

## CLINICAL UPDATE

## Lifestyle changes can prevent the development of diabetes mellitus

Tuomilehto J, Lindström J, Eriksson JG, Valle TT, Hämäläinen H, Ilanne-Parikka P, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med* 2001;344:1343-50.

**Background:** People with impaired glucose tolerance are at high risk for type 2 diabetes mellitus.<sup>1</sup> There is evidence that lifestyle changes, such as increased exercise and weight loss, may prevent the development of diabetes.<sup>2,3</sup>

**Question:** Are lifestyle changes effective in preventing type 2 diabetes mellitus in subjects with impaired glucose tolerance?

**Design:** A group of Finnish investigators randomly assigned 522 overweight subjects with impaired glucose tolerance to either a lifestyle-intervention group ( $n = 265$ ) or a control group ( $n = 257$ ). Randomization was stratified by centre, sex and mean plasma glucose level 2 hours after a 75-g oral glucose challenge (7.8–9.4 mmol/L and 9.5–11.0 mmol/L). The subjects in the intervention group were given dietary goals of a weight loss of 5% or more, reduction of fat to less than 30% of energy intake and an increase in dietary fibre to at least 15 g per 1000 kcal). To achieve these goals, the subjects met with a nutritionist 7 times in the first year of the study and then quarterly. They were also given guidance on increasing their level of aerobic exercise and were offered a supervised circuit-training program, with an exercise goal of at least 30 minutes per day.

Subjects in the control group received general oral and written information about diet and exercise at baseline and at annual visits. Laboratory and nursing staff were blinded to the patient assignments, but staff members involved in counselling and exercise programs were not. Data were analyzed using an intention-to-treat principle.

**Results:** The subjects were middle-aged (mean 55 years) and obese (mean body mass index 31.2), with a mean fasting plasma glucose level of 6.1 mmol/L and a mean 2-hour post-challenge glucose level of 8.9 mmol/L. The subjects were followed for a mean of 3.2 years. Of the 86 new cases of diabetes diagnosed during follow-up, only 27 occurred in the intervention group. The cumulative incidence of diabetes at 4 years was 11% in the intervention group and 23% in the control group. Cox regression analysis showed that the cumulative incidence of diabetes was 58% lower in the intervention group than in the control group (hazard ratio 0.4; 95% confidence interval 0.3–0.7). Weight, waist circumference, plasma glucose and insulin levels 2 hours after the glucose challenge, and triglyceride levels were all significantly lower in the intervention group than in the control group. A lifestyle change “success score” of 0 to 5 was calculated for all subjects (5 representing the greatest success), and there was a strong inverse correlation between this score and the development of diabetes.

**Commentary:** This is the first large, randomized study to demonstrate that

lifestyle interventions can delay the development of type 2 diabetes mellitus. The impressive reduction in the incidence of diabetes was achieved with modest weight loss (mean 3.5 [standard deviation 5.5] kg over 2 years) and exercise in the intervention group. The rate at which diabetes developed among the subjects who did not achieve any of the lifestyle goals (38% of 13 in the intervention group and 31% of 48 in the control group) was consistent with findings from previous studies of impaired glucose tolerance.<sup>4</sup>

**Practice implications:** Institution of a well-designed dietary and exercise program can delay the development of type 2 diabetes mellitus in high-risk individuals. Whether the results of this study can be achieved in a primary care setting remains to be seen. On the basis of these results, physicians should recommend such programs to patients with impaired glucose tolerance. — *Kathryn A. Myers*

The Clinical Update section is edited by Dr. Donald Farquhar, head of the Division of Internal Medicine, Queen's University, Kingston, Ont. The updates are written by members of the division.

## References

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