% of the patients were unable to maintain protective levels of HbA1c (n = 27).

Analyzing the distribution of the sample for the compliant and non-compliant groups and sub grouping each group by the parameter of effectiveness (either effective or non-effective), we calculated the annual costs of treatment for each group, with the following results: compliant effective (n = 21): US$ 5,645 - compliant non-effective (n = 10): US$ 4,131- non-compliant effective (n = 7): US$ 2,762 - and non-compliant non-effective (n = 17): US$ 9,890. See figure 1.

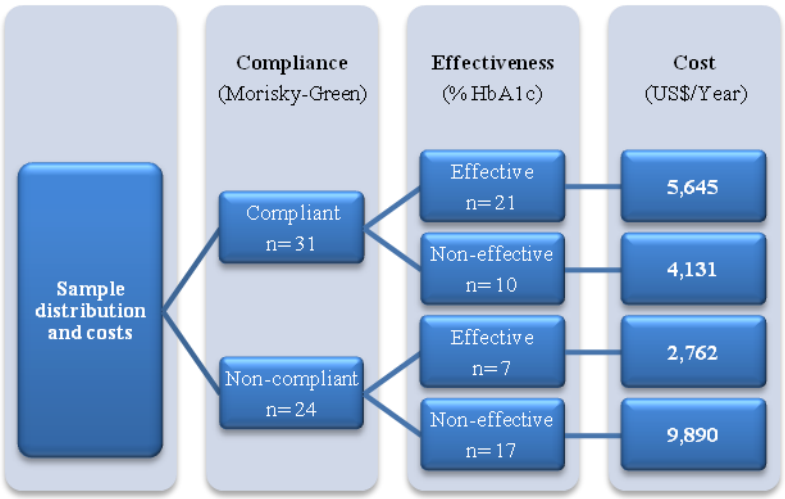

Figure 1 – Sample distribution and costs

The average annual cost per patient based on the direct cost structure analyzed per group it`s seen in Table 4, and results found that the MOH spent US$ 294 more per year for each non-compliant patient.

Table 4 - Average annual costs per patient / event

	Average annual costs per patient, per event, in US$ Dollars			
	Group: compliant		Group: non-compliant	
	Effective	Non-effective	Effective	Non-effective
Consultation at NDP	38	51	44	48
Exams at NDP	60	67	65	66
Consultations, others	10	15	24	24
Exams, others	97	137	124	121
Hospitalization	0	7	29	173

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Treatments, others	0	15	38	33
Medication provided by NDP	36	86	32	84
Medications, others	29	35	40	32
Total per patient per year	269	413	395	582
Average by Group	682		976	
Average cost difference by group	294			

It was determined that the total annual cost for compliant patients was US$ 9,776 and for non-compliant was US$ 12,652 and the cost-effectiveness ratio calculated for both groups, result of 466 US$ / effective patient, for compliant and 1,807 US$ / effective patient, for non-compliant. See Table 5.

Table 5 - Calculation of cost-effectiveness ratio for both groups of patients

	annual cost in US$	Effective patients (n)	cost effectiveness ratio
Compliant	9,776	21	466 US$ / effective patient
Non-compliant	12,652	7	1,807 US$ / effective patient

DISCUSSION

Healthcare personnel should be aware of patient's economic situation during the planning of a treatment regimen, and a healthcare finance system that provides at least some financial assistance to low income patients would be helpful to boost compliance.

Factors directly and clearly related to patient's compliance are extremely important since many of them are related to the clinical outcome of the patients. We can call them the "hard" factors. We are using this term in order to identify and quantify those factors with a major impact in health care. These "hard" factors may be amendable to a certain extent by counseling and communication by healthcare providers. In additional, the society could also participate in modify those factors and to minimize the barriers for patients to follow the therapy.

In contrast with "hard" factors, some other factors might be classified as "soft" factors because their effects are much more difficult to measure and count. However, a failure to address the "soft" factors may reduce the efforts spent in countering the effects of some "hard" factors.

The ultimate aim of any prescribed medical therapy is to achieve certain desired outcomes in the patients concerned. These outcomes are part of the objectives that the health system has defined for each disease. However, despite all the best intention and efforts on the part of the healthcare systems and its professionals, those outcomes might not be achievable if the patients are non-compliant to their therapy. Hence, therapeutic compliance is an important goal in any treatment since is directly related to patient's outcome. But not any outcome should be considered as clinically relevant. In the case of diabetes, the outcomes need to be reach are micro and macrovascular complications and death related to this disease. We can call them the "hard" factors o "had" variables that should be modify..

In contrast with "hard" factors, it exist some other factors that should be classified as "soft" factors because their impact and effects are much more difficult to measure and counter. This is the case of laboratory data. We understand that the best goal to be achieved by patients with the treatment compliance is to reduce hard factor incidence like morbility or mortaliy related to diabetes. However, a very long term study in need to measure the effectiveness of these factors, hence, for this publication we did take into account the HbA1c as effectiveness parameter, but we will continue the study in order to measure the hard factor in the next years.

In this study it was found that 56% of the patients complied with their pharmacotherapy, this data is similar with the data collected by the WHO, which give a 50% compliance rate in long-term and multiple causality treatments [9].

It should be noted that this study is a pioneer in the area of pharmaco-economics in the region, specifically in the cost-effectiveness analysis of pharmaco-therapeutic compliance, since no similar studies were done in South America.

CONCLUSIONS

The cost-effectiveness ratio of diabetes care is significantly lower (almost 4 times) in compliant patients, than in non-compliant. Therefore, based on the results obtained in this study, it can be concluded that public health service, to achieve the clinical effectiveness goals, is much more expensive to treat incompliant T2DM patients than to treat compliant ones in order to achieve the same goal.

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