Type 2 Diabetes: An Epidemic Requiring Global Attention and Urgent Action

Decades ago, the global epidemic of type 2 diabetes was predicted by epidemiologists who observed large and rapid increases in the prevalence of type 2 diabetes among indigenous peoples who adopted Western lifestyles (1–4). Subsequent epidemiological studies demonstrated that essentially all non-Europid populations who escape the ravages of communicable diseases, enjoy abundant food and less physically demanding lifestyles and survive to middle and old age are at increased risk for type 2 diabetes, its complications, and comorbidities. The global epidemic of type 2 diabetes has been documented in a series of progressively more precise, refined, and sobering projections (5).

In 1993, King et al. (6) assembled estimates of the prevalence of diabetes for adults around the world. In 1997, Amos et al. (7) first used age-specific prevalence rates for type 2 diabetes from different countries and current and projected age distributions of the world population to estimate the present and future numbers of people with diabetes worldwide. Using similar methods but incorporating additional age- and sex-specific and rural- and urban-specific diabetes prevalence rates, King et al. (8), Wild et al. (9), and Shaw et al. (10) repeated these analyses. In general, these studies projected that the number of adults with diabetes in the world will more than double between 2000 and 2030, with most of the increase occurring in developing countries, particularly in Asia. Not surprisingly, countries with the largest populations have and will have the greatest number of individuals with diabetes. Accordingly, India and China top the lists. The most recent studies have projected that by 2030, India will have 79–87 million and China 42–63 million adults with diabetes (9,10). The latter projection did not account for the rapid change in lifestyle occurring in China and appears to have substantially underestimated the future burden of diabetes in that country. A recent national study found that 92.4 million Chinese adults may already have diabetes (11).

As pointed out by King et al. (12) and Hsu et al. (13) in this issue of *Diabetes Care*, Asian Americans, Native Hawaiians, and Pacific Islanders (AANHPI) are a hugely diverse population. Asian Americans, as defined by the U.S. Census Bureau, may include persons with origins in China, the Republic of the Philippines, India, Vietnam, Korea, or Japan. AANHPI are clearly at increased risk for type 2 diabetes, yet are far from unique. The story around the world is much the same. Type 2 diabetes is now a global epidemic. The authors are correct that our ability to address the epidemic of type 2 diabetes in AANHPI will require insights gained from epidemiological and pathophysiological studies and clinical trials. Stemming the epidemic will also require culturally appropriate interventions.

An important epidemiological finding, highlighted by the authors, is that Asian Americans with type 2 diabetes are more likely to have seemingly normal indices of adiposity (using Europid criteria) compared with other ethnic groups with diabetes (12). However, the optimal BMI cutpoint to predict type 2 diabetes, hypertension, dyslipidemia, and cardiovascular morbidity and mortality in Asian populations is lower than in other populations (14). Asian Americans with diabetes are less likely to be obese than whites, but in every BMI category Asian Americans have a higher prevalence of diabetes than whites. Asian respondents to both the 2001 Behavioral Risk Factor Surveillance System and the 2006–2008 National Health Interview Survey were 60–70% more likely to have diabetes than whites after adjusting for age, sex, and BMI (12). Accordingly, the World Health Organization has recommended that a BMI cutpoint $\geq$23 kg/m^2 be used to define overweight in Asian populations (15). This compares to a BMI cutpoint for overweight $\geq$25 kg/m^2 in other populations. Similarly, the International Diabetes Federation in its consensus worldwide definition of the metabolic syndrome recommended that waist circumference cutpoints $\geq$90 cm for Asian men and $\geq$80 cm for Asian women be used to define central obesity. These compare with cutpoints $\geq$102 cm and $\geq$88 cm in other U.S. men and women and $\geq$94 cm and $\geq$80 cm in Europid men and women. These cutpoints have been endorsed by the International Diabetes Federation and other international organizations to harmonize the definition of the metabolic syndrome (16). If clinicians apply general U.S. criteria to define overweight and central obesity when they determine who should be screened for diabetes, they will fail to identify high-risk Asian Americans.

Another important epidemiological finding, highlighted by the authors, is that in Asian Americans, fasting plasma glucose and hemoglobin A_{1c} (HbA_{1c}) are less sensitive for diagnosing diabetes than the oral glucose tolerance test, which includes an assessment of the 2-h postchallenge plasma glucose. In Asian Americans, fasting plasma glucose was only 69% sensitive and HbA_{1c} $\geq$6.5% only 40% sensitive compared with the oral glucose tolerance test in diagnosing diabetes. As Hsu et al. conclude, "these diagnostic considerations are particularly significant in Asian Americans because they have higher risks for diabetes, often present without overt signs of obesity, and may be misdiagnosed if a test with low sensitivity is used" (13).

Although gaps remain in our knowledge, evidence for the efficacy of interventions to delay or prevent the development of type 2 diabetes in AANHPI is remarkably robust. As summarized by Hsu et al. (13), at least five randomized, controlled clinical trials have evaluated the efficacy of lifestyle interventions in high-risk Asian or Asian American populations, and six trials have evaluated the efficacy of medications including metformin, α-glucosidase inhibitors, and thiazolidinediones. The good news is that lifestyle interventions (29–71% risk reduction) and metformin (26–52% risk reduction) appeared to be as effective if not more effective in Asian populations. Also, the α-glucosidase inhibitor voglibose appears to be remarkably effective (58% risk reduction) in one trial from Japan. Although treatment algorithms that address the underlying pathophysiological processes among native Asian and AANHPI populations are desirable, they are not generally available. Even the American Diabetes Association/European Association for the Study of Diabetes consensus guidelines for diabetes management fail to account for potential pathophysiological differences among subpopulations that might impact treatment choices (17).

What is clear is that all interventions, whether for AANHPI populations or other at risk populations, must be grounded in a knowledge of the values, norms, knowledge, beliefs, practices, experiences, and languages of the culture (12,13). Interventions that involve behavioral self-management need to involve the target communities and incorporate a solid understanding of acculturation, alternative health pathways, psychosocial stressors, support systems, literacy, dietary preferences, and attitudes toward physical activity.

King et al. and Hsu et al. do an excellent job describing risk factors for diabetes, diagnostic issues, and the enormous and growing burden of diabetes in AANHPI. They summarize the results of clinical trials that clearly demonstrate the efficacy and feasibility of lifestyle and medication interventions for diabetes prevention. They also provide a realistic if somewhat sobering perspective on the challenges of successfully implementing such interventions.

Although we believe it is of value to focus on this unique and high-risk community, we also believe it is important to remember that type 2 diabetes is a global epidemic. The issues raised by the authors are universally relevant. To successfully address this epidemic, we must measure it, understand its risk factors, develop valid and efficient approaches to screening and diagnosis, and develop and implement culturally specific interventions for prevention and treatment.

The evidence base for diabetes prevention is robust, but the epidemic continues unabated. Type 2 diabetes has progressed beyond the point where it can simply be considered a "medical problem." It is a societal problem and an international problem and must be addressed as such. Interventions must address school education, advertising, food availability and price, the built and workplace environments, and possibly tax policy. Health systems must remove barriers and indeed provide incentives to encourage the adoption of safe and effective interventions for diabetes prevention. However, it is disappointing that both articles failed to discuss the emerging evidence that the intrauterine environment and epigenetic factors may play an important role in obesity and type 2 diabetes in adult life (18). This may be a productive area for future research, and in the meantime, a greater emphasis on maternal health may be an important strategy to reduce the global epidemic. The recent evidence that circulating mediators of appetite that encourage weight regain after diet-induced weight loss persist also highlights the need for the primary prevention of obesity (19). It is only with such an all encompassing approach that we can begin to combat the scourge of type 2 diabetes.

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DOI: 10.2337/dc12-0298

Acknowledgments—No potential conflicts of interest relevant to this article were reported.

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