





# In the “eye” of diabetes

Diabetes mellitus is considered one of the most threatening chronic diseases of the 21st century. If not treated correctly, patients can suffer damage to various organs, including the eyes. A recent study by Universidad del Rosario found that the cornea, in addition to the retina, also deteriorates in cases of diabetes. In patients with Type 1 diabetes, the cornea is damaged faster than that in patients with Type 2 diabetes.

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Photos 123RF, Milagro Castro

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**T**his seems to be a priority in health. According to the World Health Organization’s (WHO) [World Vision Report 2020](#), the eyes are the fourth most affected organ due to various diseases, including diabetes mellitus. However, this report only refers to the retina as the only tissue whose alteration can lead to blindness in diabetic patients. But why is the retina more relevant than the cornea in this chronic disease?

For [Diana Patricia Amador](#), Professor of the School of Medicine and Health Sciences of Universidad del Rosario and PhD in Physiology, the answer lies in the relevance given to the cardiovascular and neurological impact to our body. The damage caused by the excess of glucose or “sugar” in the blood (also known as hyperglycemia) significantly affects the blood vessels and the nervous tissue.

Although the deterioration caused by diabetes is not known in detail, if we add other variables, it could lead to more corneal transplants to diabetic patients; a transplant is an extreme measure for the health care system.

These two systems are the mainly affected in other types of diseases, such as hypertension or kidney failure.

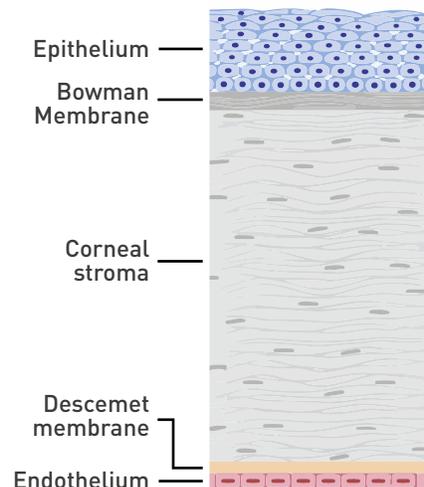
As Dr. Amador mentions, “guidelines for clinical practice worldwide do not stipulate that a medical check-up for a diabetic patient must include the evaluation of the endothelium and corneal pachymetry (medical exam that measures the thickness of the cornea).” She also states that the idea of a degeneration in the cornea as a secondary aspect came to light just a few years ago, but there is still a need of more research and prevention programs on the matter.

According to the International Diabetes Federation (IDF), by the year 2021, there were 537 million people with some type of diabetes in the world. It is estimated that there will be around 643 million by 2030. These figures are especially alarming because of the exponential increase in diagnoses. Developing countries are greatly affected by this disease, mainly due to the lack of regulation on food with high concentration of saturated fats and sugars, the lack of nutritional education, and access to certain healthy foods. In addition, there are high rates of sedentary lifestyles, alcohol consumption, and illicit drug use.

The problems caused by diabetes begin in the pancreas, where humans produce insulin, the hormone responsible for using the glucose from food as an energy source for all systems, organs, and tissues to work properly. When insulin is not produced, glucose accumulates in the blood, which, over time, leads to hyperglycemia and generates vascular and neurological damage, among others. Currently, the WHO recognizes three types of diabetes mellitus: gestational, Type 1, and Type 2 (see chart).

## What is diabetic keratopathy?

Human beings are born with a corneal endothelial cell density of up to a maximum of 7,500 cells per mm<sup>2</sup>, and the loss of this density over the years, at a rate of around 0.56 percent per year, is normal. But we are still in need of more information about this deterioration for diabetic patients.

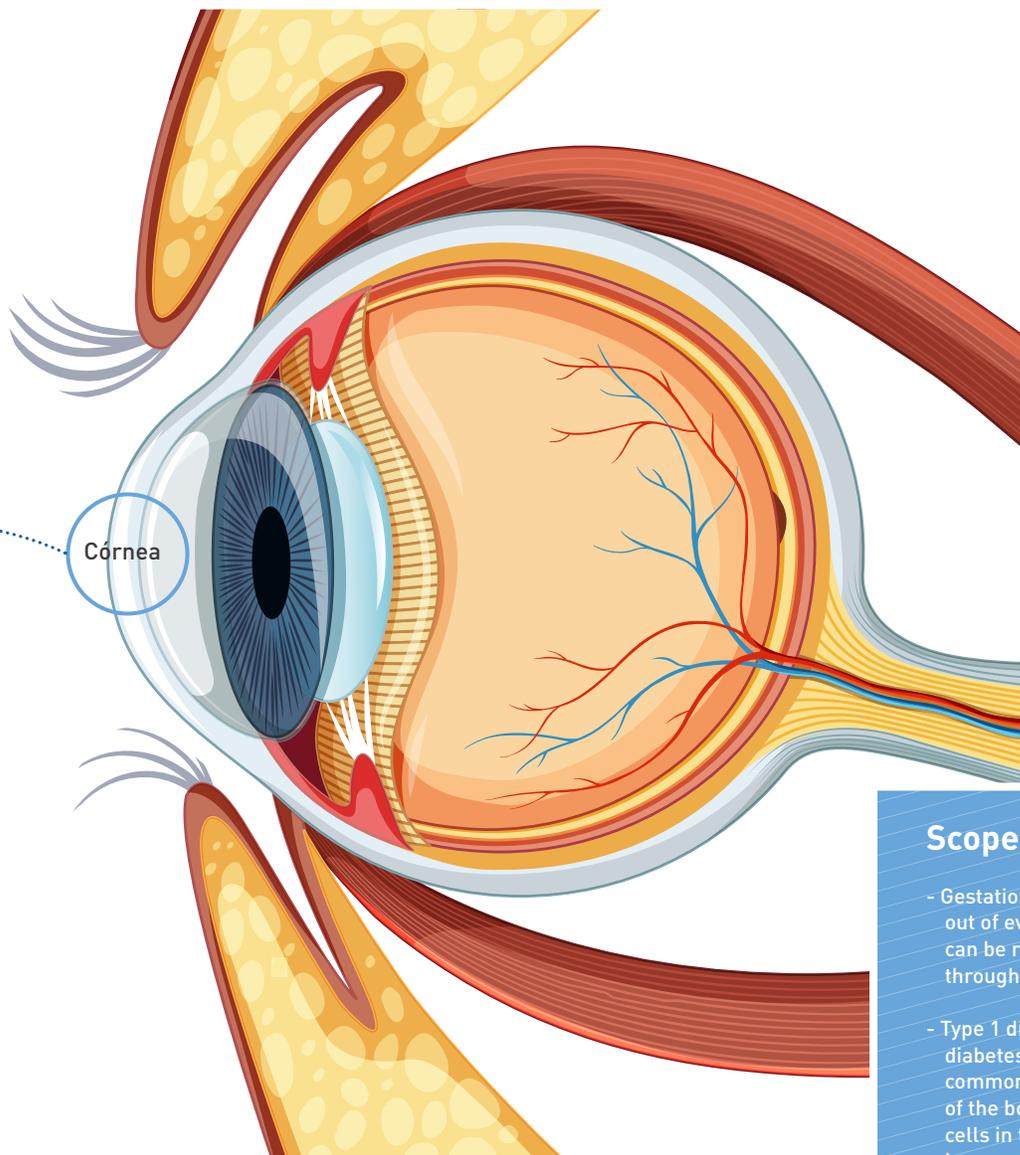


Patients with diabetes may experience this progressive cell loss due to hyperglycemia, which directly affects the endothelial cells of the cornea. These cells are not designed to control or metabolize it and, therefore, must work harder, thus producing large amounts of toxic waste that damages the cells and can even cause their death.

### Pioneering research

Despite the fact that diabetes is considered one of the most lethal chronic diseases of the 21st century, scientific studies on the subject suggest that we still do not have enough information to prevent, treat, and improve the medical prognosis of patients suffering from it or of those at risk of developing it. However, in a recent study conducted by the Neuroscience Research Group (NeURos) of the School of Medicine and Health Sciences of Universidad del Rosario and published in *Cornea*, it was found that a stronger progressive deterioration in corneal endothelial cells appeared in patients with Type 1 diabetes compared with patients with Type 2 diabetes.

Dr. Amador explains that humans are born with a corneal endothelial cell density of up to a maximum of 7,500 cells



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The researchers began by focusing on cases of Type 1 diabetes because it is a disease that generally appears at an early age and has a more severe metabolic impact, therefore requiring more medical monitoring and follow-up.

But as the study progressed, they ran into a major hindrance: they found no records of Latin American or Colombian patients aged 0 to 5 years with Type 1 diabetes or corneal injury, which forced them to limit the study group to a population of children over 8 and young adults diagnosed with type 1 diabetes, who had a study or analysis of the corneal endothelium.

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### Scopes of diabetes

- Gestational diabetes mellitus, which occurs in 1 out of every 6 births worldwide, is treatable and can be reversed after delivery or be prevented through timely obstetric care.
- Type 1 diabetes mellitus, also known as "juvenile diabetes" because it mostly affects children, is commonly caused by an autoimmune response of the body that attacks the insulin-producing cells in the pancreas, thus preventing the hormone from executing its function. Hence, the organs trigger alarm signals due to lack of energy. According to data from the IDF, in 2021, about 651,000 cases of type 1 diabetes were diagnosed in children between zero and 14 years of age worldwide.
- On the other hand, type 2 diabetes mellitus, the most common one among adults, accounts for as much as between 90% and 95% of people suffering from this disease. These patients mainly suffer from hyperglycemia, with the distinction that the organs force the pancreatic cells to produce more insulin, causing them to become overworked and eventually die. Meanwhile, the glucose that cannot be used remains in the blood stream and, if it reaches high levels, can be dangerous if not treated timely and properly.

“I was surprised (for the case of Colombia) about the fact that we did not find any data on diabetic patients in terms of quantification of any of the corneal assessment criteria, since there are at least eight. Unfortunately, there was not a single document with these specifications, or with reports of pachymetry, endothelial count, or cellular variability... nothing,” says Dr. Diana Patricia Amador. For this reason, the study group collected data from 367 patients with Type 1 diabetes and 2,136 patients with Type 2 diabetes from human studies around the world, all of them with endothelial measurements and pachymetry studies.

The researchers’ conclusion after their analysis is that patients with Type 1 diabetes have greater cell loss in endothelium and corneal thickening than patients with Type 2 diabetes, regardless of age and gender. In oth-

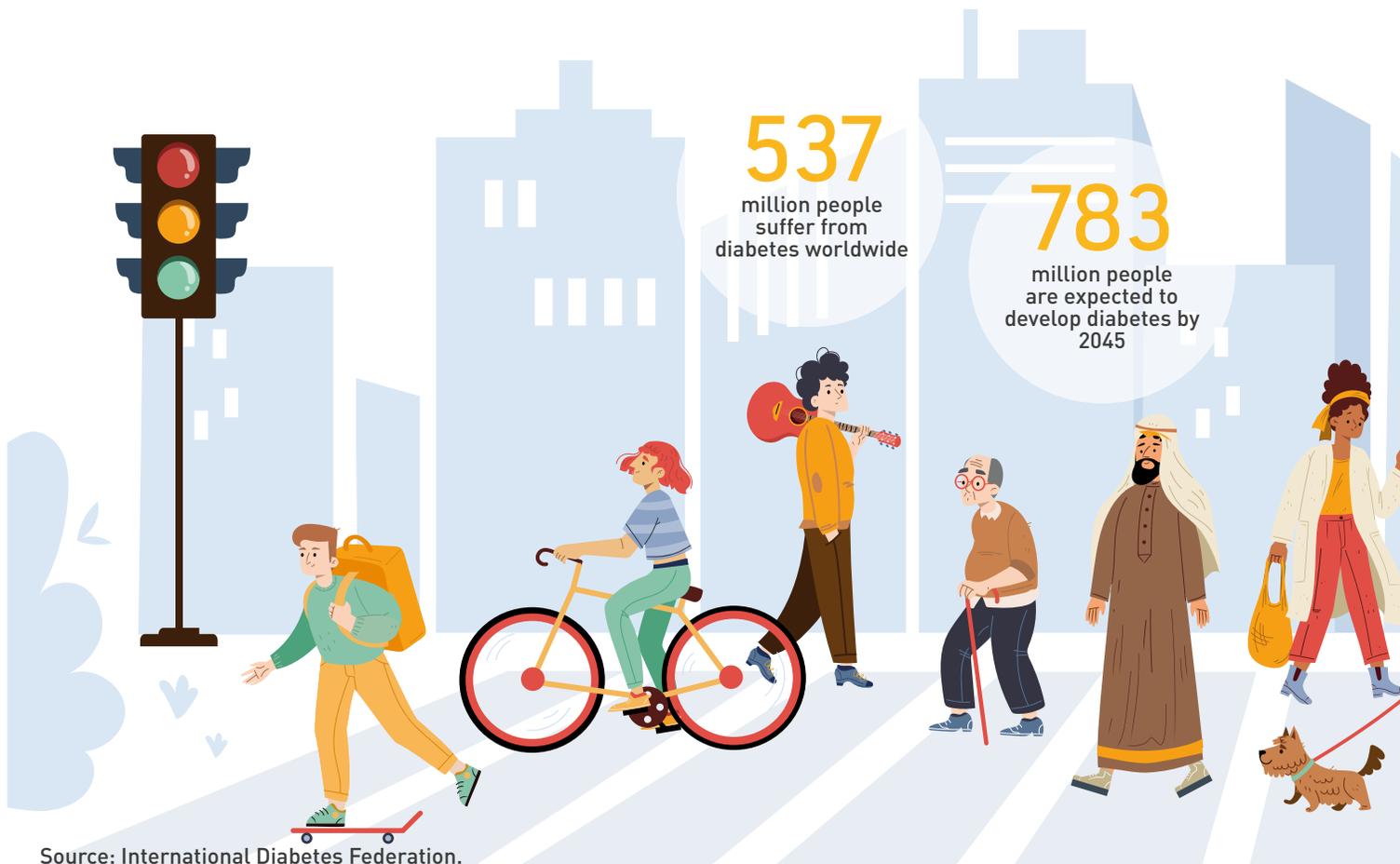
er words, the cornea is damaged faster in the former group to the extent that there is a high probability that by the age of 30, patients with Type 1 diabetes will have the cornea of a 75-year-old or with such a level of opacity as to imply the need of a corneal transplant.

For the leader of the research group, “the idea is that not only the retina should be checked, but also the cornea, and that the degrees of damage should be identified as much as possible to prevent or delay of a corneal transplant.”

The heart of the matter lies in the fact that although the deterioration caused by diabetes is not known in detail, if we add other variables, it could lead to more corneal transplants to diabetic patients; a transplant is an extreme measure for the health care system.

Dr. Amador states that “It would be ideal to be more prepared, from the point of view of the healthcare staff, to face this impact that perhaps we have not yet identified in a very efficient way.”

## An unstoppable disease



In Colombia, the IDF recorded, for 2021, close to 3,200 cases of children between the ages of 0 and 19 with Type 1 diabetes mellitus; of these, there are no reports of keratopathy diagnosis or evolution, which is a cause for alarm since no long-term projections can be made to prevent harm to the visual health of diagnosed patients when they enter young or old age.

Currently, this study on diabetic keratopathy is under continuous and collaborative development by the NeURos Research Group together with other Colombian institutions, “and we hope that this is not the first and last to be conducted in the country on this subject,” concludes the expert. ▣



Diana Patricia Amador, researcher of the Escuela de Medicina y Ciencias de la Salud (School of Medicine and Health Sciences) of Universidad del Rosario, explains that “guidelines for clinical practice worldwide do not stipulate that a medical check-up for a diabetic patient must include the evaluation of the endothelium and corneal pachymetry (medical exam that measures the thickness of the cornea).”

32

million people, approximately, live in South and Central America

42%

(around 13 millions) of adults between 20 and 79 years old are undiagnosed.

3,5

million cases of diabetes mellitus are currently present in Colombia and it is expected that by 2045 there will be 5,014,000

