



Full length article

Substance use disorders and medical comorbidities among high-need, high-risk patients with diabetes

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ABSTRACT

Background: The majority of the U.S. healthcare resources are utilized by a small population characterized as high-risk, high-need persons with complex care needs (e.g., adults with multiple chronic conditions). Substance use disorders (SUDs) and mental health disorders (MHDs) are a driver of poor health and additional healthcare costs, but they are understudied among high-need patients.

Objective: We examine the prevalence and correlates of SUDs and MHDs among adults with high-risk diabetes, who are patients at the top 10% risk score for developing poor outcomes (hospital admission or death).

Methods: A risk algorithm developed from Duke University Health System electronic health records (EHRs) data was used to identify patients with high-risk diabetes for targeting home-based primary care. The EHR data of the 263 patients with high-risk diabetes were analyzed to understand patterns of SUDs and MHDs to inform care-coordinating efforts.

Results: Both SUDs (any SUD 48.3%, alcohol 12.5%, tobacco 38.8%, drug 23.2%) and MHDs (any MHD 74.9%, mood 53.2%, sleep 37.3%, anxiety 32.7%, schizophrenia/psychotics/delusional 14.8%, dementia/delirium/amnestic/cognitive 14.4%, adjustment 9.1%) were prevalent. Overall, 81.7% of the sample had SUD or MHD. Elevated odds of SUD were noted among men (tobacco, alcohol) and those who were never-married (alcohol, cannabis). African-American race (vs. other race/ethnicity) was associated with lower odds of anxiety disorders. **Conclusion:** While data are limited to one large academic health system, they provide clinical evidence revealing that 82% of patients with high-risk diabetes had SUD and/or MHD recorded in their EHRs, highlighting a need for developing service models to optimize high-risk care.

1. Introduction

In the United States, the top 10% high-need population ranked by their health care expenses paid out of pocket (e.g., adults with multiple chronic conditions) is estimated to account for 61% of total out-of-pocket expenditures, while the lower 50% healthier population accounts for only 2% of the total out-of-pocket expenditures (Cohen, 2014). This high-need population should be researched to inform high-risk care efforts. The U.S. health system has not adequately served adults with the greatest needs (i.e., those with multi-comorbidities) that often receive poorly coordinated care, utilize potentially avoidable hospital care, or have poor outcomes, thereby contributing to spiraling healthcare costs (Hayes et al., 2016a). Behavioral health disorders

(BHDs), including substance use disorders (SUDs) and other mental health disorders (MHDs), are an important driver of poorer health and escalating healthcare costs per capita (Hayes et al., 2016b; Laderman, 2015). The lack of BHD screening and implementation of integrated care may contribute to continued high rates of BHD and associated negative outcomes. Persons with comorbid BHD and medical disorders incur much higher healthcare costs (e.g., hospitalization, prescription drugs, clinical visits) than those without such comorbidities (Freeman et al., 2014). Unfortunately, BHDs, especially SUDs, among adults with complex healthcare needs are insufficiently studied to be able to inform targeted screening and care-coordinating efforts (Walter et al., 2017). It is imperative to develop empirical knowledge and better understand patterns of BHDs and risk-management needs for high-cost patients to

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inform tailored strategies for improving their overall health and reducing healthcare costs per capita (IOM, 2007).

Multi-morbidity has a profound impact on the patient, his/her family, and the U.S. health system. Available data estimated that about 71% of healthcare spending was for patients with multiple chronic conditions, and the number of comorbidities was positively related to poorer health outcomes and higher healthcare costs per capita (Gerteis et al., 2014). Diabetes, a leading cause of death in the United States (Heron, 2016), is among the most prevalent and costly chronic conditions (ADA, 2017a,b; Ashman et al., 2014; Vijan, 2015). An estimated 30.2 million Americans aged ≥ 18 years, or 12.2% of the adult population, had diabetes (90–95% of cases with type 2 diabetes) in 2015 (Centers for Disease Control and Prevention (CDC), 2017). The growing aging population, longer life expectancy, and a rising rate of obesity may continue to intensify the epidemic of diabetes, its related chronic conditions (e.g., kidney disease), and societal costs (Gregg and Shaw, 2017; Thorpe et al., 2015). By 2050, one in three U.S. adults is estimated to have diabetes (Boyle et al., 2010). Moreover, national data indicate that multi-comorbidity is common among adults with diabetes: 73% of adults aged 25–44 with diabetes had ≥ 2 comorbid chronic conditions, which increased to 88% among diabetes adults aged 45–64 (Ashman et al., 2014). Similarly, BHDs are prevalent in the U.S. population. National data estimated that 18% of U.S. adults had a survey-defined MHD in the past year (Center for Behavioral Health Statistics and Quality (CBHSQ), 2016a). An estimated 19% of U.S. adults with a survey-defined MHD had alcohol or drug use disorder and 6% of adults without the survey-defined MHD had alcohol or drug use disorder in the past year (CBHSQ, 2016a).

Individuals with diagnosed diabetes have medical expenditures estimated to be 2.3 times higher than persons without diabetes (ADA, 2015). Economic costs of diabetes in the United States have continued to escalate. For example, between 2007 and 2012, there was a 41% increase in estimated diabetes costs, rising from \$174 billion to \$245 billion (ADA, 2015). The BHD and diabetes comorbidity represents a ‘double hazard’ in terms of costs, morbidity, and mortality. Both diabetes with complications and BHD (e.g., SUD, mood disorder, schizophrenia) not only are associated with more emergency department (ED) visits and hospitalization readmissions, but also are among the top leading diagnoses among adults who are super-utilizers of hospital care (ADA, 2015; Jiang and Wier, 2010; Jiang et al., 2015). Self-care and good eating habits are crucial for optimal diabetes care management. Having a comorbid SUD may impair self-care and compromise adherence to treatment for diabetes and other comorbidities, thus increasing medical complications or hospital care (Ducat et al., 2014; Ghitzza et al., 2013).

Despite substantial health risks from multi-comorbidities, comorbid BHD and diabetes, especially SUDs, are under-recognized and under-treated (Ducat et al., 2014; *The Lancet Diabetes Endocrinology*, 2015; Walter et al., 2017). In particular, there is a lack of research on SUDs and MHDs for the most-costly, high-risk adults with diabetes. Such high-need, medically comorbid or unstable populations are typically excluded from national surveys of BHDs in the general, non-institutionalized population and clinical trials due to safety consideration or study-specific exclusion criteria (Dennis et al., 2015; Lind, 2011). Therefore, medical record data are needed to characterize such high-cost, vulnerable patients. Given a disproportionately high concentration of healthcare expenditures in a small, but high-need population, we leveraged medical record data to examine the prevalence and correlates of SUDs and MHDs among adults with high-risk diabetes to inform much-needed screening and care-coordination efforts for them.

2. Methods

2.1. Study sample

Duke University received funds from the Centers for Medicare and Medicaid Services (2012–2016) and the Bristol-Myers Squibb

Foundation to augment existing standard of care for adults with type 2 diabetes in community-based medical settings to improve diabetes management (Spratt et al., 2015). Guided by a framework of the spectrum of health and strategies for improvement (Fielding and Teutsch, 2011), an electronic health record (EHR)-based medical risk algorithm was developed using the Duke University Health System EHR data to predict risk for a serious outcome (hospital/ED admission or death) in the subsequent year among adults with type 2 diabetes, which was used to guide the risk-stratified intervention and allocation of available resources (Spratt et al., 2015). The Duke Medicine Enterprise Data Warehouse (EDW) stores the EHR data generated in the healthcare delivery of available patients in the Duke University Health System, including three hospitals and over 200 affiliated primary care and specialty clinics (Horvath et al., 2014). The EDW employs a formal extract, transform, and load procedure to integrate data from source systems on a nightly basis to ensure consistency and quality and to minimize redundancy (Danford et al., 2013).

The risk algorithm was developed initially to predict serious outcomes in 2011 based on the EHR data in 2010, and it was validated by EHR data from 2012 (Spratt et al., 2015). By applying this algorithm to patients’ EHR data, the risk scores for a serious outcome (hospital/ED admission or death) in the coming year were used to identify adults with type 2 diabetes for targeting risk-stratified interventions. Taking into account available resources, adults with a risk score at the top 10% from the risk algorithm were considered high-risk adults for targeting the home-based primary care delivered by a multidisciplinary team (nurse practitioner, social worker, dietitian, and community health worker) over a period of up to 2 years. The home-based care was designed to improve diabetes care, especially for low-income patients with multi-comorbidities (De Jonge et al., 2014; Edwards et al., 2014; Yaggy et al., 2006).

Given that the high-risk population utilizes the majority of healthcare resources (Cohen, 2014), this study examined patterns of SUDs and MHDs among high-risk adults with type 2 diabetes that were at the top 10% of the risk score from the risk algorithm. The sample included 263 high-risk adults with type 2 diabetes living in Durham County, NC. The use of their EHR data between January 1, 2012, and June 30, 2016, for this analysis was allowed under a waiver of consent, HIPAA authorization, and the approval from the Duke University Health System Institutional Review Board (IRB). The analysis of those in the lower risk categories was not possible because they were not included in the original IRB approval.

2.2. Study variables

Demographic variables, including age, sex, patient-identified race (white/Caucasian, African-American, Asian-American, multiracial), patient-identified ethnicity (Hispanic, non-Hispanic), employment, and marital status, were included as correlates of BHDs.

Diagnostic variables were based on ICD-9-CM and ICD-10-CM codes from the list of discharge or final diagnosis codes for inpatient, outpatient, or ED encounters. Common medical conditions that tended to be associated with diabetes—including diabetic retinopathy, non-traumatic lower extremity amputation, chronic obstructive pulmonary disease (COPD), hypertensive disease, ischemic heart disease, and renal disease—were examined to provide medical profiles (ADA, 2015; Heron, 2016). For example, studies have found a robust association between COPD and type 2 diabetes (Gläser et al., 2015). The number of overall encounters (outpatient, inpatient, ED, other visits) during 01/01/2012–06/30/2016 was included as a control variable to mitigate bias related to health care use and severity of medical conditions (Wu et al., 2015). Diagnosis grouping for each variable was defined to be consistent with those from the Agency for Healthcare Research and Quality (AHRQ)’s Clinical Classification Software (AHRQ, 2016) and Military Health System (MHS)’s surveillance case definitions (MHS, 2015).

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