# The epidemic of obesity and type 2 diabetes in the US: Finding the key to an effective prevention programme

*Lubaina Presswala, Jay Shubrook, Frank Schwartz*

**The diabesity "epidemic" in the US has seen the prevalence of obesity and diabetes rise over the past two decades. With the figures showing no sign of declining, the authors look at the current state of medical education with relation to obesity and diabetes and find that diabetes as a specialism is often overlooked and that there is often a theory-practice gap among final-year medical students. The authors state that the key to halting the epidemic lies in prevention programmes that need strong leadership from knowledgeable physicians and which can be implemented by a strong team of healthcare professionals. They discuss the importance of initiating lifestyle change by offering intensive education programmes and targeting communities rather than individuals. They explain that in the US, prevention schemes are undervalued because of the way healthcare is funded. However, they conclude that a change in culture is essential and a focus on aggressive early interventions to reduce the prevalence of obesity will be the only way to stop the spread of diabetes and its long-term impact on health.**

Diabesity, a term coined in recognition of the significant interdependence between obesity and type 2 diabetes, has evolved into an American epidemic (Golay and Ybarra, 2005). An estimated 25.6 million adults in the US were affected by diabetes in 2010 (Centers for Disease Control and Prevention [CDC], 2011) and 60–90% of all people with the disease are, or have been, obese (Golay and Ybarra, 2005). Disturbingly, childhood obesity and the prevalence of type 2 diabetes in children and adolescents continues to grow in the US and worldwide. Childhood obesity is associated with a higher chance of premature death and disability in adulthood (Hannon et al, 2005; Franks et al, 2010) and, therefore, it is crucial to introduce obesity and diabetes prevention strategies early in life to halt the detrimental consequences of chronic obesity and uncontrolled hyperglycaemia.

Obesity and diabetes prevention demand a nationally driven, unified, aggressive cultural change in lifestyle. Agricultural subsidies for healthier foods, access to educational and exercise programmes, and incentives for improving lifestyle habits can all improve people's health. Changes in medical education and graduate medical training programmes can provide a foundation for change, along with the development of physician-led programmes that introduce changes in health-related policies and improvements in the healthcare infrastructure.

This paper will reflect upon the trends in obesity and diabetes in the US over the past two decades, review research studies on medical education training and graduate medical training programmes, and discuss the established strategies for disease management and the future of diabesity in the US.

The UK faces similar problems. Figures from the National Child Measurement Programme (Department of Health, 2012) show that in 2011/12 almost one-third of 10–11 year olds and more than one-fifth of 4–5 year olds were overweight or obese. As the rates of obesity rise across Europe, the UK had reported overall rates of 26.1% obesity in 2012 (Organisation for Economic Co-operation and Development, 2012). Sharing the experiences of healthcare teams in the US can inform the UK's approach to its own epidemic of diabesity.

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## Article points

1. The US is facing an epidemic of diabesity with one in 10 adults now having diabetes.
2. Childhood obesity is also on the rise in the US.
3. A focus on preventing obesity needs to start with improvements in medical education.
4. Medical students need to be encouraged to specialise in diabetes prevention to address the shortage of diabetologists in the US.

## Key words

- Diabesity
- Medical education
- Prevention
- US healthcare

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## Obesity

The prevalence of obesity has escalated rapidly in the US. Despite substantial awareness of the health risks of obesity, rates have dramatically increased over the past 20 years. In 1994, all but two states (48/50) had a prevalence of obesity less than 18% and no state exceeded 22% (Powell-Griner and Anderson, 1997). However, in 2010 no state had less than 18% and all but two states (48/50) exceeded 22% (Xu et al, 2013). More than 35% of US men and women – about 78 million adults – were obese in 2009–2010 (Ogden et al, 2012). It is widely accepted that a child with obesity will also have obesity as an adult. In the past two to three decades childhood obesity rates have doubled (Maggio and Pi-Sunyer, 1997). More than 5 million girls and 7 million boys (roughly 16% of children and adolescents in the US) were obese in 2009–2010 (Ogden et al, 2012).

The rising incidence and subsequent impact of diabetes and obesity have not gone unnoticed. In 2000, a Healthy People 2010 objective was developed by the CDC with an aim to reduce the prevalence of obesity among US adults to 15% (Sherry et al, 2010). A behavioural risk factor surveillance system assessment in 2007 indicated that no state had met the Healthy People 2010 goals of 15% obesity among adults and 5% obesity among children (Sherry et al, 2010). A repeat assessment in 2009 indicated that obesity prevalence was significantly higher than previous data reported at 26% across all states (Sherry et al, 2010). The continuous growth in obesity despite numerous interventions proves that substantial disparities exist between knowledge about obesity and translation of this knowledge into meaningful changes in behaviour.

Twenty obesity objectives and 16 diabetes objectives were established in 2010 for the Healthy People 2020 health priority goals (US Department of Health and Human Services, 2013). Additionally, leading health indicators were established to emphasise the determinants of health and health disparities as well as to develop strategic opportunities to overcome barriers, promote health, and improve quality of life for all people in the US. Several core measures will serve as progress indicators for the 2020 health goals through the 10-year period. Adults who are obese, children and

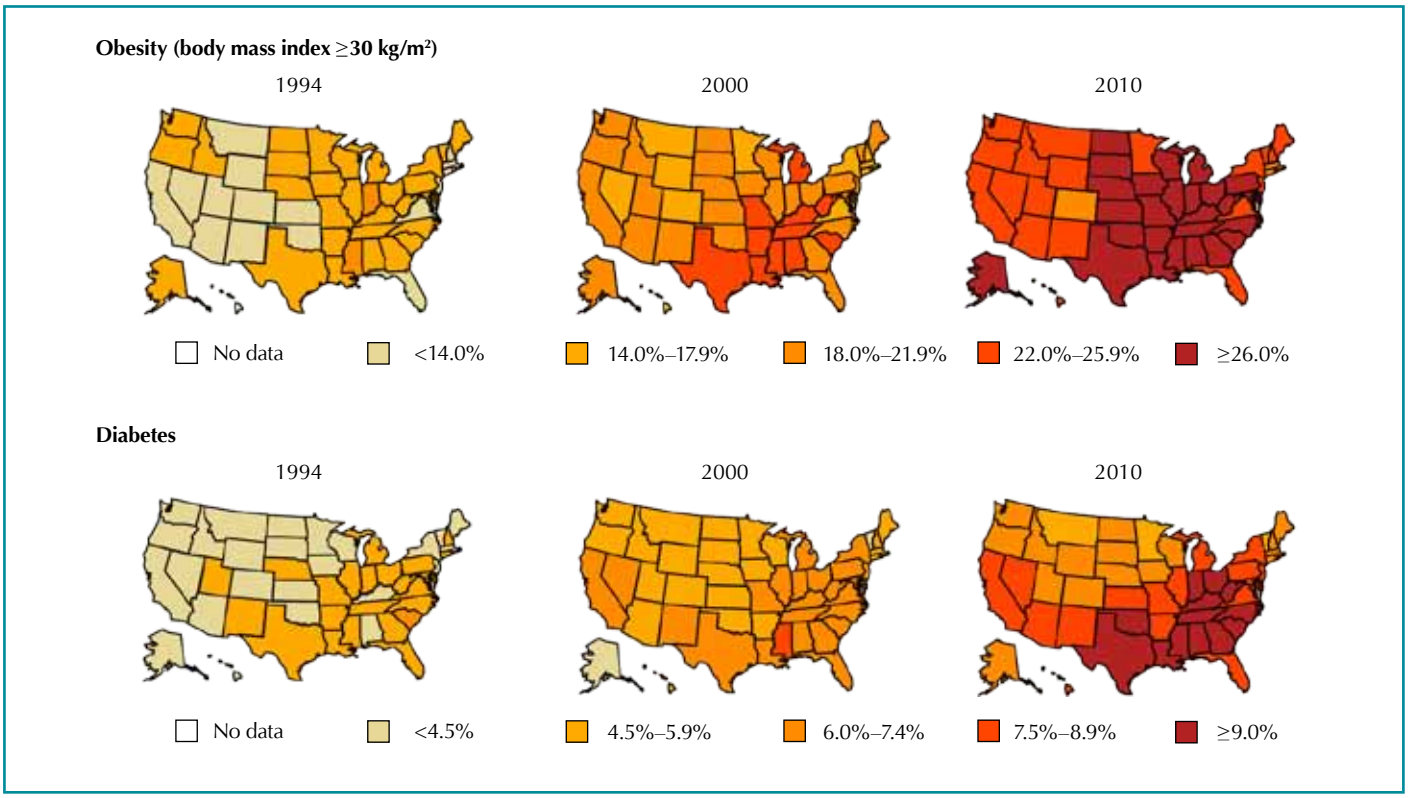


*Figure 1. Age-adjusted prevalence of obesity and diagnosed diabetes among US adults. (Source: Centers for Disease Control and Prevention)*

adolescents who are considered obese, adult diabetes patients with an $HbA_{1c}$ >75 mmol/mol (9%) and adults who are current cigarette smokers are some examples of these core measures. At baseline, all core measures have a pre-defined level. A target for improvement is determined and it is anticipated that by 2020 patients will have reached target changes in core measures.

## Type 2 diabetes

Today, nearly 1 in 10 people in the US have diabetes and it is projected to be 1 in 3 by the year 2050 (Boyle et al, 2010). *Figure 1* provides a representation of obesity and diabetes trends in the US from 1994–2010 showing how the condition has spread. Obesity is a significant driver of insulin resistance. Insulin resistance – a core pathophysiologic feature of diabetes – usually precedes the development of type 2 diabetes by 10–20 years (Golay and Ybarra, 2005). Therefore, the public health approach to diabetes would best be channelled into preventing the condition.

A 58% relative risk reduction was achieved in individuals with impaired glucose tolerance tests who were assigned to intensive lifestyle intervention using the Diabetes Prevention Program (DPP; DPP Research Group, 2002). These results have been replicated in a community setting (New York State Health Foundation, 2012). However, transfer of the DPP lifestyle interventions to the general population for disease prevention has not happened. The link between social networks and risk factors for obesity indicates that intervention needs to done at the local level and should be initiated within schools, churches or other social groups to provide the support needed for long-term changes in lifestyles required for major behavioural change.

The emergence of type 2 diabetes in children and younger people has increased significantly in the US in the past two decades. There was a 10-fold increase in the incidence of type 2 diabetes among children and adolescents (<19 years of age) between 1982–1994 (Pinhas-Hamial et al, 1996). An estimated 3600 people aged <20 years were newly diagnosed with type 2 diabetes annually between 2002–2005 (CDC, 2011). The SEARCH study, the largest standardised registry of childhood diabetes in the US, estimated an overall diabetes incidence of 24.3 per 100 000 person-years for young people <20 years of age and 25% of children with diabetes now have type 2 diabetes (Imperatore et al, 2012). This is anticipated to quadruple from 2010 to 2050 with a 178% increase in disease prevalence (Imperatore et al, 2012).

Equally distressing, the TODAY (Treatment Options of Type 2 Diabetes in Adolescents and Youth) study indicated that the standard medical treatments that are effective in adults are less effective in children leaving them with many more years of managing the disease with the ensuing accumulation of long-term complications (TODAY Study Group, 2012). Further, the long-term safety of using diabetes therapies in children is unknown and reinforces the importance of prevention of obesity and diabetes. An aggressive approach from physicians during early management of obesity can help prevent these chronic conditions.

## Medical student education and research

Educating medical students about obesity and diabetes creates the opportunity to improve competency in chronic disease management. A well-trained healthcare team dedicated to disease prevention from early childhood could substantially alter the burden of obesity and diabetes. In the US, medical education offers training in human anatomy, basic sciences, clinical practice and several other domains. It is difficult to estimate the amount of time dedicated to medical training as this varies among schools. Typically, students spend 2 years in the classroom learning basic medical sciences and the remaining 2 years in the clinical setting (hospital or outpatient) rotating specialties every month.

The 2-year classroom curriculum may selectively focus training on body systems such as the cardiovascular system, endocrine system, gastroenterology system, neurology system and so on. The remaining 2 years provide mostly clinical experience for acute care, but the location and setting limits education and time spent learning about caring for outpatients with chronic conditions. Most residencies are hospital-based and the students will spend a minority of their time (10–25%) in the outpatient setting where preventive medicine is put into practice.

The medical education curriculum at the authors'

***"Educating medical students about obesity and diabetes creates the opportunity to improve competency in chronic disease management."***

**Page points**

1. There is a theory-practice gap in the knowledge of medical students regarding diabetes and obesity.
2. Medical education programmes in the US do not often devote enough time to diabetes.
3. The US has a shortage of endocrinologists and diabetologists.

college offers a system-based learning approach. The endocrine system is a 5-week session offered in the second year of medical school. About 80 hours of classroom curriculum is devoted to obesity and diabetes. Additionally, first and second year students spend about 528 clinical education hours (4% of a total 12 610 hours) in outpatient obesity and diabetes management. About 20% of third-year students and 50% of fourth-year medical students at an affiliated hospital complete an average of 110 hours of elective training in endocrinology during the last two clinical years of medical education. Several elective research projects on the topics of obesity and diabetes (14 studies in the previous 2 years) have been completed by students and residents at our institution.

In general, there is a paucity of literature on the outcomes of educational hours offered to medical students on the topics of obesity and diabetes. To date, only a few studies have evaluated the knowledge of medical students, residents, and nursing staff on the topics of obesity, diabetes, and management of chronic diseases.

In a study by Lansang and Harrell (2007), 52 fourth-year medical students completed question sets that included case scenarios for new in-patients with chest pain (CP), hypertension (HTN) or chronic obstructive pulmonary disease (COPD) with a known or unknown diagnosis of diabetes. Patients also had hyperglycaemia, used steroids or had acute renal failure. All students correctly identified disease presentation ($P<0.001$) and provided an appropriate initial plan ($P<0.001$) for CP, HTN and COPD. However, 17 students (33%) provided inappropriate management plans for diabetes, which demonstrated gaps in recognising hyperglycaemia and in the application of theoretical knowledge into clinical practice. In conclusion, we can interpret that more training in diabetes is needed among medical students before residency training.

Further evidence of this knowledge gap was reported in the results of a 21 question survey-based study on standards of care for diabetes (Rubin et al, 2007). The survey was given to 48 registered nurses (RN), 52 internal medicine (IM) residents, 21 family practice (FP) residents, and 42 surgery residents. Participants averaged <50% correct on questions on fasting plasma glucose criterion for type 2 diabetes, insulin pharmacokinetics, hypoglycaemia treatment, and peri-operative management for type 1 and type 2 diabetes. Scores among IM residents (69%), FP residents (64%) and RNs (66%) were comparable and were significantly higher than scores of surgery residents (44%; $P<0.001$). In conclusion, although general medical practitioners may be better equipped to manage diabetes, a general deficiency in knowledge was observed among all healthcare providers.

Resident education demands clinical expertise in disease management for inpatient and outpatient settings. The focus of education can vary from programme to programme depending on size and expertise of the faculty. This variation in comprehensive training is observed within the authors' affiliated hospitals as well as in the national training system. For example, residents in the IM and combined IM/emergency medicine programmes at a hospital affiliated with the authors' institution dedicate 4 weeks (about 200 hours) solely to the study and management of endocrine diseases. At other institutions similar education may be simply optional. Still, clinical hours during residency can be a poor measure of resident knowledge, as exposure to obesity and diabetes-related disorders is difficult to assess outside of specialty programmes.

There is a major shortage of endocrinologists and diabetologists in the US. The shortage of US endocrinologists was first identified in 2003 when a deficit of 12–15% was estimated for the current needs (Rizza et al, 2003). In 2010 there were 5811 board-certified endocrinologists; however, more than 1500 were not clinical care providers (instead they were doing research, administration, teaching or pharmaceutical industry activities) leaving less than 4000 Doctor of Medicine (MD) endocrinologists available to provide clinical care (Stewart, 2008). Furthermore, many endocrinologists will focus their practice on other aspects of endocrinology as diabetes is often seen as mundane.

Presently, there are only 131 MD and five Doctor of Osteopathic Medicine (DO) accredited fellowship training programmes in endocrinology, diabetes and metabolism in the US as listed by the American College of Graduate Medical Education and American Osteopathic Association. Training time is usually 2 years with an average of 47 hours per week. If these programmes each produced

one to two fellows per year there would be an anticipated increase of only 160 endocrinologists per year (Stewart, 2008). The number of graduates from these programmes falls far short of meeting the current need. A hypothetical model made by quantifying experts in the field has shown that demands for endocrinologists will exceed supply up until 2020 (Rizza et al, 2003).

A major reason for the shortage of endocrinologists in the US is purely economic. Endocrinology is a cognitive specialty, which is time consuming. The current procedure-based reimbursement system in the US does not reward prevention or quality of care. Specialties that focus on prevention and chronic disease management have no financial incentive under the US healthcare system. Coupled with the increasing financial burden of the cost of medical education these issues are major considerations by residents applying to specialty programmes. As a result, endocrinology, which is seen as less lucrative, also becomes a less attractive option for many residents seeking a specialty fellowship.

## The future of obesity and type 2 diabetes in the US: The way forward

### Medical education level

It is clear that there are deficiencies in obesity and diabetes-related knowledge among medical students, physicians and other healthcare providers. Changes in the medical education curriculum, including application of knowledge in patient simulations and a focus on prevention geared to fourth year training, can have a positive impact on obesity and diabetes management in medical school and residency. An institution in Michigan has revamped their pre-clinical curriculum with a focus on teaching the physiologic regulation of satiety, nutrition, and intestinal absorption to first year students. Furthermore, the focus is shifted to studying the pathology of metabolic syndrome, diabetes, nutritional deficiencies and malabsorption in the second year of training. Additionally, an institution in California has incorporated a pre-clerkship obesity curriculum involving obesity-related lectures and extensive training in community-driven services for obesity management. Leadership roles are fostered among students to become motivational speakers and mentors to their future patients (Colbert and Jangi, 2013). Similarly, clinical training during residency must be combined with classroom education on topics of obesity and diabetes. In a prospective study by Rubin and McDonnell (2010), inpatient diabetes education targeted to first-year residents has been shown to modestly improve diabetes-related knowledge.

Primary care physicians are more likely to face issues of obesity and diabetes within their practice. There needs to be a structured curriculum on chronic disease management within the outpatient section of residency training. Physicians should learn to be part of a team that treats a person with chronic disease. Additional opportunities to participate in obesity and diabetes-related research, attend presentations at diabetes and endocrine society meetings and clinical education at leading diabetes institutions can improve a resident's training and interest in a specialty fellowship beyond their residency.

There are only two programmes in the US that train primary care physicians to be diabetologists. Diabetes fellowship programmes provide physicians with expertise in obesity and diabetes management. An expansion of these programmes may help meet the supply-demand mismatch between the amount of doctors there are and the increasing numbers of people with type 2 diabetes.

### Health administration level

A "one-man approach" in addressing obesity and diabetes is no longer a viable option. Teams of healthcare providers including physician assistants, nurse practitioners, clinical researchers, nurses and diabetes educators are some critical components to an outpatient clinic specialising in obesity and diabetes management. Physicians are urged to establish a team that provides comprehensive care. Young physicians should also promote strong community leadership, support evidence-based clinical practice, institute health policies to prevent chronic diseases and advocate for federal reimbursement for physical activity training programmes. The national recognition of obesity as a disease by the American Medical Association in 2013 is a step in the right direction for obesity awareness and encourages federal reimbursements

***"A holistic approach that reinforces physical activity incentives, promotes health and education about nutrition, increases resources for the general population that promote weight loss as well as access to dynamic teams of healthcare providers can inspire change in the way obesity is managed."***

**Page points**

1. There are signs that obesity rates in the US have plateaued.
2. Community-driven prevention programmes are having an impact on obesity rates.
3. Improved medical education in obesity is essential to the prevention of diabesity.

for disease prevention and management programmes. Finally, healthcare providers and hospitals must develop quality indicators that reflect greater standards of care with goals set to decrease rates of obesity and type 2 diabetes among their patient population.

## Community level

Previous attempts to address obesity on an individual level have failed, which has led to the recognition that obesity is a culturally dependent disease. There is also increasing evidence that socioeconomic disparity and stress contribute to the risk of diabesity in at-risk populations. A focus on community-driven prevention programmes has accelerated in recent years and promises to provide possibly more effective long-term results. A holistic approach that reinforces physical activity incentives, promotes health and education about nutrition, and increases resources for the general population that promote weight loss, as well as access to dynamic teams of healthcare providers, can inspire change in the way obesity is managed. A focus on social and cultural influences that have an impact on health may serve as a useful resource for organisations and communities to address obesity.

Fortunately, there are early signs that obesity rates in the US have plateaued or are decreasing in certain areas of the country. A recent analysis of obesity rates by NHANES (National Health and Nutrition Examination Survey) suggests that prevalence of obesity among adults and children have not changed significantly since 2003 (Yanovski and Yanovski, 2011). Although these trends provide some encouragement, the prevalence of obesity continues to be unacceptably high.

Enhanced patient education, access to physical activity resources and changes in lifestyle may be contributing to some changes in obesity and diabetes trends presently observed in the US. A focus on community-driven prevention programmes has accelerated in recent years and promises to provide effective long-term results. For example, a unified workplace nutrition programme encourages companies to implement policies that require healthier food options to be served in vending machines and at meetings and events. Employers and private insurances must also establish physical activity indicators in their health benefits programme to prevent obesity as a cost-effective measure.

Some community prevention programmes have also been effective in school children. The CATCH (Coordinated Approach to Child Health) programme incorporated changing behaviour in elementary schools with increased physical activity and dietary modifications in the school cafeteria. Study results showed that students significantly increased time spent in physical activity within physical education classes (from 40% to 50%) and considerably decreased their consumption of fat in school meals (from 39% to 32%) (Franks et al, 2007).

## Conclusion

Chronic diseases such as obesity and diabetes have years of subclinical disease with pathologic adaptations before a definitive diagnosis. Medical education and post-graduate training are essential in creating leadership and expertise in chronic disease management. A focus on affecting communities and providing incentives for quality healthcare promises more efficient healthcare delivery. Increased awareness of these processes and more aggressive intervention earlier in the disease process can prevent or reduce the consequences of obesity and diabetes and lead to better long-term outcomes. It is absolutely prudent to shift the paradigm of obesity management to obesity prevention. ■

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