Diabetes Education for Primary Healthcare Professionals
Feature Editor: Kathie L. Hermayer, MD

South Carolina 20 Years of Diabetes—A Public Health Concern

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ABSTRACT

Objective: To assess and enumerate the trends in diabetes prevalence, morbidity and mortality rates in South Carolina (SC) within the past 2 decades.

Materials and Methods: We analyzed state-level data from vital records, Behavioral Risk Factor Surveillance System, Children's Health Assessment Survey and Administrative Claim Files.

Results: Over the past 20 years, there has been an average 2.5% annual increase in diabetes prevalence among adults in SC ($P < 0.01$). Although a typical reduction in mortality rate of 2.2% has been observed during the same period, the increased number of people living with diabetes (from 5.0% in 1995 to 12.0% in 2014) has brought more need for diabetes care, particularly for severe in-hospital cases and cases with crisis at the emergency department, totaling $404 million in annual costs.

Conclusions: SC has experienced an epidemic of diabetes. Coupled with declining trends in mortality and increased hospitalization and emergency department visits, the state is experiencing historical morbidity and complications due to diabetes. The shift in complexity of the disease onset and management has resulted in more individuals living with cardiovascular disease and other comorbidities. The cost of care for all South Carolinians with diabetes is estimated to exceed 2.8 billion dollars in 2014 and projected to be more than 4 billion dollars by 2020. If the diabetes prevalence trend of increasing rates continues over the next 20 years, the number of individuals living with diabetes and its complications would rise to 1.3 million in SC.

Key Indexing Terms: Diabetes mortality; Diabetes hospitalization; Diabetes comorbidity and diabetes prevalence. **[Am J Med Sci 2016;351(4):327–332.]**

INTRODUCTION

The diabetes epidemic is a major public health concern, which needs a carefully planned strategy for assessment and intervention. In the United States, approximately 29.1 million (9.3%) men, women and children have diabetes with approximately 21 million of those with diagnosed diabetes.[1] Furthermore, among adults aged 20 years or older, an estimated 86 million had prediabetes 2012.[2] Every state within the United States is affected by this disease with the greatest burden experienced in the southeast where approximately 15 states comprise the diabetes belt, a geographic area consisting of 644 counties that have an estimated prevalence of diagnosed diabetes greater than or equal to 11% and are within close proximity of each other.[3] South Carolina (SC) is 1 of the 15 states and contains a plurality of these high-prevalent counties.[3] As of 2013, SC had the third highest prevalence of diagnosed diabetes among adults aged 18 years or older in the nation.[4]

When diabetes is not controlled, the risk of morbidity and mortality increases.[2] The existence of multiple comorbid conditions among individuals with diabetes is becoming more common with approximately 88–92% having at least 1 additional comorbid condition.[5,6] In general, the number of persons with multiple comorbid conditions is increasing overall in the United States, which is concerning given the potential growth in this group due to the aging U.S. population and subsequent increased risk for multiple comorbid conditions with age.[7] This was evident in the 2010 National Health Interview Survey which revealed that adults 65 years and older were more likely to have multiple comorbidities in comparison to the other age groups.[7] The health and economic consequences associated with this increasing issue includes premature death, functional impairment, reduced quality of life and increased healthcare utilization and costs, which are also portrayed among individuals with diabetes.[8-10]

Despite the evidence demonstrating the burden of this disease in SC, the trend of diabetes prevalence, mortality and healthcare utilization over the past 20 years has not been critically examined. Furthermore, the effect of comorbidity on hospitalizations for diabetes over the years is uncertain as well. We sought to provide a brief review of population trends in diabetes rates in SC.

MATERIALS AND METHODS

Data Sources

We used 1995–2014 data from SC Vital Records,[11] Behavior Risk Factor Surveillance System (BRFSS),[12] Children's Health Assessment Survey (CHAS) (2012-2014)[13] and Administrative Claim files (1996-2014)[14] to study diabetes and related conditions' encounters. CHAS is specific to SC and began in 2012 as a follow up survey to those parents who participated in the SC BRFSS survey. From death records, we examined International Classification of Diseases (ICD) 9th and 10th revision codes "250.xx" and "E10-E14" for diabetes, respectively. Furthermore, we used the direct method for standardization of the calculated rates.

Data Analysis

Age-adjusted rates for mortality and morbidity were calculated and regressed over time. The Average Annual Percent Change (AAPC) in diabetes prevalence trends among adults were computed and tested for differences between groups (ie, men and women). We also applied the Elixhauser Comorbidity algorithm[15] to the hospital discharge data of the SC administrative claims files, using ICD-9 diagnoses codes, to define the existence of 30 comorbid conditions as separate dichotomous categorical variables for each inpatient stay. Then, we calculated the total number of comorbid conditions present for each inpatient visit with diabetes as the primary diagnosis. The comorbidity categories of diabetes mellitus and diabetes mellitus with complications were not included in the total number of comorbid conditions. Inpatient visits were further categorized according to the number of comorbid conditions as follows: zero (or no) comorbidity, 1 comorbidity, 2 comorbidities or 3+ comorbidities. Age-adjusted diabetes-related hospitalization rates using 2000 standard population were calculated for each year between 1996 and 2014, and graphed to examine how the rates changed over time for each number of comorbid conditions present. The Joinpoint Regression Program (version 4.2)[16] was used to perform a piecewise regression analysis of the trend lines to determine the best model with the fewest number of joinpoints (observable points of change in the slope).[17] As the unit of analysis is year, there were 19 data points of hospitalization rates included in the analysis. A set of pairwise comparisons to test parallelism assumptions were made between the trend lines.

RESULTS

Diabetes Prevalence

Children

The recent epidemic of overweight and obesity has made it necessary for the states to start measuring and monitoring childhood diabetes. According to the 2012-2014 CHAS, 0.79% (95% Confidence Interval (CI) of 0.41-1.10%) of children 2-17 years of age were reported having been diagnosed with diabetes. There are noted disparities in diabetes prevalence in SC with obese children and African-American (black) children displaying a higher prevalence. The 3-year average (2012, 2013 and 2014) prevalence of diabetes among black children was 0.8% (95% CI: 0.4–1.2%) in comparison with 0.6% (95% CI: 0.2–1.0%) among white children. Children
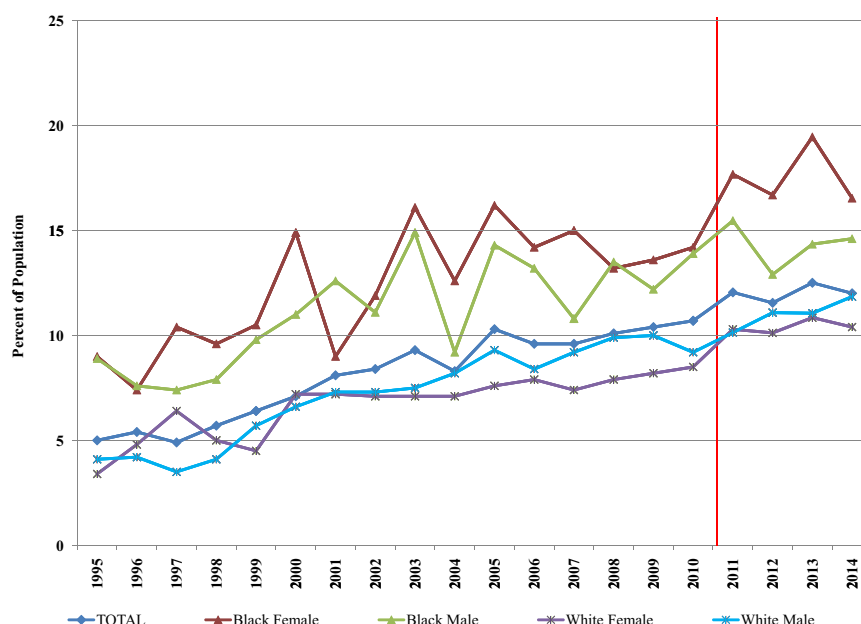

FIGURE 1. Adult self-reported lifetime diabetes prevalence by race and sex, SC 1995–2014 (Data Source: South Carolina Behavioral Risk Factor Surveillance System; generated by the Division of Chronic Disease Epidemiology, September 2015). Red line indicates methodological change in BRFSS.