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Diabetes in the United Arab Emirates:
Crisis or Opportunity?

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Executive Summary

The epidemic of type 2 diabetes and its warning sign, prediabetes, are sweeping across the globe, shortening lives and straining the financial resources of health care systems everywhere.

The prevalence of type 2 diabetes in the United Arab Emirates (UAE) is amongst the highest in the world. By 2020, an estimated 32 percent of the adult population (age 20-79), including both UAE nationals and expatriates, may have diabetes or prediabetes at a possible cost of \$8.52 billion (USD)* (AED 31.27 billion[†]) over the next decade if current trends continue. That means that one in three adults from all levels of UAE society will be affected. Yet, the vast majority of cases of prediabetes and about 35 percent of cases of diabetes in the UAE remain undiagnosed, representing lost opportunities to avoid the costs and complications of a largely preventable disease.

Type 2 diabetes is a common, chronic and potentially disabling disease that affects a broad range of individuals; in fact, anyone can develop the disease, regardless of ethnic or socioeconomic background. When talking about diabetes, weight is at the heart of the problem. Many people do not realize that obesity, prediabetes and diabetes are related conditions that create a dangerous, yet preventable, cascade of health and economic impacts. According to the World Health Organization, about 73 percent of adult women and 66 percent of men are overweight or obese in the UAE, placing the country in the top five worldwide in the obesity stakes.

Medical costs attributable to diabetes and prediabetes in the UAE are forecast to increase to perhaps \$1.04 billion (AED 3.82 billion) by 2020, representing a 58 percent increase from an estimated \$657 million (AED 2.41 billion) in 2010.

Fortunately, the toll of diabetes can be reduced by early, aggressive intervention. Screening tests, lifestyle changes, and disease management can help prevent type 2 diabetes and, for those who already have diabetes, reduce the risk of developing deadly complications, such as heart and kidney disease, nerve damage, blindness and limb amputation.

Curbing the UAE's epidemic of diabetes and prediabetes should include collaboration between the government's public health agencies, nonprofit organizations and the private sector. The way forward begins with designing and implementing culturally-appropriate, community-based initiatives for diabetes prevention and control in the UAE, drawing on and adapting what has worked in other parts of the world.

As an innovative, modern, technologically-advanced country, UAE is well-positioned to make diabetes prevention and management a top priority, serving as an example to other countries in the region, and around the world, that stopping the epidemic *is* possible.

* Unless otherwise stated, the monetary value is in 2010 constant U.S. dollars.

[†] USD1.00=AED3.6724, Bloomberg, as of 01 December, 2010

Introduction

The prevalence of diabetes and prediabetes has ballooned globally over the past two decades, paralleling the increase in obesity. More than 285 million people worldwide have diabetes. Without intervention that figure is expected to climb to 438 million within 20 years.¹

The UAE has one of the highest rates of type 2 diabetes in the world,² representing huge societal costs, in terms not only of morbidity and mortality, but also lost productivity and a steep burden on the healthcare system.

Interventions that have worked in other countries may be effective if adapted and implemented in the UAE.

Type 2 diabetes and its complications are largely preventable. Lifestyle interventions aimed at obesity, one of the principal risk factors, have been shown to prevent or delay the onset of disease. At the same time, proper diabetes management has proven effective in lowering the risk of complications in those who already have it.

This paper lays out the scope of the problem in the UAE and provides estimates of future trends; and describes selected approaches from other countries that could prove useful as a starting point for discussion of how to tackle this pressing public health issue in the UAE.

Type 2 Diabetes

Diabetes mellitus is a metabolic disorder characterized by abnormally high levels of glucose in the blood. Type 1 diabetes (previously known as juvenile diabetes) is a relatively rare autoimmune disorder in which insulin-producing cells in the pancreas are nonfunctional. In type 2 diabetes (previously known as adult-onset diabetes), either the pancreas does not make enough insulin or the body is unable to use it efficiently.

Type 2 diabetes is a common, chronic, and progressive disease that is frequently disabling and potentially deadly. Diabetes can shorten life expectancy by as much as 15 years, and the majority of deaths in people with type 2 diabetes are due to cardiovascular complications.³

In fact, type 2 diabetes is closely related, as both cause and consequence, to cardiovascular disease (CVD), and people with diabetes are at heightened risk of heart attack, stroke, amputation due to peripheral arterial and nerve damage, blindness, and kidney failure due to damage to circulatory structures.

Type 2 diabetes may remain undetected for many years without obvious signs or symptoms. The average person with diabetes does not get diagnosed for four to seven years, and the vast majority of people with prediabetes have no diagnosis.⁴

Fast Facts on Diabetes

- Diabetes—fasting blood glucose 126 milligrams per deciliter (mg/dL) or greater or A1c above 6.5 percent
- Prediabetes—fasting blood glucose between 100 and 125 mg/dL (IFG) and two-hour glucose between 140 and 199 mg/dL (IGT) or A1c between 5.7 and 6.4 percent
- Impaired fasting glucose (IFG)—level of glucose after an eight- to 12-hour fast that is higher than normal, but not high enough for a diagnosis of diabetes; an indicator of prediabetes
- Impaired glucose tolerance (IGT)—level of glucose two hours after the start of an oral glucose tolerance test that is higher than normal, but not high enough for a diagnosis of diabetes; an indicator of prediabetes
- A1c—levels of this type of hemoglobin reflects average blood glucose concentrations over an eight- to 10-week period. Used to monitor blood sugar to improve control in individuals with diabetes; its use in diagnosis of diabetes and prediabetes has been endorsed by the International Expert Committee.⁵

Prediabetes should not be regarded as a condition separate from type 2 diabetes. Rather it is part of a continuum in which individuals have higher than normal blood glucose levels that have not yet reached the threshold to be classified as diabetes. Between 33 percent and 65 percent of those with IFG or IGT will go on to develop type 2 diabetes within six years, compared to less than five percent of those with normal blood glucose.⁶ Although people with prediabetes may show signs of cardiovascular disease, such as hypertension and high blood lipids (cholesterol and triglycerides), they are often unaware of the connection or of their risk for developing full-blown diabetes.

Although age and genetics are risk factors for type 2 diabetes, obesity is a major contributor to both prediabetes and the full-blown disease. The rising incidence of prediabetes and type 2 diabetes worldwide is strongly linked to increased rates of overweight/obesity and an associated decrease in physical activity.

People with prediabetes who lose 5 percent of their body weight can reduce the conversion to full-blown diabetes by 58 percent.⁷

Unlike type 1 diabetes, type 2 diabetes is largely preventable through changes in lifestyle. Achieving and maintaining normal weight through diet and exercise can significantly lower the risk of developing the disease. In many cases, it can reverse blood sugar abnormalities seen in prediabetes, delaying or even preventing progression to clinical disease.

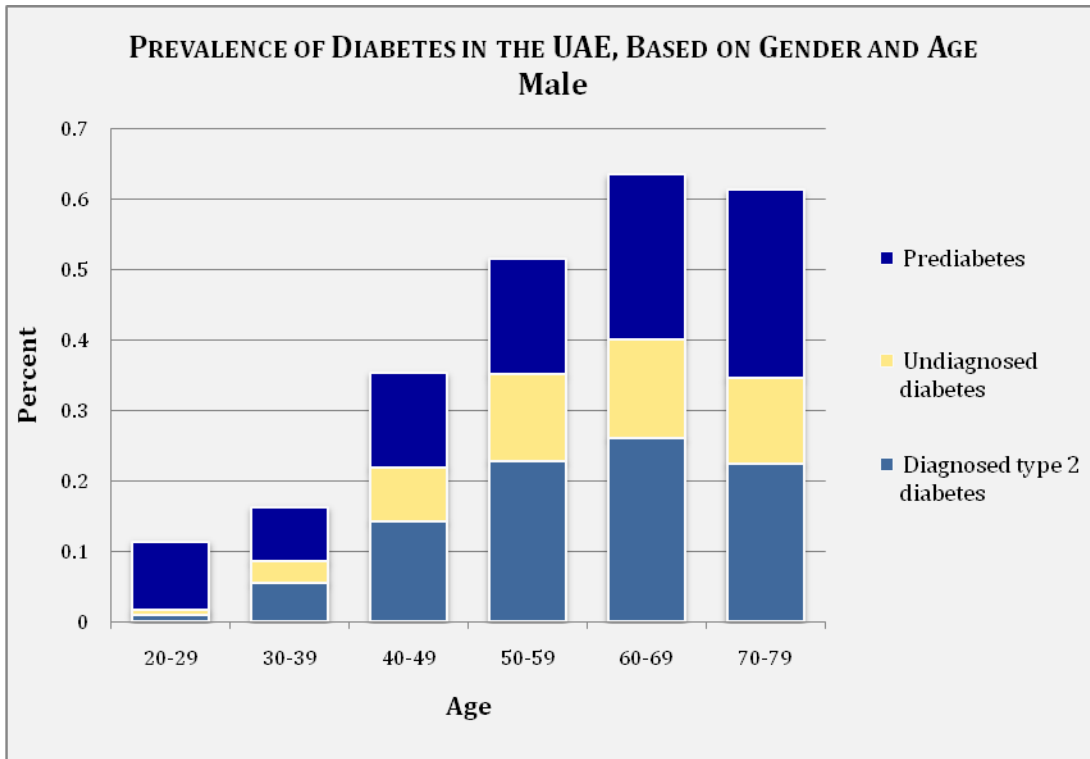
Type 2 Diabetes in the United Arab Emirates

The prevalence of type 2 diabetes in the UAE is amongst the highest in the world with some estimates putting it in the top five. Globally, 6.4 percent of the population between 20 and 79 years of age has diabetes.* In the UAE, more than double that percentage has diabetes — about 13 percent, or nearly one in eight people in the 20-79 age group.⁸

The prevalence of type 2 diabetes is estimated to be similar among male and female adults, with about 13 percent of men age 20-79 with type 2 diabetes (including both diagnosed and undiagnosed cases) and about 12 percent of women⁹. Another estimated 14 percent of the population has prediabetes, meaning they are at grave risk of developing the disease. Women in the UAE are more likely to have prediabetes than men.¹⁰

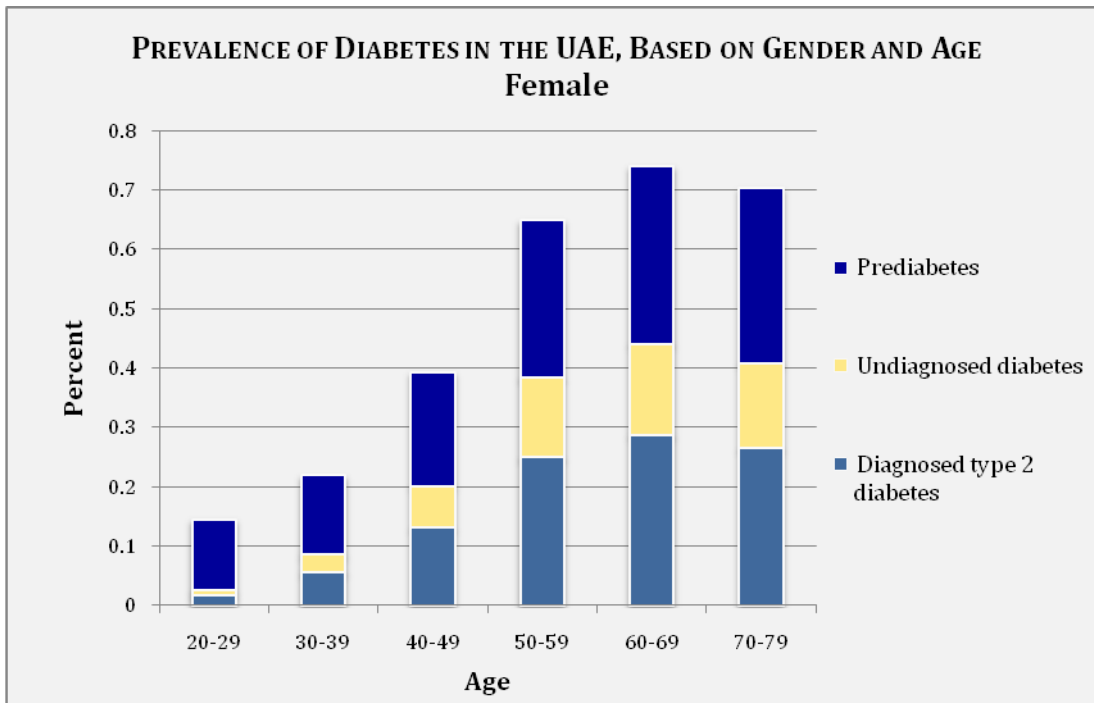
* Prevalence data is for both types 1 and 2 diabetes. According to the *IDF Diabetes Atlas*, “For most low income countries few people with type 1 diabetes survive long in adulthood so [data for adults] is close to 0%. In higher income countries around 5% to 10% have type 1 diabetes and the rest type 2 diabetes.”

Figure 1



Source: UnitedHealth Group Modeling, 2010

Figure 2



Source: UnitedHealth Group Modeling, 2010

Undiagnosed Diabetes: A Missed Opportunity

Even more consequential than the absolute numbers is the fact that the majority of cases of prediabetes and 35 percent of full-blown diabetes in the UAE are likely to be undiagnosed.¹¹ (While we do not provide estimates on the number of people with undiagnosed prediabetes in the UAE, globally undiagnosed prediabetes remains a significant public health issue, leading to the assumption that the same holds true in the UAE.) This represents lost opportunities to avoid the significant costs and the severe, disabling, and potentially deadly complications of what is largely a preventable disease. Screening of at-risk individuals is an important first step. Lifestyle interventions have been shown to delay or even prevent progression from prediabetes to clinical disease. Effective management and control of type 2 diabetes can reduce the risk of complications, which include heart attack, stroke, blindness, kidney failure, and limb amputations.

The Cost of Type 2 Diabetes

The economic impact attributable to type 2 diabetes is driven by the medical cost of treating the disease and its complications. The societal costs, however, extend beyond health care expenditure to loss of worker productivity due to illness, absenteeism and disability.

In the UAE, the annual medical costs attributable to diabetes are perhaps \$60 million (AED 220 million) for people with prediabetes and \$597 million (AED 2.2 billion) for those with diagnosed and undiagnosed diabetes. That adds up to \$657 million (AED 2.41 billion) in 2010 alone.¹² The mean health expenditure¹³ per person with diabetes in the UAE is currently estimated to be \$1067 in 2005 U.S. dollars (AED 3,920) (equivalent to \$1227 (AED 4,507) in 2010 dollars), compared to the worldwide average of \$703 (AED 2,580).

Why is the prevalence of type 2 diabetes so high in the UAE?

Numerous population studies in the UAE^{14,15,16,17,18} have identified high rates of obesity and overweight. Among the studies, one¹⁷ looked specifically at insulin resistance, a factor in diagnosing prediabetes, concluding that “peninsular Arabs and South Asians share a tendency to insulin resistance, differing from other ethnic groups living in the UAE.” The combination of obesity and insulin resistance may account for the disproportionately high rates of prediabetes and diabetes in the country. Another study concluded that “prompt action is required to avert a major public health crisis due to the long-term complications of diabetes in the near future.”¹⁶

The Future of the Diabetes Epidemic in the United Arab Emirates

Sharp increases are predicted within the next decade in both the prevalence and cost of type 2 diabetes in the UAE. The impact on the health system will be significant if action is not taken.*

* The future prevalence and costs of diabetes that are likely to be experienced in the United Arab Emirates during the period between 2010 and 2020 are based on projections developed by analysts at UnitedHealth Group’s Lewin Group, relying on the economic and epidemiology literature for the historical trends of diabetes.

If historical trends continue in the absence of prevention programs, the number of people with type 2 diabetes in the UAE is expected to rise to 677,000 by 2020, representing more than 15 percent of the adult population between the ages of 20 and 79. Of those an estimated 237,000 will be undiagnosed and therefore will not be treated at an early stage, greatly increasing the risk of developing health complications related to diabetes. Another estimated 671,000 people, or nearly 16 percent of the adult population, will fall into the prediabetes classification by the end of the decade.

Figure 3

BASELINE DIABETES PROJECTION (ADULT POPULATION 20 TO 79)			
YEAR	2010	2020	2011-2020
Type 2			
Total Population (000)	3,563	4,320	-
Disease Cases (000)	288	440	3,665
Disease Prevalence (%)	8.1%	10.2%	9.3%
Medical costs (US \$ Millions)	\$353 (AED 1.30 billion)	\$563 (AED 2.07 billion)	\$4,607 (AED 16.92 billion)
Medical cost per case (US \$)	\$1,227 (AED 4507)	\$1,281 (AED 4705)	\$1,257 (AED 4617)
Type 1			
Total Population (000)	3,563	4,320	-
Disease Cases (000)	29	44	366
Disease Prevalence (%)	0.81%	1.02%	0.9%
Medical costs (US \$ Millions)	\$54 (AED 198.3 million)	\$89 (AED 326.9million)	\$714 (AED 2.62 billion)
Medical cost per case (US \$)	\$1,861 (AED 6835)	\$2,021 (AED 7423)	\$1,947 (AED 7151)
Undiagnosed Type 2 Diabetes			
Total Population (000)	3,563	4,320	-
Disease Cases (000)	155	237	1,973
Disease Prevalence (%)	4%	5%	5.0%
Medical costs (US \$ Millions)	\$190 (AED 697.8 million)	\$303 (AED 1.11 billion)	\$2,481 (AED 9.11 billion)
Medical cost per case (US\$)	\$1,227 (AED 4507)	\$1,281 (AED 4705)	\$1,257 (AED 4617)
Prediabetes			
Total Population (000)	3,563	4,320	-
Disease Cases (000)	508	671	5,915
Disease Prevalence (%)	14.3%	15.5%	14.9%
Medical costs (US \$ Millions)	\$60 (AED 220.4 million)	\$84 (AED 308.5 million)	\$721 (AED 2.65 billion)
Medical cost per case (US\$)	\$118 (AED 433)	\$125 (AED 459)	\$122 (AED 448)
Total Medical Cost (US \$ Millions)	\$657 (AED 2.41 billion)	\$1,039 (AED 3.82billion)	\$8,522 (UAE 31.30 billion)
Cost per UAE case (US \$)	\$184 (AED 676)	\$241 (AED 8859)	\$215 (AED 790)

Source: UnitedHealth Group Modeling, 2010

The increase in prevalence will inevitably be accompanied by an increase in medical expenditure, even without taking inflation into account.* The total annual costs for treating people with type 2 diabetes is expected to rise to \$563 million (AED 2.07 billion) by 2020 with an additional \$89 million (AED 327 million) spent on type 1. Undiagnosed diabetes will cost \$303 million (AED 1.11 billion) and another \$84 million (AED 309 million) will be spent treating people with prediabetes at a total of \$1.04 billion (AED 5.14 billion).

Turning the Tide on Type 2 Diabetes

These predictions for the UAE are not inevitable. They assume no change in the approach to treating type 2 diabetes and individuals at risk for developing the disease. Fortunately, there is unequivocal evidence that the enormous health and financial toll of diabetes can be significantly reduced by early and aggressive intervention.

A review and meta-analysis comparing pharmacological and lifestyle interventions found that both approaches “reduce the rate of progression to type 2 diabetes in people with impaired glucose tolerance,” one of the diagnostic criteria of prediabetes, and that “lifestyle interventions seem to be at least as effective as drug treatment.”¹⁹

“Interventions to delay or even prevent type 2 diabetes have the potential to improve the health of a population and reduce the burden of healthcare costs.”²⁰

In the U.S., which has high rates of type 2 diabetes and prediabetes, as well as the closely-related risk factor of obesity, interventions have been tested through controlled trials or pilot projects with the National Institutes of Health (NIH), Centers for Disease Control and Prevention (CDC), YMCA of the USA, Indiana University, clinical centers, employers and retail pharmacies. These strategies may serve as models that can be adapted culturally and scaled across the UAE.

Potential Cost Savings in the UAE

An analysis of health care costs over a 10-year period after implementation of interventions for both prediabetes and diabetes in the UAE estimates gross savings ranging from \$156 million (AED 573 million) to \$1.22 billion (AED 4.5 billion) before the cost of implementation.²¹

* Costs based on 2010 US dollars. A sensitivity analysis suggests that an inflation rate with an annual medical consumer price index increase of 5% would increase the total cost by about 30%.

Opportunities for Intervention

Paradoxically, the high rate of undiagnosed diabetes and the relationship between type 2 diabetes and obesity represent multiple opportunities to intervene to prevent or delay onset of the disease, and to control the disease early in its course and thus help individuals with type 2 diabetes avoid traumatic complications. Moreover, effective early intervention in the disease life-cycle can have a material effect on the costs associated with prediabetes and diabetes.

Screening

Identifying people with diabetes and prediabetes can help them avoid disease complications and expensive treatments. In many cases, screening can help people avoid diabetes onset altogether.

The same tests can be used to diagnose diabetes and prediabetes: fasting plasma glucose, oral glucose tolerance, and hemoglobin A1c. Targeted screening of individuals with known risk factors (overweight, inactivity, hypertension, abnormal blood lipid levels, cardiovascular disease, family history and belonging to a high-risk ethnic population) would help. A more sophisticated screening model used by the UnitedHealth Group Diabetes Prevention and Control Alliance combines an analysis of historical health coverage/benefits claims, health assessment, and biometric screening.

Prevention

Lifestyle interventions emphasizing diet and exercise directly address the principal risk factors of obesity and inactivity.²² Intervention studies of people with prediabetes in Sweden, China, the U.S., Finland, and India have uniformly showed reductions in progression to type 2 diabetes.

UnitedHealth Group's Diabetes Prevention Program (DPP), launched in April 2010 in collaboration with the U.S. Centers for Disease Control and Prevention (CDC) and the community-based Y, uses a group-based lifestyle intervention designed especially for people at high risk of developing diabetes. In a group setting over 16 sessions, a trained lifestyle coach counsels participants on eating more healthfully and increasing physical activity, as well as other behavior modifications. After the initial 16 sessions, participants meet monthly for added support to help them maintain their progress.

"Generally we can assume that lifestyle interventions incur fewer and less serious side effects than drug treatment, but, as with the pharmacological interventions, their effect may not be permanent and advice on diet and exercise may need to be reinforced on a regular basis."²³

An integral part of UnitedHealth Group's Diabetes Prevention and Control Alliance, the DPP is based on the original U.S. Diabetes Prevention Program, funded by the National Institutes of Health (NIH) and CDC, which showed that with lifestyle changes and modest weight reduction of about five percent, a person with prediabetes can prevent or delay the onset of the disease by 58 percent. Indiana University School of Medicine researchers were able to replicate the successful results of the U.S. Diabetes Prevention Program in conjunction with the YMCA in a group setting.

The Evidence Base

- **Sweden:** A controlled randomized crossover study in men with normal glucose tolerance (NGT) and impaired glucose tolerance (IGT), or prediabetes. The intervention group received six months of supervised physical training and dietary treatment. Compared to the control group, the intervention group had a lower incidence of type 2 diabetes and a greater reversal of glucose intolerance. At the 12-year follow-up, the mortality rate of the men with prediabetes (IGT) in the intervention arm was no different from the mortality rate of the "normal" subjects, whereas the mortality rate of the individuals with prediabetes in the intervention group was less than half the mortality rate of the men with prediabetes in the control group.²⁴
- **China:** A randomized controlled trial of men and women with prediabetes (IGT), comparing diet, exercise, and diet plus exercise. Over six years, 67.7 percent of the control group developed type 2 diabetes. When adjusted for baseline body mass index (BMI) and fasting glucose (FG), risk reduction in intervention groups was 31 percent for diet, 46 percent for exercise, and 42 percent for diet plus exercise.²⁵
- **Finland:** A randomized controlled trial that included counseling on losing weight, reducing fat and increasing fiber intake, and increasing physical activity. The group receiving the intervention showed half the risk of developing type 2 diabetes compared to the control group.^{26,27}
- **India:** A prospective study of progression from prediabetes (IGT) to type 2 diabetes comparing lifestyle and drug (metformin) interventions. It found a 28.5 percent risk reduction with lifestyle modification compared to 26.4 percent with metformin, and no added benefit of combining the two.²⁸
- **U.S.:** NIH/CDC-sponsored Diabetes Prevention Program was a placebo controlled study comparing lifestyle versus drug (metformin) interventions in a diverse group with prediabetes (IGT). Both interventions had positive effects on prevention of type 2 diabetes and restoring blood glucose levels to normal (NGT). Lifestyle intervention was more effective than metformin in preventing type 2 diabetes, particularly in older adults, and lowering the mortality rate compared to the control group.²⁹

Disease Management

Control and monitoring of blood sugar levels and adherence to insulin and/or oral medication regimes can be challenging for people diagnosed with type 2 diabetes. Managing the disease also requires achieving and maintaining weight loss through diet and exercise, self-care measures such as daily foot inspection, and regular eye and dental examinations. All are essential if the devastating complications of the disease are to be avoided.

Studies have found that improved blood sugar control benefits people with diabetes. In general, every percentage point drop in A1c can reduce the risk of microvascular complications—eye, kidney, and nerve diseases—by 40 percent.³⁰

Research is increasingly demonstrating the value of intensive lifestyle intervention to prevent complications for people who already have type 2 diabetes. Community-based programs, enlisting local pharmacists, have been proven effective in educating and supporting diabetes patients to improve compliance with their treatment plans.

In the U.S., UnitedHealth Group’s Diabetes Prevention and Control Alliance’s Diabetes Control Program provides people with diabetes access to local pharmacists trained to help them manage their condition. The role of the pharmacist is to improve patient adherence to their physician’s care treatment plans. This is consistent with the NIH/CDC’s National Diabetes Education Program recommendations: *Team Care: Comprehensive Lifetime Management for Diabetes*.³¹

The Evidence Base

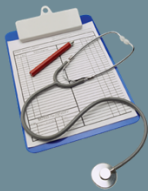

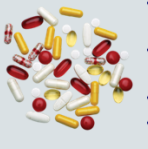

- **The Asheville Project:** Pharmacists helped patients improve compliance with their physician’s treatment plan, including routine diabetes preventive care, medication adherence, and healthy eating and activity goal-setting. Mean A1c decreased at all follow-ups, with more than 50 percent of patients demonstrating improvements at each visit.³²
- **The Ten City Challenge:** The program replicated the Asheville model, with pharmacists providing private, face-to-face diabetes consultation and coaching. The program achieved similar outcomes as the Asheville Project, including reductions in A1c, blood pressure, and LDL levels, and improved self-care.³³
- **Look AHEAD:** an ongoing multicenter, randomized clinical trial studying the long-term effects of intensive lifestyle intervention on major cardiovascular events in overweight or obese patients with type 2 diabetes. Begun in 2001, early results of the 13.5-year trial show positive changes in A1c levels, blood pressure, and lipid levels, as well as greater weight loss and improved fitness, compared with the control group.³⁴

Value-Based Insurance Designs

Value-based insurance designs (VBID) can be used to encourage patient compliance with evidence-based standards of care through information, incentives (such as reducing or eliminating payments), and other behavioral “nudges.”

Case Study: UnitedHealth Group’s Diabetes Health Plan

Goal: Avoid complications of diabetes through early identification and incentives for compliant behaviors

<p>Diabetes and Pre-Diabetes Screening Model Identifies diabetics and pre-diabetics through:</p>  <ul style="list-style-type: none">• Historical Claims Analysis• Health Assessment• Biometric Screening	<p>Diabetes Specific Benefit For the diabetic and pre-diabetic employees. These include:</p>  <ul style="list-style-type: none">• Reduced or eliminated physician office out-of-pocket expenses (for diabetes-related visits)• No charge for selected diabetes self-monitoring training and supplies• Reduced or eliminated out-of-pocket expenses for certain diabetes-related drugs and drugs prescribed for co-morbid conditions
<p>Compliance Requirements Designed to help consumers modify their behavior, improve health and reduce costs. These include:</p>  <ul style="list-style-type: none">• Tracking Web site with personalized care compliance plans• Automatic re-enrollment in year two for members who adhere to evidence-based requirements• Compliance Monitoring System• Access to the UnitedHealthcare Personal Health Record	<p>UnitedHealth Premium Program</p>  <p>Provides access to UnitedHealth Premium designated physicians and facilities that follow national evidence-based quality of care guidelines and market-based cost-efficiency guidelines</p>

UnitedHealth Group pioneered the first commercial VBID design focused solely on diabetes, the Diabetes Health Plan™ (DHP). It provides enhanced benefits to people with prediabetes and people with diabetes, in exchange for meeting care compliance goals derived from evidence-based guidelines, including medication, lab services, professional services, and preventive screenings. The DHP approach starts with a screening model using targeted biometric screening to identify patients with diabetes. The program helps navigate patients to physicians with documented success in supporting people with diabetes. Patients also benefit from a unique condition-specific, web-based reminder system that highlights relevant compliance goals. Early results of the DHP program are encouraging from both an enrollment (as an indicator of consumer acceptance) and compliance (as an indicator of outcomes) perspective. Among participating members, compliance with guidelines for diabetes management has risen by 70 percent. More specific compliance improvement results include:

- LDL- improved from five percent to 28 percent.
- HbA1c- improved from 35 percent to 59 percent.
- Cancer screenings: breast cancer screening increased from 57 percent to 80 percent, and colon cancer screening increased from 31 percent to 59 percent.
- Enrollees filled prescriptions for treatment of the clinical features of diabetes (drugs for hyperlipidemia, hypertension) at a greater rate after DHP enrollment than during the prior year.

It should be emphasized that these are early results from what is an innovative experiment. We expect to continue to evolve the model as more data become available.

Continued on page 14

Case Study: UnitedHealth Group's Diabetes Health Plan *continued*



A Call to Action

The best hope of turning the tide on the evolving diabetes crisis in the UAE is the establishment of community-based initiatives through collaboration between government public health agencies, nonprofit organizations and the private sector. Elements of such programs might include:

- Public education about diabetes and its risk factors
- Early detection through screening
- Prevention/delay of onset through lifestyle modification
- Support for management of chronic disease to avoid complications

The way forward begins with studying and adapting what has worked in other parts of the world to design and implement culturally-appropriate programs for diabetes prevention and control in the UAE. The benefits will be seen in both the public health and economic arenas, by decreasing the burden of disease in the population and lowering the impact on families and communities, private and public employers and the healthcare system as a whole.

APPENDIX: Methodology

To evaluate the prevalence of type 2 diabetes in the United Arab Emirates, we used the two leading, large-scale studies done in the country: 1) Emirates National Diabetes and Coronary Artery Disease Risk Factor Study (ENDCAD), and 2) a regional survey among UAE citizens from Al Ain.^{35,36} Based on these studies, diabetes prevalence rates can be derived either through biometric information (ENDCAD) or self-reported variables (Al Ain survey). Following the regression model used by the International Diabetes Federation in its Diabetes Atlas (third and fourth editions), we derived the weighted average of both studies for our model.^{37, 38}

For type 1 diabetes, no direct information is available for the UAE. Globally, roughly five percent to 10 percent of adult diabetes cases are type 1, depending on the population mix. We assumed that five percent of the diabetes cases in the UAE studies are likely to be type 1 and used that assumption to develop a rough estimate for this form of the disease.

The UAE 2000 ENDCAD reported the portion of clinically-detected diabetes cases that had not been diagnosed prior to the survey. These are essentially undiagnosed cases of diabetes. We applied that fraction, roughly 35 percent of all surveyed UAE respondents, to obtain the prevalence rate for undiagnosed diabetes.

For prediabetes, the UAE 2000 ENDCAD reported impaired glucose tolerance, or IGT. As IGT represents only a subset of prediabetes, the prediabetes estimate presented should be considered an under-reporting of the prevalence of prediabetes.

To estimate the medical costs attributed to diabetes, we calculated a ratio of the medical expenditure per capita for the United States to that of the UAE. The same ratio also is used to estimate the UAE prediabetes cost per case in the model. We assumed no inflation between 2010 and 2020 and used the constant 2010 U.S. dollar in the model. A sensitivity analysis suggests that an inflation rate with an annual Medical CPI increase of five percent would increase the total cost and savings by about 30 percent.

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About UnitedHealth Group

UnitedHealth Group (NYSE:UNH) is one of the world's largest health and well-being companies, serving more than 75 million people in over 50 countries. Our core strengths are in health care technology, actionable health information, care management, consumer engagement and health care financing and insurance. We use these competencies and assets to improve health and health care for consumers, employers, and governments, working in partnership with health professionals and hospitals.

UnitedHealth Group is widely recognized as a pioneer in developing innovative new care models for preventing and treating diabetes, in partnership with patients, health professionals, community organizations and governments. *FORTUNE* magazine independently ranked UnitedHealth Group number one in its industry for innovation in 2010. It was also recognized by *The Wall Street Journal's* 2010 Technology Innovation Awards. Visit www.unitedhealthgroup.com for more information.

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