Type 2 Diabetes Care and Management:
A Comparison of German and American Approaches

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ABSTRACT

Type 2 diabetes, or T2D, affects over 422 million people worldwide. In 2017, diabetes care for the 29 million T2D Americans cost $327 billion, an approximately 88% increase from an American Diabetes Association estimate of $174 billion in 2007. These exorbitant costs are primarily associated with the consequential secondary complications and hospitalizations of T2D. These include cardiovascular disease, stroke, blindness, kidney failure, neuropathy, Alzheimer's, and lower limb amputation. Within their multi-payer healthcare system, Germany has used standardized, evidence-based interventions called Disease Management Programs, or DMPs, to manage T2D since 2002. Studies have shown markedly improved healthcare delivery and health outcomes since DMP implementation, including reduced incidence of diabetic secondary complications, decreasing financial burdens of T2D in Germany. No such programs exist in the United States' fragmented healthcare system. American reform configuration warrants examination of and comparison with German T2D DMPs' successful methods. This study employs interviews and surveys to investigate German and American primary care physicians' opinions of the efficacy of their nation's respective T2D management methods in improving health outcomes, healthcare costs, and quality of care. German physicians reported similar protocol and resource availability for T2D management, as they all enroll their T2D patients in DMPs. In contrast, American physicians' responses varied widely by clinical network and patients' insurers. This thesis will discuss strengths and weaknesses of both systems as well as outline several universal challenges encountered with management of T2D. It will also provide insight into primary care physicians' opinions and recommendations on best directions forward for chronic disease management, particularly addressing these universal challenges.

BACKGROUND INFORMATION / LITERATURE REVIEW

1. Why Type 2 Diabetes Needs to be Noticed

Type 2 Diabetes, or T2D, is one of two types of Diabetes Mellitus, a pathology characterized by the body's inability to control the blood concentration of the small sugar called glucose that is central to nutrition and metabolism (American Diabetes Association). Type 1 Diabetes Mellitus usually manifests itself early in life and is defined by the body's inability to produce insulin, the hormone that controls blood glucose levels (ADA). T2D, however, typically develops later in life and is defined by progressive increased resistance to insulin due to prolonged high blood glucose levels. This thesis deals exclusively with T2D.

T2D has steadily risen to be one of the most significant health concerns worldwide: the number of individuals affected has risen from 108 million in 1980 to 422 million in 2014 (Mathers & Loncar, 2006). According to the National Diabetes Statistics Report in 2017, 8.9% of the U.S. population, or 29 million people, have T2D. It was America's seventh leading cause of death in 2015. The number of adults diagnosed with T2D is estimated to have tripled in the last 20 years (Center for Disease Control and Prevention, 2017), which would suggest there are fundamental environmental or behavior contributors associated with this non-communicable disease. There were approximately 5.8 million people with T2D

in Germany as of 2010, according to Deutsches Ärzteblatt International, (Tamayo, Brinks, Hoyer, et al., 2016). From 2012 data, the nationwide German National Health Interview and Examination Survey for Adults found the overall prevalence of T2D to be 7.4% in the German population between 18 and 79 years of age (Tamayo et al., 2016).

Average healthcare expenditures for diabetics were 2.3 times higher than what expenditures in absence of diabetes would be (CDC, 2017). Furthermore, care for diagnosed diabetics accounts for 1 in 4 healthcare dollars in the U.S., more than half of that expenditure being directly attributable to diabetes, according to the American Diabetes Association (2018). These massive costs in both nations are not primarily associated with the molecular cause of diabetes — the body's inability to properly metabolize glucose — but instead are largely associated with consequential long-term complications and hospitalizations due to prolonged high glucose levels, including cardiovascular disease, leading to heart attack and stroke, blindness, kidney failure, nerve damage, Alzheimer's, and lower limb amputation (Mathers & Loncar, 2006). In Germany, individuals with T2D had 1.81 times higher direct annual healthcare costs, €3352 vs. €1849, and 2.07 times higher indirect annual healthcare costs, €4103 vs. €1981 annual healthcare costs than those without diabetes (Ulrich, Holle, Wacker, et al., 2016). As expected, these increased costs were significantly associated with cardiovascular complications, long duration of diabetes, and treatment with insulin (Ulrich et al., 2016). Beyond the intangible costs of pain, suffering, and decreased quality of life that Type 2 diabetics experience with the accompanying health problems of T2D, these economic estimates highlight the substantial financial burden that diabetes imposes on society.

The estimated total economic cost due to diagnosed diabetes in the U.S. in 2012 was $245 billion, a 41% increase from the previous estimate of $174 billion in 2007 (ADA, 2013). This cost was estimated to be $327 billion in 2017, a further 26% from 2012 once adjusted for inflation (ADA, 2018). Of this total, $237 billion were due to direct medical costs while $90 billion can be attributed to reduced productivity, (CDC, 2017). These ever rising costs are due to both the growth in T2D prevalence and the increased medical costs per diabetic, particularly among the population aged 65 years and older, thus contributing heavily to the growing economic burden of the Medicare program (ADA, 2018). While these reported costs did not distinguish between Type 1 and 2 diabetes, 90 to 95% of diabetes cases in the U.S. are T2D, so the heavy majority of these costs can be assumed to be associated with T2D (CDC, 2017).

Diabetic progression is identified by a patient's glycated hemoglobin (HbA1c) value, a key diagnostic marker used as an index of mean glycemia, or blood glucose levels, in diabetics. HbA1c levels correspondence to diabetic progression do vary slightly among individuals, but the general, universal parameters are as follows: <5.7% = normal, 5.7–6.5% = prediabetic, >6.5% = diabetic. More than one in three American adults fall into this category of prediabetes — approximately 33.9% of the U.S. adult population (CDC, 2017). Perhaps even more concerning is the fact that nearly 90% of those 84.1 million adults are unaware they are prediabetic (CDC, 2017). Prediabetes often leads to T2D, and elevates risk of heart disease and stroke (CDC, 2017). The consequential health and economic detriment that the massive and growing epidemics of prediabetes and T2D in both Germany and the U.S. calls for drastic action. This study will examine how such action ought best be taken.

2. German & American Healthcare Systems Compared

Many industrialized countries employ a universal mandate for healthcare coverage, of which there are three primary program types. Universal coverage is characterized by a health insurance mandate and alleviates the costly overreliance on emergency services that comes from a lack of preventive care for uninsured populations. In the first type of universal coverage, a national health service, medical services are delivered through government-salaried physicians in publicly-owned and -operated hospitals and clinics, financed by the government through tax payments. Private physicians collect their fees from the government and have specific regulations on their practices. Examples of this system include the United

Kingdom., New Zealand, and Spain. In the second type, a national health insurance or single-payer system, a single government entity collects all healthcare fees and pays out all healthcare costs. Canada, Denmark, and Sweden all employ this method in which medical services are publicly financed but not publicly provided. In the third type, a multi-payer health insurance or all-payer system, universal health insurance is provided via not-for-profit health insurance funds, or "sickness funds," that collect premiums from employees and employers and that are used to eliminate the administrative costs for billing by paying physicians and hospitals at uniform rates. Japan, France, and Germany all utilize this system. In contrast, the U.S. healthcare system is unique and not uniform, with no universal health care coverage mandate (Department of Professional Employees, 2016). Instead of operating a national health service, a single-payer national health insurance system, or a multi-payer universal health insurance fund, the U.S. healthcare system can be best described as a hybrid system.

In a Commonwealth Fund Commission healthcare comparison contrasting the U.S. with Australia, Canada, France, Germany, the Netherlands, New Zealand, Norway, Sweden, Switzerland, and the U.K., the U.S. ranked last overall in many categories (Davis, Stremikis, Squires, & Schoen, 2014). This demands attention, especially with the American healthcare system being by far the world's most expensive per capita. U.S. healthcare specialists are among the best in the world, but American medical treatment is often overspecialized, extremely inequitable, and problematically neglectful of primary and preventive care (DPE, 2016). While the U.S. ranked fifth for quality of care, it came in last in efficiency, healthiness of citizens' lives, and efficiency among those 11 countries. Germany fell in the middle of the pack among the 11 countries regarding healthcare spending per capita at $4,495, while the U.S. ranked highest at $8,508. However, Germans were the most likely of the 11 nationalities to hear back from a doctor quickly if they had a question, the most likely to be able to get a same-day or next-day appointment, the most likely to be able to access doctors after-hours without problem, and were found to rarely use emergency rooms. The U.S. was at low end for each scenario (Mossialos et al., 2015). Additionally, according to an analysis in the American Journal of Public Health, for each $100 Germany spends on healthcare, it extends life by about 16 weeks. Meanwhile in America, each $100 spent on healthcare resulted in only two to three weeks more of longevity (Khazan, 2014).

3. Type 2 Diabetes Care Compared

3.1. Type 2 Diabetes Care in the German Healthcare System

The nearly 6 million Type 2 diabetics in Germany is shown to be a 38% increase from 1998 (Diabetes in Zahlen). Individuals with T2D in Germany were found to incur approximately twice as high both direct and indirect healthcare costs annually than those without it (Ulrich, Holle, Wacker 2016). T2D complications, which include foot amputation, retinopathy, blindness, nephropathy, end-stage renal disease, stroke, myocardial infarction/cardiac arrest, ischemic heart disease, chronic heart failure, and angina pectoris, have been shown to have a significant impact on total healthcare costs in Germany not only at the time of an event, but also in subsequent years (Kähm, 2018). Direct medical costs of diabetes in Germany averaged 21 billion euros, and the prevalence of the disease in Germany is projected to continue increasing in upcoming years (Köster, Schubert, & Huppertz, 2009).

Prevention is a priority in German healthcare (Khazan, 2014), so Germany has tried to combat its diabetes epidemic with a preventive outlook. Disease Management Programs, or DMPs, are programs geared towards specific groups of patients suffering from a chronic illness, such as T2D, who receive a standardized, coordinated, set of evidence-based interventions. The goals are to enhance the patients' long-term health outcomes, lower healthcare spending by reducing the need for hospitalization and other costly treatments, and improve quality of medical care (Brandt, Hartmann, & Hehner, 2010). Though many of America's pioneering DMPs in the 1990s did not show short-term positive impacts, other nations including Germany have since tried to follow suit with their own nuanced approaches (Brandt et al., 2010). German statutory health insurance funds started offering DMPs nation-wide in cooperation with

primary care physicians in 2002 (Bundesversicherungsamt, 2016). As of 2006, 75% of primary care physicians in Germany were registered with DMPs (Nagel, Baehring, & Scherbaum, 2006), and nearly four million patients had been enrolled in T2D DMPs by 2014 (Fuchs, Henschke, Blümel, & Reinhard, 2014). In German DMPs, the primary care physician sees DMP-enrolled patients approximately every three months, keeps close tabs on their adherence to program protocol, and coordinates specialist referrals. The DMP protocol includes diabetes education, nutrition consultation and guidelines, enrollment in fitness classes and gym membership, regular foot, eye, and kidney exams, medications (varies by disease progression), and strict, routine blood sugar checks.

Recent studies have shown markedly improved health care delivery and decreases in enrolled patients' HbA1c values (Kostev, Rockel, Jacob, 2017). Furthermore, Germany's DMPs significantly reduced incidence of several diabetic medical complications and had lowered overall cost of care by 13% as of 2010 (Brandt et al., 2010). These successful results, coupled with some of the past, more mixed, results warrant further investigation into these programs' efficacy, as there are many variable factors. This study approached evaluating the efficacy of T2D DMPs via inquiry of opinions of Germany primary care physicians. As they have been administering T2D care through these programs to their patients for many years, they have important firsthand insights into the strong and weak points of the DMPs. Due to the lack of centralization of information from the nature of the U.S. healthcare system, comparable statistics for the U.S. disease management are largely inaccessible and progress is thus harder to discern. However, the nationwide success of German T2D DMPs apparent from these certain studies warrants a point of comparison with the differing American approach.

3.2. Type 2 Diabetes Care in the American Healthcare System

With the rising burden of chronic disease, America's aging population, and a tight financial healthcare climate, delivering better care in a more cost–effective and health outcomes–focused way is a necessity. As discussed in the German healthcare section, disease management programs emphasize educating the patient on how to better self-manage their conditions using evidence-based guidelines. Fragments of U.S. healthcare have also been making efforts to utilize models of integrated care with some characteristics similar to the German DMPs. Integrated care, also known as coordinated care, and patient-centered collaborative care, or disease management, have the clear purpose of providing individuals with chronic diseases with coordinated care that empowers the patient and as a result reduces demand for hospital admissions and improves health outcomes. One particular initiative in the U.S. towards better disease management is seen in the rise of accountable care organizations, or ACOs, which have been piloted in recent years by private insurers, states, and the Centers for Medicare and Medicaid Services (Diabetes Management Programs: Improving Health). ACOs stand to improve clinical integration and coordination and build a sharper focus on prevention, disease, management, and self-care (McClellan, Kent, Beales et al. 2013). Another example of American disease management can be seen with the American Diabetes Association's Standards of Medical Care for Diabetes. Their guidelines include recommendations for glucose monitoring, nephropathy screening, glycemic control, blood pressure control, lipid management, immunizations, detailed guidelines for lifestyle management regarding nutrition, weight management, physical activity, tobacco use, alcohol consumption, and effective strategies for coping with stress (ADA, 2017). Providing guidelines-based care is challenging for primary care physicians largely due to the insufficient amount of time primary care physicians have to spend with each patient; studies found that only on average 54.9% of necessary recommendations were found to have been provided to adult patients by their primary care physicians (McGlynn, Asch, Adams, et al., 2003).

U.S. healthcare's current fee-for-service reimbursement system, which is characterized by physicians being paid per person per visit rather than being paid on a basis of patient health outcome metrics, generally does not offer specific compensation to healthcare providers for emphasizing preventative guidelines to help patients make changes to improve their health. Prevention is not deemed to be at the forefront of importance in American healthcare (Frist & Rivlin, 2015). But for T2D, research

clearly shows that high-risk individuals can avoid developing T2D — or, those already diagnosed can improve or reverse the condition — by implementing preventive lifestyle improvements, including losing weight through dietary intervention and regular physical activity (Mathers & Loncar, 2006). Given both the health outcome and financial motivations, there is an enormous need to more robustly incentivize both patients and providers to focus heavily on successfully fulfilling preventative protocol, particularly in the case of T2D. As no experiential research of primary care physicians with disease management programs exists, this study provides new insight into what methods of chronic care management providers of primary care themselves believe most effectively improve health outcomes, healthcare costs, and quality of care for patients – from the approaches used in the doctor's office with the patient to the insurance and policy level.

4. Purpose of Research Study Questions

This study will address the following questions:

A. In the opinion of German primary care physicians, what are T2D DMPs' biggest
    1. Strengths?
    2. Weaknesses?
    3. Areas of possible improvement?
B. In the opinion of American primary care physicians, what are their T2D care's greatest:
    1. Strengths?
    2. Weaknesses?
    3. Areas of possible improvement?
C. In the opinion of German primary care physicians, how effective are German T2D DMPs in:
    1. Improving health outcomes of T2D patients?
    2. Reducing costs associated with secondary complications of T2D?
    3. Improving quality of care delivered to T2D patients?
D. Considering the opinions of all of the physicians questioned, what are the current most effective management and treatment practices for T2D?
E. Looking forward, what changes in physicians' practicing or healthcare policy would be most effective at improving the health outcomes, cost burdens, and quality of care of T2D patients?

RESEARCH METHODS & DESIGNS

1. Overview

In Germany, I interviewed 8 primary care physicians, emailed them a link to an online survey, and requested they forward the link to primary care physician colleagues to fill out the survey as well. The length of time they have practiced medicine was asked in the survey, but otherwise, no other personal or demographic information was recorded. Data from all 8 interviews were used in results, and a total of 7 survey responses were correctly filled out and recorded. All recruitment of and communication with German physicians, including emails, the interviews, and the surveys, was conducted in German. In the U.S., in Colorado, I interviewed 9 primary care physicians, emailed them a link to an online survey, and requested they forward the link to primary care physician colleagues to fill out the survey as well. I also interviewed a care coordinator in one of the primary physician's offices for supplemental, contextual data. Additionally, I conducted an informative interview with an employee of the YMCA who runs Denver's branch of the Diabetes Prevention Program, or DPP. The YMCA runs their DPP in a partnership with the CDC's National Diabetes Prevention Program. This DPP program is a version of a nationwide, year-long lifestyle intervention program for individuals at risk of developing T2D that was started by the National Institute of Diabetes and Digestive and Kidney Diseases. Data from all 11 interviews was used in

interview results, and a total of 24 survey responses administered to primary care physicians were correctly filled out and recorded. The interviews were all initially recorded, and I listened back to each recording following the interviews to take detailed notes, then deleted the recordings. The data from the results were compiled into qualitative results, analysis, and conclusions.

RESULTS

1. German Physician Results

1.1. T2D Diagnosis & Disease Management Program Protocol in German Healthcare

Every 2 years after age 35, patients have a check-up that is covered by health insurance, though not everyone goes in reality, physicians reported. There is a screening for T2D at this check-up in the measurement of HbA1c, and it was stressed that many patients do not realize they have T2D. Though the exact designations of HbA1c levels vary by age and race, general parameters in Germany were the same as the U.S., where under 5.7% is normal, 5.7–6.5% is pre-diabetic, and over 6.5% is diabetic. If patients have a prediabetic HbA1c, physicians typically do not yet recommend DMP enrollment but rather recommend lifestyle changes, including nutritional instruction and an increase in physical activity. They also request the patient come in for more frequent appointments.

When a patient is diagnosed with a diabetic HbA1c, they are enrolled in a T2D DMP. To enroll their patients in a DMP, German physicians must take an education course; most primary care physicians participate in DMPs. DMPs are largely covered by "Krankenkassen," or health insurance. Approximately 75 to 90% of the program components are fully covered by insurance, and patients are generally willing to pay the remaining small amount out of pocket, reported physicians. Health insurance pays for most medicines that the doctor deems necessary. The T2D DMP protocol includes enrollment in a diabetes education course, enrollment in fitness programs, and consultation with a dietician to supplement nutrition recommendations from the doctor. The DMP protocol also includes regular check-ups with an ophthalmologist, or an eye doctor; a podiatrist, or a foot doctor; a nephrologist, or a kidney specialist; and in extremely progressed cases, an endocrinologist, a hormone specialist.

The primary care physician receives feedback from each specialist; they oversee and direct all aspects of care for the patient. A DMP participant must come to regular appointments every three months. Participants receive a phone call from the health insurance company if they miss an appointment, in which the health insurance company tells them that they will be dismissed from the program if they miss two appointments in a row. One doctor explained how the requirement of seeing all of his DMP patients every three months is not a challenge, thanks to the appointment scheduling format that changed with the implementation of DMPs: the blocks from 9 to 11 a.m. and 4 to 5:30 p.m. every day are only for the already planned appointments like these DMP appointments, which are each very brief, leaving sufficient time throughout the day for appointments regarding more proximate or urgent illnesses, explained this physician.

1.2. Strengths & Weaknesses of T2D DMP

Most of the doctors reflected that they remembering having been quite annoyed with DMPs when they were first implemented. They thought, "Why do I need to do this? This is pointless; I already administer good enough care myself. For whom should we do this? For the health insurance companies?" But now, approximately 16 years after DMP implementation, almost every physician interviewed admitted that they think the DMPs do add value for a variety of reasons.

These reasons include the structure and regularity inherent to DMPs, the sustainability of lifestyle changes they have seen in their DMP-enrolled patients over time, the decreased incidence of secondary complications in DMP-enrolled patients, and the accountability that results from the DMP platform.

However, physicians also reported weaknesses, including excessive documentation and bureaucracy, a lack of customization to patients, the potential for alternate financial motives, and a lack of added value.

2. American Physician Results

2.1. T2D Diagnosis and Care Protocol in American Healthcare

U.S. physicians typically start checking for T2D around age 40, thoughthey may begin at a younger age if the patient is obese or if there is family history of T2D. T2D used to be called "adult onset" diabetes, but it is now called Type 2 instead; in recent years, there have been more and more children diagnosed. Thus, screening of overweight individuals for T2D is starting much younger and more often. Most physicians interviewed said they are able to catch T2D patients fairly early and on the preventive side, if the patients are coming for their regular annual or biannual checkups. While older patients tend to meet those standards, younger adults generally are not as consistent. A physician noted that amidst their busy lives, adults often do not want to make the time to go to the doctor for these preventive visits and are further disincentivized when their insurance doesn't cover it. Although regular preventive visits are covered in Medicaid and some private insurers, they are unfortunately not covered by all insurers. Some physicians interviewed have encountered this problem in practice, and these physicians said they thus pick up T2D incidentally more often than through preventive care. One physician explained that, in addition to the financial and time reasons, "A lot of people don't want to have a chronic disease, so they ignore it for a while." The high blood sugars characteristic of T2D do not cause debilitating symptoms until they are present for a prolonged period of time. A physician said that in her patient population in her smaller practice, some patients will not come in until their glucose level is so high that it can't even be read on the glucometer, which tops out at 600. Often the reason patients visit the doctor's office is because of a yeast infection or bacterial infection in the skin, which can occur as a result of these prolonged high blood sugars. At this point, patients have presumably had high glucose levels for a long time and thus often have the severe secondary complications of long-term organ damage, such as kidney failure, gangrene, neuropathy, and retinopathy. Manifestations of secondary complications are very hard to predict and widely vary from patient to patient. An inadvertently helpful area of incidental T2D detection is in pregnant women, as they are all screened for the disease at their first prenatal visit. One physician remarked that many patients who do not come in regularly often go ten years with T2D before being diagnosed. She inquired, "Is that the fault of [the] health system? Of the patients for not coming in? Of the doctors? Hard to say."

However, networks such as Kaiser Permanente, America's largest integrated managed care consortium, and HealthOne Colorado Care Partners, a clinically integrated network and accountable care organization, focus more heavily on prevention. The physicians within these networks reported that they diagnose pre-diabetes much more often from preventive screening than by chance, as their patients tend to come more regularly for their insurance-covered, preventive visits. A HealthOne physician stated that he rarely sees secondary complications in his patients as compared to 30 years ago, because they "catch [T2D] earlier, treat it harder, and have more drugs." Though the U.S. Preventative Services Task Force has recommended HbA1c as the best test for screening for T2D, a HbA1c test is currently covered by most insurances only if an abnormal glucose level has been diagnosed first for many practices. Kaiser Permanente, however, runs preventative labs including HbA1c on a regular basis. For anyone with a BMI of over 25, which is considered overweight, HbA1c screening is always included. HbA1c testing will probably be more widely covered, without needing the glucose test first, in upcoming years, however, one physician explained.

After discussing weight loss, diet, exercise, lifestyle changes, and food diaries, most physicians put T2D patients on the fairly inexpensive, generic medication Metformin. Metformin works by lowering glucose production in the liver and improving the body's insulin sensitivity, and the majority of T2D patients stay on Metformin for life. At Denver Health, the physician said she puts almost all T2D patients

on, in addition to Metformin, a low-dose ACE-inhibitor, which lowers blood pressure and maximizes blood flow to the kidneys, and a statin, which lowers cholesterol. After these "first line of defense" options come sulfonylureas, which help the body secrete more insulin. These are followed by newer, more expensive medications, including GLP-1 receptor agonists and SGLT-2 inhibitors, which lower blood sugar, help enable weight loss, and lower risk of heart disease and cardiovascular events, or, at last resort, insulin. GLP-1 receptor agonists respond quickly to rises in a patient's blood sugar but also do not cause hypoglycemia. This new medication is thus extremely beneficial for elderly T2D patients, as hypoglycemia is a common problem that arises with insulin use and can be particularly dangerous for seniors. Physicians noted that many patients have trouble with insurance coverage of these newer, more effective medications and thus cannot afford them. Retrospective research showed that German physicians utilize fairly similar medication guidelines; the medication details were discussed in this American section because this information was learned from the American physicians; the language barrier inhibited discussion of specific medications beyond Metformin and insulin with German physicians.

In regards to the specialist visits that are sometimes part of T2D care, the majority of physicians said that they only send their very progressed cases of T2D to endocrinologists and nephrologists, though many T2D patients do end up needing nephrologist attention at some point in their care. Most physicians said they give foot exams at every appointment and administer an annual microalbumin check for kidney function. In addition, an annual eye doctor visit is required for all T2D patients to check for retinopathy. Patients are referred to specialists under supervision of the primary care physician when needed. One physician noted that if a specialist recommends an expensive medication, Medicare or Medicaid is more likely to cover it than if a primary care doctor recommends it, so that is sometimes the reason for specialist referral. However, it is often difficult to make an appointment with a specialist, particularly for Medicare and Medicaid patients, as many providers do not get a significant reimbursement for seeing these government-insured patients.

2.2 Strengths & Weaknesses of American T2D Care Protocol

The majority of strengths of T2D care in the U.S. revolve around the opportunity for innovation that is possible to some degree within the American healthcare system. This flexibility enables the potential for rapid evolution of improvement of care. While this potential has certainly not yet been realized throughout the entire healthcare system, there are strong examples of promise that were elucidated in several of the American physician interviews. Such strengths include increased utilization of technological tools for T2D management and accountability, development of nuanced, robust management programs such as the Diabetes Prevention Program, increased use of the motivational interviewing technique with patients, and the evolution towards team-based care and improved transitional care.

The majority of the weaknesses stem from the disparities within the U.S. healthcare system, given its lack of uniformity across payers and providers. While this gives rise to some of the benefits of innovation discussed above, it also poses many challenges revolving around unequal access to adequate care and resources for both patients and providers. As one of the physicians interviewed said, "Access is everything. If it wasn't disincentivizing to come see me, patients would come in more often and be able to get questions answered. If the healthcare system was free, socialized, single-payer, whatever you want to call it." However, as previously discussed in the weaknesses of Germany's T2D care, universal coverage alone does not solve every problem. But such universal healthcare access would at least remove financial barriers for T2D patients, allowing them access to the medications and effective intervention programs they needs. Key weaknesses include the high cost of medications, the lack of insurance-covered diabetes education, overcrowding of the public healthcare system, and America's somewhat cultural focus on reactive rather than proactive healthcare.

ANALYSIS

1. Similarities Between German and American T2D Care

Despite the wide variance of resources available to T2D patients across Germany and the U.S., the two nations do share much of the basic protocol when diagnosing and administering care for this disease. To start, both German and American physicians stated that the target HbA1c, and thus recommendations surrounding it, varies from patient to patient, especially in respect to age. Older patients do not need to keep their HbA1c as low as middle aged or younger patients, because older patients may die before most of the consequences of T2D affect them, and because a low blood sugar is more dangerous for elderly people. Next, doctors in both countries generally want to see their T2D patients every three months until they have their condition controlled, at which point bi-annual appointments become the norm, although this frequency is typically not achieved across all patient populations in reality. Both American and German physicians also agreed that diabetic education is a factor critical to success for their T2D patients, and that the intensity of this education need be improved, delivered more frequently and for a longer total period of time, and, in the U.S., made more widely available at no cost to all T2D patients.

Another shared characteristic of the T2D protocol was that primary care physicians usually oversee most diabetic care. Doctors universally try to personalize care to each patient and recommend small, realistic lifestyle changes with which they follow up at the following three month appointment. Examples of such recommendations from both German and American physicians included to only drink water and cut out sugary drinks, eat five handfuls of veggies per day, or lose ten pounds, rather than 50 pounds. Both nations' physicians also said that they send their T2D patients who have progressed so far as to need insulin to the endocrinologist approximately every three months, in addition to the three-monthly primary care visit. Finally, some German physicians explained that the success of DMPs in preventing secondary complications does not usually come from completely curing the patients and graduating them from the program. It rather comes from the typically lifelong enrollment in the DMP where patients achieve a state of controlled T2D, in which they have an HbA1C of 7 to 8% and are stabilized with just Metformin. In the same light, American physicians largely agreed that while T2D is reversible, most patients do not enact drastic enough sustainable lifestyle change to achieve such reversal but rather are stabilized or controlled with Metformin and some small lifestyle improvements. The physicians interviewed generally concurred that while a T2D patient's health will rarely be rapidly reversed, success comes through working together as patient and doctor, month after month, year after year, to implement and sustain small lifestyle changes that all add up to a healthier patient.

Both nations also encounter several similar challenges with T2D management, however. One challenge is how diabetes is a "silent disease" that often is not tended to until it has progressed, because many people are unaware that they are diabetic. Physicians have to work to convince the patient of the importance of lifestyle changes and motivate them to make these changes, because high sugar levels alone do not have immediate detrimental effects. Other challenges include the inevitable variety of patient compliance level, the difficulty of sustaining lifestyle changes, the immense control possessed by pharmaceutical companies, and healthcare professionals' lack of time; they complained of spending too much time on bureaucratic paperwork and not enough time with patients. Another challenge both German and American physicians strived to solve was reaching rural patients. A primary care physician interviewed who works in a small, rural German town explained how, in rural areas, primary care physicians must try to do all treatments for their patients since specialists are so few and far between. One hopeful solution to this issue of reaching rural populations is increased use of telemedicine, which will be discussed in the upcoming recommendations and future directions section.

2. Differences Between German and American T2D Care

Challenges unique to the U.S. include T2D's disproportionate detriment to minority populations and people of lower socioeconomic status, prohibitively expensive pharmaceuticals, conflicting financial interests within American healthcare, and rising T2D rates in children. Challenges unique to Germany primarily consisted of the aforementioned downsides of the DMP. The main distinct forte of American T2D care, as discussed in the U.S. strengths section, is the greater prevalence of new, creative methods to try to drive behavior change and lifestyle improvement of T2D patients. The German physicians embraced much the mindset that this DMP is a set protocol; regardless of whether it was succeeding at improving health outcomes and reducing costs incurred, they would follow it and not challenge it to be improved. Some German physicians stated they wouldn't change anything about the DMP when asked in interviews — they considered it a very good and well-structured program. They believed the lack of a 100% success rate for it was due to patients' discipline, thus outside of their responsibility. While this physician satisfaction illustrates potential effectiveness of DMPs on one hand, it also illustrates an inflexible cultural mindset within Germany that prevents flexible innovation, as in the U.S.

In the U.S., some of the more progressive primary care practices put heavy emphasis on the constant effort to innovate new and better ways to improve their T2D patients' health outcomes and reduce their cost burdens. While not all American providers are of this mindset, it was more common as compared to Germany. And though Germany's T2D DMPs have been more successful in improving T2D than American healthcare on average, the novel T2D care in some of the more progressive primary care practices in the U.S. most certainly trumped the results of the DMPs in terms of both economic savings and improving patient outcomes through innovative methods of driving lifestyle change. Many of the recommendations for future directions in the upcoming section come from these American primary care practices, as the German physicians offered far fewer ideas for change and means of improvement as compared to the U.S. physicians. As for fortes unique to Germany, several of the German physicians did recount very positive results of success from their T2D DMP patients. One physician talked about how he observed significant lifestyle improvements in his patients, though he is not positive if it is a result of the DMPs. He thought that cultural and generational improvement could be contributing factors ("70 is the new 60," he said). He explained that people exercise much more now; many of his T2D patients enroll in sport programs that are insurance covered as part of their T2D "*Kassenleistung,"* or services covered by health insurance. Most of the German physicians recounted that, on average, their T2D patients' health has improved since DMP implementation. This view, paired with the studies showing DMP efficacy, suggests that DMPs have, in fact, been an advantageous addition to German chronic care management.

3. Recommendations for Improvement of T2D Care

The concluding recommendations for improvement include increasing use of motivational interviewing to better ascertain root causes, addressing and striving to alleviate social determinants of health, increasing use of technological tools for T2D accountability and management, providing broader access to free T2D education, increasing employment of team-based care and home visits, and revisiting payment incentive structures to shift towards more value-based, rather than fee-for-service, healthcare. Several German physicians stated that the problem with the T2D DMPs was a lack of a rewards principle; they believed there would be greater success in improving patient health if both the patient and the physician were rewarded monetarily for achieving progress. They explained how they thought that such monetary incentives would end up saving money at the end of the day. However, it is highly improbable that T2D patients will be paid by health insurance companies for adhering to program protocol and achieving health improvements any time in the near future, in either German or American healthcare. Change that is more probable, however, is change surrounding physician payment.

Several physicians interviewed brought up the recently catalyzed shift in American healthcare from fee-for-service, or FFS, to value-based reimbursement. The FSS payment model that has dominated U.S. healthcare for decades is characterized by physicians being paid per person and per visit, as mentioned in the introduction. Since physicians are not incentivized to make efforts to provide preventive care to patients and American culture does not emphasize prevention, many patients wait until they are in dire need before coming in to the doctor's office, compromising prevention efforts. Additionally, physicians are not reimbursed based on quality of care or their patients' health outcomes, so there is little differentiation between effective and ineffective patient-physician interactions. This payment model based on patient volume also disincentivizes doctors to take the time to explain the necessary lifestyle change advice to patients; prescription writing is faster thus allows for seeing more patients. A societal shift from the exorbitantly expensive reactive care to the much more cost effective and quality-of-life-improving proactive care described throughout this paper can likely only be driven by economic means.

The answer to this need comes from the value-based primary care reimbursement model, which incorporates clinical outcomes into provider payment and provides differential reimbursements based on measures of medical costs incurred and clinical quality (NIDDKD). This transition is well underway, as nearly a quarter of reimbursement among U.S. healthcare organizations has turned value-based in recent years, replacing a fee-for-service dominated system that had been stagnant for decades. To succeed, the value-based revolution will have to overcome barriers including changes in infrastructure requirements, regulation/policy, information technology, and administrative details. But value-based contracting does hold promising potential for chronic care management, because, as stated by a HealthOne physician, "To succeed in value-based contracting, you've got to focus on prevention." Only the upcoming years will tell to what extent value-based care improves the health outcomes of, quality of care for, and cost burdens incurred by T2D patients. If it is successful, perhaps Germans will be investigating American value-based T2D management programs in the future, instead of Americans investigating the German T2D DMPs as has been done in this thesis.

CONCLUSION

This paper has laid out findings of similarities, differences, strengths, and weaknesses of T2D management methods in Germany and the U.S., as well as best directions forward. Germany champions the strength of providing fairly effective DMP-administered T2D care through their universal health insurance coverage, while the quality of T2D care and resources available varies widely in the U.S., depending on healthcare providers and insurers. With a high number of Americans lacking comprehensive insurance, or with none at all, many who need healthcare to control their T2D end up suffering expensive hospitalizations due to secondary complications that occur with the lack of preventive care, which is detrimental to all parties.

Noteworthy strengths of Germany's T2D DMPs included better blood sugar level monitoring, due to the frequency of visits; improved patient accountability, from health insurance companies calling patients if they miss an appointment; more regular specialist visits, reducing occurrence of secondary complications; and availability of access to T2D management resources without financial barrier. German DMP key weaknesses included lack of customization and excessive bureaucratic documentation for minimal added value. Strengths of American methods revolved around a greater prevalence of innovation, exemplified by increasing utilization of technological tools and motivational interviewing techniques, as well as an evolution towards team-based care delivery and value-based reimbursement models. Weaknesses stemmed from systematic inequality of access in U.S. healthcare, including lack of insurance-covered diabetes education, prohibitively high costs of medication, and insufficient provision of

affordable preventive care. Despite these differences between German and American T2D care, both nations do encounter several universal challenges in T2D management. Such shared challenges include imperfect patient compliance and difficulty of achieving sustainable lifestyle changes — indicating a need for improvement in both nations' T2D care. Due to the strict structure of German DMPs, there was less impetus to create creative methods to overcome this barrier and drive patients' lifestyle improvements among German providers, as compared to select U.S. providers. Yet, nearly all physicians agreed on needing to address these universal challenges. Primary recommendations included restructuring the payment incentive system, based on rewarding improved health outcomes, as well as increased utilization of home visits, dieticians, mental health counselors, technological tools for patient communication and accountability, team-based care, and rigorous diabetes education. Evidently, the future of improving T2D care and management hinges on an intensification of preventive measures, which must be directed by primary care providers, incentivized by insurers, and achieved by patient–physician cooperation. This heightened prevention is the only way forward — not only for the sake of financial reduction it is sure to bring, but first and foremost, for the health outcomes of millions of present and future T2D patients that it can improve.

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