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A review of diabetes care and treatment in Mexico

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ABSTRACT

Objective: To assess how the burden imposed by type 2 diabetes mellitus on the Mexican healthcare system is being managed in comparison with the Latin America reality. **Methods:** Literature search in the PubMed/Medline, SciELO and LILACS databases. **Discussion:** The healthcare reform experienced in Mexico, by the implementation of Seguro Popular, was pointed out as a reference for countries with all levels of resources. Although there is still room for enhancements, comparative analyses to evaluate the effects of this project have shown a significant improvement regarding healthcare access, blood glucose control, and a reduction of out-of-pocket expenses. Additional actions are also being taken as healthcare systems are being challenged to accommodate measures to guarantee the quality of life of people with diabetes. **Conclusion:** Awareness of diabetes and its associated complications must be raised as this might encourage the population to develop healthier lifestyle habits and improve treatment compliance. (REV MEX ENDOCRINOL METAB NUTR. 2017;4:42-50)

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Key words: Diabetes mellitus type 2. Latin America. Mexico. Prevention and control. Primary health care.

RESUMEN

Objetivo: Evaluar cómo se está manejando la carga impuesta por la diabetes tipo 2 en el sistema de salud mexicano en comparación con la realidad de América Latina. **Métodos:** Se realizó una búsqueda bibliográfica en PubMed/Medline, SciELO y LILACS. **Discusión:** La reforma de la salud en México con el Seguro Popular se señaló como una referencia para los países con todos los niveles de recursos. Aunque hay lugar para el progreso, los resultados de un análisis comparativo que evaluó los efectos de este proyecto han mostrado una mejora significativa en el acceso a los cuidados de la salud, el control de la glucemia y la reducción de los gastos de su bolsillo. Además, se están tomando medidas adicionales, como incentivar a los sistemas de salud para que adopten las medidas necesarias para garantizar la calidad de vida de las personas con diabetes. **Conclusión:** Se debe dar atención a la concienciación de la diabetes y sus complicaciones asociadas, con el fin de alentar a la población a desarrollar hábitos de vida más saludables y mejorar el cumplimiento del tratamiento.

Palabras clave: Diabetes *mellitus* tipo 2. América Latina. México. Prevención y control. Atención primaria de la salud.

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INTRODUCTION

Diabetes is a chronic disease, currently affecting about 415 million adults worldwide, of which 11% are Latin American[1]. The global intensification of diabetes has been associated with overweight, sedentary lifestyle, and the aging of the population. Besides, Latin Americans have a genetic propensity to develop insulin resistance and abdominal obesity, which, together with several cultural and socioeconomic factors, stimulates the progression of type 2 diabetes mellitus (T2DM)[2].

As a result of the fast developmental growth and demographic changes, Latin America has witnessed an epidemiological transition in the last decades. During this period, economic progress has promoted a remarkable increase in the consumption of high energy-density food as a substitute for healthier alternatives. As a consequence, chronic diseases have replaced infectious diseases and become the leading healthcare problem in this region[3]. Far from being solved, the global prevalence of people with diabetes in Latin America is projected to increase by 65% in 2030[4].

Mexico is one of the most affected Latin American countries, with an estimated diabetes prevalence of 14.7% among adults between 20 and 79 years of age. Notably, the International Diabetes Federation (IDF) predicts that there are still almost four million people with undiagnosed diabetes[1]. From 2002 to 2013, diabetes rose from the third to the second leading cause of death in Mexico, preceded by cardiovascular diseases[3,5]. Cardiovascular diseases and diabetes are closely related and constitute independent risk factors for each other. Besides, diabetes is usually associated with other cardiovascular risk factors, mostly overweight/obesity and hypertension. As a result, people with T2DM are more prone to developing life-threatening health problems such as cardiovascular and kidney diseases, retinopathy, and infections, among others. These conditions contribute to the decline of patient's quality of life and to the increase of healthcare costs.

Despite the burden of disease, up to now limited financial resources have been invested by Latin America in diabetes care[6]. In Mexico, the annual expenditure on T2DM in 2011 was estimated at US$ 7.7 billion, of which US$ 3.4 billion were direct costs and US$ 4.3 billion were indirect costs[7]. All the treatment of diabetes and related complications were estimated to cost US$ 3.84 million per day[8]. In addition, the financial requirements needed to provide T2DM healthcare increased 33% between 2010 and 2012[7].

As a result of the aforementioned circumstances, Latin American countries face remarkable challenges in ensuring the prevention and quality care of T2DM. The aim of this review is to assess how the burden imposed by T2DM in the Mexican healthcare system is being managed in comparison with the Latin America reality.

METHODS

A literature search was made in the PubMed/Medline, SciELO and LILACS databases for articles reporting clinical trials, observational studies, current opinions and review articles on diabetes care, treatment guidelines, and preventive actions for T2DM in Latin American countries, particularly in Mexico. In addition to the diabetes estimates predicted by IDF and WHO reports, references provided in governmental Mexican entities, such as Dirección General de Información en Salud and Instituto Nacional de Estadística y Geografia, were also considered.

DIABETES MANAGEMENT STATE-OF-THE-ART

Mexican healthcare systems

In Mexico, most of the population belongs to the public healthcare system and only a small part has private health insurances. The public health system is subdivided in independent organizations aiming to ensure social security. The Instituto Mexicano del Seguro Social (IMSS) is the main national

system providing social security for formal sector workers and their families. More than half of the Mexican population is associated with this institute, which is the biggest of its kind in Latin America[9]. The Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado (ISSSTE) ensures social security specifically for public sector employees. More recently, the government has created a public health insurance, called Seguro Popular, to protect persons that are not covered by any health service, with the goal of reducing social healthcare imbalances. People are enrolled voluntarily regardless of their previous health condition and, importantly, without the need of co-payments; family fees may be considered depending upon their financial capacity. This project was the basis for the health system reform in Mexico. Its progression, which includes the level of covered services and financial support[10], strongly depends on the available funding coming from the state and federal districts[11].

From 2008 to 2013, the number of Seguro Popular beneficiaries increased from 27 to 55.6 million[12]. Analysis of data from National Health Surveys have shown that people who were uninsured in 2001, but had Seguro Popular in 2012, turned out to have better access to healthcare when compared to those that continued without any insurance[13]. Families with diabetes problems enrolled in Seguro Popular also showed less out-of-pocket expenses[14] and better blood glucose levels (glycosylated hemoglobin [HbA1c] ≤ 7%)[15]. Though out-of-pocket expenditure still persists, a drop in catastrophic health expenditures has been apparent since the implementation of Seguro Popular[10].

The successful Mexican experience with Seguro Popular was pointed out as a reference for countries with all levels of resources[10]. Over the last years, healthcare reforms have been occurring in other Latin American countries and some of them, like Chile, Peru, and Colombia, have followed similar patterns to the health system implemented in Mexico[16]. Although different approaches have been implemented, the main goal is the same: universal health coverage is required to improve people's health as provision of healthcare is independent of ability to pay.

Glycemic control: Latin American reality

Studies from other countries[17-20] have demonstrated that glycemic control is crucial for diabetes management. In these studies, intensive blood glucose control in T2DM patients has shown to have a preventive effect regarding the risk of developing diabetes-related complications, in particular microvascular and neuropathic problems. In the UK Prospective Diabetes Study[21], the benefit of glycemic control was still evident after a 10-year follow-up as it reinforced the reduction of microvascular complications and revealed the decline of cardiac infarction and death from any cause. Moreover, it constitutes an important indicator to assess the quality of diabetes care[22].

The level of HbA1c has become the gold standard for monitoring glycemic control in many countries. In contrast to fasting blood glucose (FBG), HbA1c results in an average of plasma glucose and is technically less unstable, and therefore not requiring special preparation[6,23]. Nevertheless, there are some limitations hampering its broad use in countries with scarce resources, such as the costs of HbA1c tests and some clinical conditions (hemoglobinopathies and anemia) that impact HbA1c analysis. As a result, it was accepted by several Latin American physicians and associations that glycemic control evaluation in Latin America is measured through FBG[6]. Regardless of the laboratory measurement adopted, both values (FBG and HbA1c) can be converted into each other in order to facilitate the patients understanding[6].

López-Jaramillo, et al. recently suggested that the reduction of the current cutoff points (such as FBG ≥ 126 mg/dl or HbA1c ≥ 6.5%), accepted by WHO and ADA, to diagnose T2DM in Latin Americans could contribute to a decline in diabetes-related cardiovascular complications[23]. A remarkable example is a study performed with Colombians that has shown that glycemic values > 100 mg/dl are significantly associated with the presence of coronary artery diseases[24]. Several studies have also shown this tendency; however, most of them were not conducted in Latin America, nor were they originally designed to investigate the potential association

between diabetes-related cardiovascular complications and HbA1c or FBG levels. Moreover, the ACCORD trial showed that highly stringent cutoff points to control T2DM (HbA1c < 6.0%) were associated with an increased risk of severe hypoglycemia in older patients and a higher risk of mortality in younger patients[25]. Treatment targets should thus be carefully individualized, taking into consideration the clinical history and diabetes-related complications of each individual. Further investigation is needed in order to re-evaluate the treatment targets for the Latin American population.

Diabetes management in Mexico

In 2000, the Sociedad Mexicana de Nutrición y Endocrinología together with the Asociación de Medicina Interna de México and the Sociedad de Nutriología reported a consensus statement to provide guidelines for the prevention and management of T2DM and its chronic complications.

According to Mexican guidelines, the diagnosis of T2DM can be established by detecting one of the following in two consecutive measurements: (i) a fasting plasma glucose (FPG) concentration > 126 mg/dl; (ii) a two-hour plasma glucose (2hPG) concentration measured after a 75 g oral glucose tolerance test (OGTT) > 200 mg/dl; (iii) a plasma glucose concentration measured during the day > 200 mg/dl; or (iv) symptoms of hyperglycemia. Fasting glucose was the method recommended by the American Diabetes Association (ADA) in 1997, which suggested that the OGTT should not be used as it is more expensive, complex, and less reproducible. Nevertheless, the DECODE study[26] has shown that about one third of the studied population with diabetes (measured by FPG or 2hPG after OGTT or both) would remained undiagnosed when evaluated with FPG only. People diagnosed with diabetes by 2hPG that have body mass index (BMI) < 25 kg/m^2 and BMI > 30 kg/m^2 presented FPG values of 104 and 116 mg/dl, respectively. The presence of T2DM risk factors, in particular obesity, contributes to the lowering of specificity and sensitivity of FPG values. Consequently, it was strongly recommended by the consensus to evaluate the 2hPG after OGTT when the FPG value was between 100-125 mg/dl, particularly in cases associated to T2DM risk factors.

After a diagnosis is confirmed, it is important to evaluate the patient's condition, detect complications, select and adjust treatment, and establish a monitoring program. These steps involve collecting data on medical and familial history focused on the intentional search for symptoms and signs of late complications such as neuropathy, nephropathy, retinopathy, and cardiopathy, among others. Treatment goals should be customized according to the patient's characteristics and lifestyle. The patient should be involved in defining the treatment plan, and be convinced of its benefits when achieving each goal in order to persuade them to follow the plan.

DIABETES TREATMENT AND GUIDELINES

Consensus for the treatment of type 2 diabetes mellitus

In 2010, the Asociatión Latinoamericana de Diabetes (Latin American Diabetes Association, ALAD) organized a consensus between 17 Latin American countries for the treatment of T2DM. Though adjustments had to be made for the Latin America reality, the resulting treatment guidelines were in agreement with the recommendations of the ADA. A treatment algorithm was created from this consensus, mostly to guide primary care physicians through their therapeutic decisions. It establishes the start of the decision making process by dividing the patients into two groups, according to their level of glycemic control (HbA1c < 9% or 240 < FBG ≥ 126 mg/dl vs. HbA1c ≥ 9% or FBG ≥ 240 mg/dl), clinical condition (presence/absence of ketosis), and BMI.

Considering the ALAD consensus guidelines, HbA1c values < 7% are recommended for most of the patients with the goal of potentially reducing the risk of cardiovascular complications. Particular situations, such as young patients without evidence of

diabetes complications, may admit lower HbA1c values (HbA1c < 6.5%)[6].

Up to now, the most cost-effective therapeutic strategy comprises lifestyle modifications and metformin[19,20]. In case of metformin contraindication, one of the following antidiabetic medications should be considered: sulfonylureas, meglitinides, glitazones (thiazolidinediones), acarbose, dipeptidyl peptidase 4 inhibitors, and glucagon-like peptide-1 analogues. On the other hand, if the administration of metformin alone was not sufficient to achieve glycemic control, a combined therapy should be used. The most frequent combination therapy used in Latin America is metformin with sulfonylurea. If the goal of HbA1c control has not yet been achieved, the addition of insulin should be considered, thus making a triple association between these drugs. In primary care practice, the early introduction of insulin or oral antidiabetic drugs should be encouraged so as to delay the adverse effects of hyperglycemia. Nevertheless, any pharmacological therapy should be preceded by lifestyle modification. Of note, this consensus comprises special recommendations for obese patients, which include the implementation of an adequate diet and exercise program complemented by psychological support.

Quality of diabetes care and challenges

According to international and Mexican guidelines[27,28], the quality of diabetes care can be measured by a combination of indicators that include the monitoring and control of diabetes, the detection and prevention of diabetes-related complications, and pharmacological treatment. Data collected in a National survey between 2006 and 2012 have shown that the quality of care provided in the Mexican public healthcare systems was still under 50%[22]. Although the individual indicators of quality care in Mexico follow international trends, preventive and therapeutic actions are particularly scarce. In this study, the use of insulin was associated with the decline of glycemic control and the presence of diabetes-related complications. This is corroborated by the late initiation of insulin therapy in Mexico, which has also been described worldwide[6,29]. In addition, Mexico is one of the countries with the lowest percentage of insulin usage, which might be attributed to insulin costs and management[6,29]. It is well documented that adjustments of insulin dose and daily self-monitoring of blood glucose levels constitute a challenge for both patients and healthcare providers who are reluctant about its prescription[30].

A recent study performed in private practice in nine Latin American countries has shown that most of the patients have diabetes-related complications and poor glycemic control when considering the abovementioned guidelines; only 43.2% had HbA1c < 7.0%[31]. Mexico was ranked in the sixth position of poor glycemic control right after Costa Rica, Argentina, Chile, Ecuador, and Brazil. These results are particularly alarming when considering the higher quality of care and access to medical assistance normally associated with the private healthcare providers in Latin America. Nevertheless, it is important to mention that most of these private health insurances do not cover the reimbursement of the prescribed medication[31], which might hamper patients' treatment adherence.

Other factors that contribute to reducing the quality of diabetes care include the absence of a multidisciplinary clinical approach, limited access to care (especially in more isolated rural areas[10]), and lack of diabetes knowledge by patients and healthcare providers. In Mexico, as in other Latin American countries, diabetes is mostly treated by primary care physicians that are often overworked and need further training to better manage the disease. For instance, physicians in Brazil have assumed to have gaps in disease knowledge and thus did not feel comfortable in instructing diabetic patients[32].

As a complement to treatment guidelines that resulted from the recent ALAD consensus[6], further adequate training for healthcare professionals is therefore necessary[30]. Physicians should be fully equipped to select the best treatment option, implement educational practices for patients, and instruct them to self-monitor and manage their own disease[13]. Most of the patients are currently under treatment (94.1%), yet only a minority comprehends the importance of lifestyle modifications (< 25%)[29].

Results from PEDNID-LA, an educational program implemented in T2DM patients from 10 Latin

American countries, has shown important improvements in the quality of their diabetes indicators after one year[33]. Although only non-insulin dependent patients with no severe complications were selected, this study constitutes a proof-of-concept that reinforces the costs-saving and health benefits of educating the diabetic community. Such education programs are important not only for the patients, but also for their families and for the overall population[30]. The knowledge of the disease contributes to create awareness of diabetes and its associated complications, and might encourage the population to develop healthier lifestyle habits and improve treatment compliance[6,13].

PREVENTIVE AND CONTROL ACTIONS

With the intention of overcoming the continuous escalation of diabetes prevalence, several preventive and control actions have been implemented in Latin America.

Inspired by a successful community-based intervention performed in northern Finland in the 1970s, a Latin American synergy has created the Fundación para la Prevención y Control de las Enfermedades Crónicas no-transmisibles en América Latina (FunPRECAL)[34]. This Foundation was registered in Argentina in 2010, and currently constitutes a strong network operating throughout the Latin American region, together with Brazil, Colombia, Cuba, Ecuador, Guatemala, Mexico, Paraguay, Peru, and Uruguay.

The FunPRECAL has established partnerships with universities and public and private health entities, aiming to promote effective preventive strategies among healthcare professionals acting in this region. A remarkable example is the DEMOJUAN project, implemented by the Health Research Centre (CIIS Ltd) in Barranquilla, Colombia[35], and funded by the IDF via a BRIDGES grant sponsored by Lilly Diabetes. Through this project, the Finnish diabetes risk questionnaire (FINDRISC) was applied in this community, with the purpose of identifying people at high risk for diabetes. Identifying people at high risk for diabetes will allow implementing measures for lifestyle modification that prevent the progression of the disease.

Other interesting FunPRECAL projects are the Exercise is Medicine® courses, which aim to provide adequate training for healthcare professionals about the benefits of prescribing physical activity[34,36]. This task force has already been implemented in several Latin American countries including Mexico.

Technological innovations have also been implemented in Latin American countries to improve self-care and management of chronic diseases[37]. Considering that, in Mexico, around 80% of families have cell phones and around 30% have Internet access, the use of technological applications is a cost-effective and accessible way to enhance the quality of healthcare provided[38]. Automated monitoring and self-care support calls are examples of successful applications already tested in Honduras, Mexico, and Bolivia. Also worth mentioning is the Diabediario that is part of the CASALUD program, which was implemented in Mexico with funds from the Carlos Slim Health Foundation[8]. This low-cost healthcare application is a diabetes diary that helps patients to control their disease by controlling for treatment compliance and avoiding complications.

In Mexico, the healthcare reform also triggered the implementation of health community programs[39]. In collaboration with the private sector and society, the Mexican government has implemented a national strategy for preventing and controlling the major risk factors for diabetes, which are overweight, obesity, cardiovascular diseases, and physical inactivity[40]. Table 1 summarizes some of the important preventive actions established by the government.

Differences between Mexican regions in terms of chronic disease concerns have led to the implementation of distinct preventive actions. For instance, Mexican northern border states are affected by a higher prevalence of obesity[41], hypertension[42], and rates of mortality due to ischemic heart diseases[43] when compared to central and southern regions. In this context, the Sonora region has implemented two health promotion programs called *Meta Salud*

Table 1. Important preventive actions towards overweight, obesity and diabetes recently taken by the Mexican government

Action	Main goal
Acuerdo Nacional de Salud Alimentaria (ANSA, 2010)[40]	Prevent overweight and obesity involving actions mainly directed to minors of age, such as[44]: • Promotion and health education (nutrition literacy) through enriching the content on free textbooks with issues of food orientation, healthcare and physical activation, which will be supported by audiovisual, print, and electronic educational materials. • Promoting regular physical activation, which must incorporate at least 30 minutes of moderate, at the beginning, physical activity in the classroom and active recreation. • Access and availability of healthy foods and drinks that provide proper nutrition and could be distributed in schools.
Agreement for the dispensing or distribution of selected food and beverage for consumption in basic education schools (2010)[40]	Promote healthy eating habits favoring a correct diet for the prevention of overweight and obesity.
Consejo Nacional para la Prevención y Control de las Enfermedades Crónicas no Transmisibles (CONACRO, 2010)	Help to establish inter-agency mechanisms for prevention and control, as well as instruments able to quickly address, in an organized and effectively way, the needs of healthcare generated by non-communicable diseases in the affected population.
Integrated programs for prevention by the *Instituto Mexicano de Seguridade Social* (PREVENIMSS, since 2002)[40] and by the *Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado* (PrevenISSSTE, 2010)[40]	Develop actions at the primary care level to prevent, detect, and promote an early diagnosis of a comprehensive range of health issues, including diabetes mellitus and obesity.
Law on food assistance for workers (2011)[40]	Improve workers' nutritional status to prevent diseases linked to poor diet and thus protect their health in the working environment.
General law of physical culture and sport (2013)[40]	Educate and train human resources for promoting and implement physical activity and related events in several environments, such as in basic education schools and in public and recreational spaces.
Program: *5 Pasos*[45]	Promotes behavior changes to adopt healthy habits with only 5 actions: 1. Be active 2. Drink water 3. Eat vegetables and fruits 4. Measure yourself 5. Share

and Es *Tiempo ¡Cuídate!* organized by the Center for Health Promotion in Northern Mexico and the ISSSTE del Estado de Sonora, respectively. The first program, *Meta Salud*, consists in a community health workers-based intervention for primary prevention of chronic diseases including diabetes, which was adapted from a program applied to Hispanic people living in USA called *Pasos Adelante*. It comprises 13 weekly educational sessions plus a set of physical activities to promote self-preventive skills and the motivation needed to develop healthy habits. The latter, *Es Tiempo ¡Cuídate!,* was

a five-month program aiming to monitor chronic degenerative diseases among the affiliated ISSSTE workers of the Sonora state.

CONCLUSION

The increased prevalence of T2DM in Latin America is indisputable, particularly when considering that this population has a genetic propensity to attain insulin resistance and abdominal obesity. As a result, Latin American countries are facing remarkable challenges to ensure prevention, quality of care, and health access in diabetes.

Mexico is one of the most affected countries in this region, with diabetes currently leading the causes of death in the country. The successful healthcare reform experienced in Mexico, by the implementation of Seguro Popular, was pointed out as a reference for countries with all levels of resources. Comparative analysis to evaluate the effects of this project have shown a significant improvement regarding the access to healthcare, the control of blood glucose, and the reduction of out-of-pocket expenses.

Despite the Mexican progress regarding the treatment of diabetes, there is still place for improvements. The quality of care provided in the public healthcare systems and the glycemic control observed in private systems are still under 50%. The poor glycemic control is related with diabetes-associated complications and both, in turn, are associated with the late initiation of insulin. Though treatment guidelines recommend the early introduction of insulin, its use is hampered mainly due to costs and management.

The cost-effectiveness management of diabetes is strongly related with the prevention and control of the disease so as to avoid the development and progression of its complications. In this context, healthcare systems are being challenged to accommodate the necessary measures to guarantee the quality of life of people with diabetes. This includes the education of healthcare professionals, patients, and society in general in order to enhance their diabetes knowledge.

Further studies focusing on the Latin American population should be performed in order to improve the current treatment guidelines and goals, aiming to select the best treatment option. Finally, it is essential to keep raising awareness of diabetes and its associated complications, which might encourage the population to develop healthier lifestyle habits and to improve treatment compliance.

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