

# The Deadly Sins and Diabetes

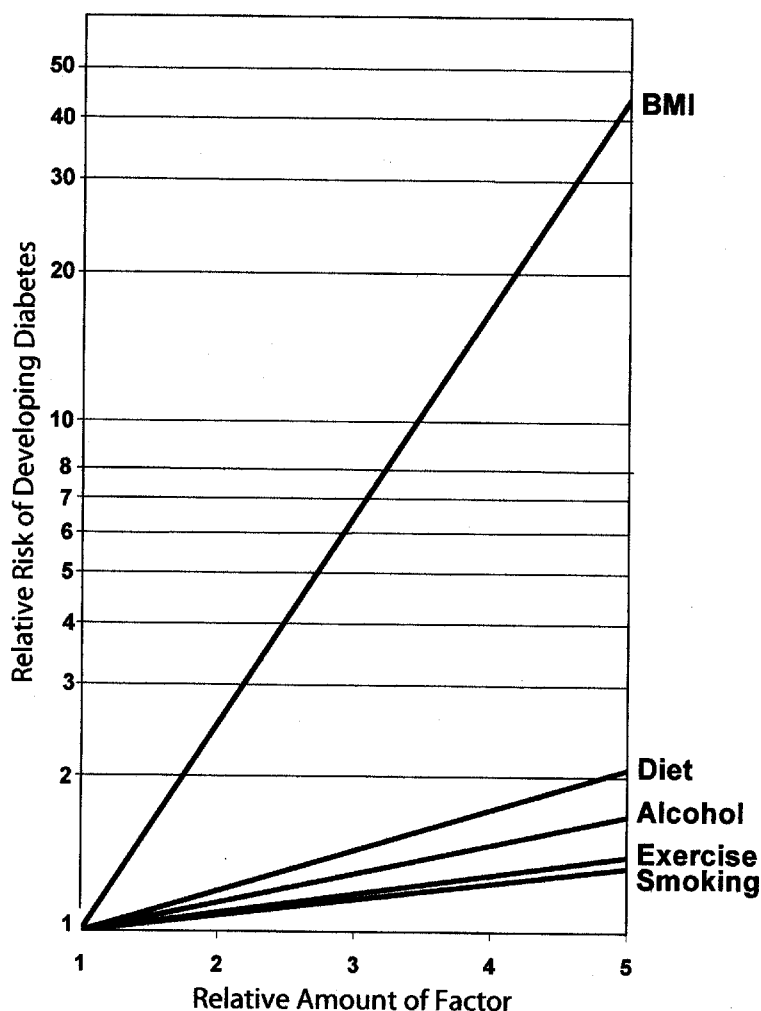
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**T**HE EXCESSIVELY HIGH blood sugar that characterizes all forms of diabetes mellitus imposes an enormous medical and financial burden on those who suffer from the disorder and, increasingly, on those who help underwrite the chronic problems that derive from persistently high blood sugar: heart attack, stroke, vascular insufficiency and amputation, blindness, kidney failure, nerve damage. Over the past 20 years, the death rate attributable to diabetes has increased by over 30% in this country, while that due to cardiovascular disease, stroke, even cancer, has declined.<sup>1</sup> The rise in death rate is largely due to the marked increase in prevalence of type 2 diabetes. The preponderance (better than 20 to 1) of type 2 diabetes over type 1 means that it produces the vast bulk of the disease burden. I will focus my comments here on type 2 diabetes.

## What "Causes" Type 2 Diabetes?

Family studies confirm that genetic susceptibility lies behind the development of type 2 diabetes.<sup>2</sup> These genetic factors are still only dimly perceived, and one of the anticipated benefits of the "genomic revolution" that is transforming medical science will be the clear definition of these genetic factors. I expect that in a not-too-distant future we will look back on our present state of imperfect knowledge as a quaint parallel of the way doctors once looked at "fever" as an entity in itself, rather than a surface reflection of a whole host of disparate underlying diseases.

Still, no matter what genetic research reveals to us in the future, no one doubts that so-called "lifestyle factors" (mainly what we eat and how much, and how little we exercise) fuel the rising epidemic of type 2 diabetes in North Carolina and



**Figure 1.** Relative influence of lifestyle factors on the development of type 2 diabetes (calculated from data provided in reference 3). Note the logarithmic scale of the ordinate; the abscissa represents increasing degrees of deleterious factors (increasing Body Mass Index; high-fat, low-fiber diet; abstinence from alcohol; lack of exercise; smoking of cigarettes).

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around the world. The role of these factors is clearly demonstrated in a paper by Hu et al.<sup>3</sup> These authors followed nearly 85,000 healthy female nurses from 1980 to 1996. None of the subjects had diabetes or other chronic disease at the start but, over the ensuing 16 years, 3300 of them developed type 2 diabetes. Five lifestyle factors were correlated with an increased risk of developing diabetes: overweight (defined as a body mass index or BMI above 25); eating a diet high in fat and low in cereal fiber; abstaining from alcohol; exercising for less than 30 minutes daily; and smoking cigarettes. The relative risk contributed by each of the factors is shown in Figure 1. BMI (body weight in kilograms divided by the square of height in meters) was far and away the most important of these risk factors. Women with a BMI greater than 35 had a nearly 40-fold increased risk; even those with a BMI in the “high-normal” range (23–25) had nearly three times the risk of those with BMI under 23. A high BMI probably reflects poor eating and exercising habits, but these factors independently contributed to a modestly increased risk. Cigarette smoking increased the risk of diabetes (just another nail in the coffin of cigarettes), but—and this was surprising—moderate and consistent alcohol intake (about one drink per day) appeared to have a protective effect.

The data of Hu et al. and a multitude of other researchers make a clear point: Type 2 diabetes develops in persons with genetic susceptibility who eat too much and exercise too little.

### How should We Treat Type 2 Diabetes?

Nathan<sup>4</sup> recently summarized current thinking about the treatment of type 2 diabetes. He presents a graphic representation of what most clinicians have come to accept as the standard time-course: (1) Diabetes is diagnosed four to five years after actual onset, and the patient is told to “diet and exercise”; no other help is provided and it is assumed that the advice will fail. (2) Five to 10 years after onset, an oral hypoglycemic drug is prescribed, and it “works” briefly. (3) Ten to 15 years after onset, continuing hyperglycemia leads to simultaneous administration of multiple hypoglycemic drugs, which “work” briefly. (4) Fifteen to 20 years after onset, insulin is prescribed, but long-term complications are already present. (5) After 20 or more years, the patient succumbs. Implicit in this commonly accepted sequence is the assumption that it represents an inexorable progression. Each step is transiently effective—except the first (change of lifestyle), which is assumed almost never to work. Some authorities, considering the health risks of too-long elevated blood sugar, even recommend using insulin immediately and forgoing all other medications.

I do not challenge this gloomy picture, but I believe that the problem lies mainly with the health profession’s willingness to accept the “impossibility” of lifestyle change. Difficult, yes; but much too often our failure to help patients

lose weight, to exercise more, to change their lives, is the self-fulfilled outcome of a deep-seated belief that change is beyond the pale. In fact, weight loss, right eating and regular exercise are the sine qua non of treatment in type 2 diabetes. If we allow this to fail, all else fails too. That is not to say that doctors do not give lip service to the importance of these things; they do, but in their heart of hearts, they believe that no one can ever really change how they live. That belief induces a powerful nocebo effect, one that ensures failure and bolsters doctors’ misplaced certitude about the correctness of their prejudice. I say again, without true and lasting change in eating and exercise, all other treatment is mere delaying action, expensive but ultimately futile. Why so?

### We Can Prevent or Undo Type 2 Diabetes

Two recent and carefully executed studies have shown that the onset of type 2 diabetes can be delayed or prevented. The investigators of the Diabetes Prevention Program Research Group<sup>5</sup> randomly assigned over 3000 persons at risk of diabetes (because of elevated blood sugars, both fasting and after a glucose load) to treatment with placebo, or with metformin, or to a closely monitored program of exercise (150 minutes of physical activity weekly) and weight loss (a planned 7% decrease in body weight). The study was halted one year early (after an average of less than three years of observation) because the results were so clear-cut: diabetes developed at the rate of 11, 7.8, and 4.8 cases per 100 person-years in the placebo, metformin, and lifestyle groups, respectively. Compared to the placebo group, the incidence of diabetes was reduced by 58% in the lifestyle group and 31% in the metformin group. These highly significant differences led to cessation of the study because it was considered unethical to withhold treatment to the placebo group.

Profound as these effects were, they do not accurately reflect the power of lifestyle modification because analysis was based on intention to treat. That is, individuals were counted as being in their assigned group whether they adhered to the treatment program or not. Only half the participants in the lifestyle group actually achieved the goal weight loss at one year, and some members of the metformin and placebo groups, who were given written advice about healthy living, did decrease their daily calorie intake while in the study. These results will blur the distinction between placebo, metformin, and lifestyle modification groups.

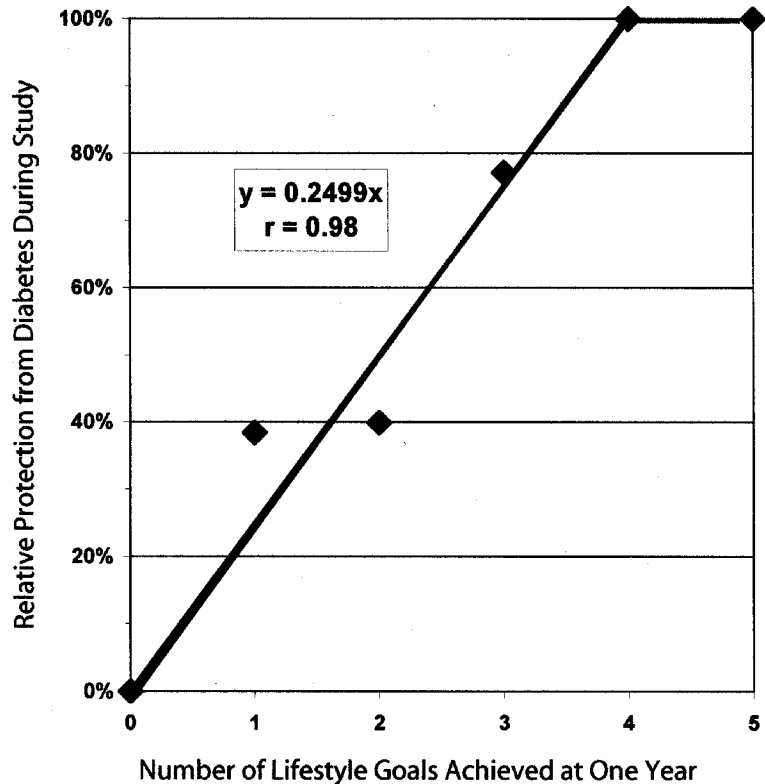
Better information about the power of lifestyle intervention is available in a study from Finland.<sup>6</sup> Tuomilehto and colleagues randomly assigned over 500 patients at high risk of developing type 2 diabetes to either a control group given general information about diet and exercise, or to an experimental group given continuing supervision and instruction in five program goals: (1) decrease body weight by 5%; (2) limit total dietary fat intake to 30% and (3) saturated fat

to 10% of calorie consumption; (4) increase dietary fiber intake to 15 g/1000 kcal; and (5) engage in moderate exercise for 30 minutes daily. The trial was ended prematurely at the time of first data analysis because of a highly significant 58% reduction in the incidence of diabetes in the experimental group (32 cases per 1000 person years, compared to 78).

Once again, data were analyzed on the basis of intention to treat, which, as state above, obscures the real power of lifestyle modification to prevent the onset of diabetes. Not everyone in the experimental group actually did what they were advised to do, and some of those in the control group took the general advice they were given to heart and modified what they ate and how they exercised. But we can get some idea about this effect. At the end of one year in the study, Tuomilehto et al. assessed how well their subjects complied with the five recommendations about eating and exercise. The remarkable thing is that none of the subjects who, at the end the first year, had achieved the stated goals developed diabetes during the duration of the study (up to six years; mean 3.2 years). *None!*

From the data provided by Tuomilehto et al, I have calculated the relative protection from diabetes afforded by adhering to one or more of their lifestyle goals (it is not possible to specify from the data provided which, if any, factors are more important, but I doubt that they are all equally protective). The slope of the line calculated to fit the data (Figure 2) implies that achieving one lifestyle goal reduces the likelihood of developing diabetes by about 25%, two goals, 50%, etc. These goals are *not* staggeringly difficult to achieve—and we need to stop acting like they are. For example, to reach these goals, a 250-pound, 70-inch-tall person would have to lose 12.5 pounds over a year, devote 30 minutes a day to walking, be careful to limit the intake of total and saturated fats, and get sufficient fiber. That is not a high price to prevent the gruesome effects of diabetes.

Finally, not only can type 2 diabetes be prevented, it can be rendered invisible (it is difficult to say “cure” when talking about a genetically based disorder). From personal, daily experience with the stringently calorie-restricted (800–1000 kcal/day), ultra-low fat (5%–10% of daily energy intake) Rice Diet, I know that not only can impaired glucose tolerance (so-called “pre-diabetes”) be reversed by a program of diet and exercise, but even long-established and insulin-treated type 2 diabetes can entirely recede from detectability. In many cases, blood sugars return to normal within days of starting to eat and exercise properly, and oral drugs or insulin (if they have been in use) must be markedly curtailed or stopped entirely. These beneficial effects on blood sugar precede any



**Figure 2.** Relative protection against development of type 2 diabetes afforded by adherence to up to 5 prescribed lifestyle goals: 1) loss of 5% of body weight; 2) limitation of dietary fat and 3) saturated fat; 4) increased dietary fiber intake; 5) 30 minutes of daily exercise (calculated from data provided in reference 6; it is not possible to ascertain whether some factors were more protective than others). Adherence to protocol was assessed at one year after enrollment, but duration of protection extended for up to five years.

substantial weight loss; they begin *as soon as the patient starts living properly*. But when weight loss does occur and is maintained, the effects on type 2 diabetes appear quite durable—certainly for as long as I have been able to observe such patients (up to five years).

## Can We Really Do Anything About Type 2 Diabetes?

Here are the premises: (1) Lifestyle factors—too much high-fat, low-fiber food and too little exercise—explode a genetic time-bomb carried by a large percentage of all humans (with racial and familial variations in the exact percentage). Without an external detonator, clinical diabetes does not appear or persist. (2) Drugs, even insulin, are doomed to ultimate failure in treating type 2 diabetes because they do not attack the root cause of the problem. They may make things look a little better for a while, and they make drug companies and doctors a little richer, but they do not get at the fundamental cause.

If those premises are correct, health professionals and health policy planners need to look with radically new eyes at ways to modify those deleterious factors. The lack-of-information part of the problem is relatively easy. We have known about the dangers of immoderate and lazy living for millennia; certainly from before the 6<sup>th</sup>-century lifetime of St. Gregory, who cataloged the Seven Deadly Sins: Pride, Envy, Lust, Anger, Greed, Gluttony, and Sloth. The last two lead directly to our present plight. So it is not a matter of knowing what the problems are, it is a matter of doing something about them. And if centuries of preachers have not eliminated “sinful” behaviors, will decades of doctors do better by calling them “unhealthy” behaviors? Well, maybe—at least we will need to give it a try. I suspect that we will have to figure out more compellingly coercive means of motivation than mere moral suasion, some of which may sound downright Draconian. I give here my list of potential measures.

**1. Education.** We need to begin and continue a relentless barrage of information about the way the body works. Most of our citizens remain deeply ignorant of human anatomy and physiology (witness the popularity of “alternative” treatments and quack cures), of the nature of probability and the complete absence of certainty in medicine, of the long-term consequences of seemingly small incremental risks to health. We need to educate all citizens about the nature of healthy eating and living, and we need to do this over and over again. So called “fast food” companies have made a fortune out of obscuring such risks. This will require government-level programs designed to educate the entire populace and couched in language understandable by all.

**2. Behavior Modification.** Commercial food vendors have invested fortunes in ways to induce certain behaviors (such as buying?and eating?more than we need of less than healthy foods). Their activities, which bear a deep resemblance to the behavioral techniques of operant conditioning, bring in profits vastly in excess of their investments. So it is unlikely that they will abandon those practices. If governments can overcome the large “donations” made by the food industry, they can begin to recruit or conscript employees from that industry, people well versed in the techniques of selling their product to those who don’t need it. We will need a very high level of expertise to devise countermeasures that will overcome the devilment that makes so much profit for food industries. If the country needs a Department of Homeland Security, surely it needs a Department of Health Advocacy and Protection. Can politicians rise above the influence of lobbyists to help our citizens in this way?

**3. Fiscal Rewards.** Much good advice about eating and exercise goes unheeded because there is a long delay between the perceived input (avoiding risky or unhealthy behavior) and reward (a longer, more healthy life). Neither of my first two suggestions is likely to overcome this problem. Hence, I

propose a tangible, monetary reward in the form of a governmental check for those who maintain healthy behaviors. Persons who keep their body mass index within the bounds of desirable (under 25) should be positively rewarded for doing so; those who let themselves slip outside those bounds, but make measurable and continuing progress toward them, should also be rewarded for doing so. We know that, in the aggregate, a BMI that exceeds desirable level is the most important contributor to the development of type 2 diabetes, and hence to an enormous cost burden for society. Why should only those who do not work towards or maintain healthy weight have a claim on financial benefits? I say that good health practices should reap rewards in the here-and-now; let those who do not take care of themselves reap their rewards in drug and hospital subsidies in the future.

**4. Encourage Exercise.** Physical activity plays a major role in preventing or treating type 2 diabetes. Alas, American communities are designed to promote physical inactivity. Most destinations of interest are too far to be walked to, and even if they are close enough, there are no safe walking paths. To discourage the inordinate use of automobile transportation, we need to markedly increase the price of gasoline. A price of \$4 to \$5 per gallon, which is what gasoline costs in many countries, would encourage using our legs to get around. Tax revenues supplied from gasoline sales could be used to construct sidewalks and bike paths that would make daily activity safe and possible. If the cost of gasoline works a hardship on certain persons or occupations, there could be a mechanism for tax rebate to qualified individuals or companies. This will cause much uproar from those of us used to reveling in the conflagration of our petrochemical heritage, but it is necessary and it can be done.

Secondly, we need to consider what school busing and video games have done to our young people. America’s great increase in obesity began about 1980, just as the busing of students long distances to centralized schools reached its zenith. There was a time when students walked to neighborhood schools (easily a total of an hour a day, five days a week). Now they ride for an hour a day to distant schools. We need to reconsider whether the social and educational goals that motivated school busing are working. If not, we need to abandon them and get students back to walking; if they are, then we need to find other ways to get students back to walking. Furthermore, we need to think about what purpose is served by video programs that mimic sports activities. Players can sit on the couch and with a flick of the thumb induce video images to “tackle” runners, “field” ground balls, “slam dunk” over Tim Duncan. These games are pernicious because they do not just encourage the player to mimic the athletic prowess of, say, Michael Jordan; at some deep psychological level they let the player become Michael Jordan. This passive substitute for activity uses almost no calories, and I doubt that it leads to a later flurry of actual physical activity that would compensate for the time spent

in front of the video screen. We need a long societal look at what to do about this latest assault on fitness.

5. *Refuse to Collude.* We often hear that medicine needs to be a collaborative partnership between patient and doctor, both cooperating in improving the health of the patient. I have no argument with this position, but I think we should make explicit that it is a *shared* responsibility. Patients with type 2 diabetes should be told, up front and in one-syllable words, that the *prime and fundamental* treatment for their diabetes is lifestyle modification. This means that the patient must undertake immediate work on and show continuing progress toward a BMI of 23 or less. The doctor will provide information and arrange any needed consultations with nutritionists and diabetes educators, but it is the patient who must demonstrate the consistent weight loss (say one pound per week) that reflects adherence to diet and exercise standards. Unless the patient shows evidence of full participation, doctors should refuse to collude with them by prescribing secondary treatment like oral hypoglycemic or other drugs that serve as a semblance of care. Doctors are familiar with rejecting inappropriate or outrageous demands—for narcotics, for medical “excuses” from work or other obligations, for false reports, for surgery that is not indicated or is too dangerous or will not solve the patient’s problems. So we should refuse to participate in what amounts to a medical *folie à deux* by treating secondary problems while ignoring the real cause of type 2 diabetes and the patient’s absolute responsibility to do something about it.

## A Summation

Type 2 diabetes is a spectacularly large and growing health problem. Patients with diabetes have healthcare expenditures that are twice those of the average citizen. We do not clearly understand the genetic predisposition that allows type 2 diabetes to develop, but we do know that lifestyle factors are the most important modifiable factors leading to that disorder. A proper diet and regular exercise (manifested by the presence of a healthy body mass index) can prevent development of latent diabetes, or reverse the manifestations of overt diabetes. It is unlikely that the food industry—already bloated by the high profits from enticing people to buy and consume more and more calories—will voluntarily decide to limit its income. So we will need a number of initiatives from healthcare professionals and from governments at all levels of society to turn this situation around. Some of the measures will require enormous political courage and foresight on the part of our elected officials. Without that, we will hardly need to worry about defense from external enemies. As a nation, we will soon be so fat that we will not be able to waddle to work or to war; those who can will be trying to earn enough money to pay for all the glucose meters and insulin needles and hypoglycemic, antihypertensive, and cholesterol-lowering drugs “required” for the evidence-based treatment of hundreds, even thousands, of blind, neuropathic amputees crowding our cardiac care and dialysis units.

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