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Social Science & Medicine 64 (2007) 1766–1775

SOCIAL SCIENCE & MEDICINE

www.elsevier.com/locate/socscimed

Racial disparities in diabetes a century ago: Evidence from the pension files of US Civil War veterans

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Available online 19 January 2007

Abstract

Using a comprehensive database constructed from the pension files of US Civil War veterans, we explore characteristics and occurrence of type 2 diabetes among older black and white males, living circa 1900. We find that rates of diagnosed diabetes were much lower among males in this period than a century later. In contrast to the late 20th Century, the rates of diagnosed diabetes were lower among black than among white males, suggesting that the reverse pattern is of relatively recent origin. Two-thirds of both white and black veterans had body-mass indexes (BMIs) in the currently recommended weight range, a far higher proportion than documented by recent surveys. Longevity among persons with diabetes was not reduced among Civil War veterans, and those with diabetes suffered comparatively few sequelae of the condition. Over 90% of black veterans engaged in low paying, high-physical effort jobs, as compared to about half of white veterans. High rates of work-related physical activity may provide a partial explanation of low rates of diagnosed diabetes among blacks. We found no evidence of discrimination in testing by race, as indicated by rates of examinations in which a urinalysis was performed. This dataset is valuable for providing a national benchmark against which to compare modern diabetes prevalence patterns.

Keywords: USA; Type 2 diabetes mellitus; Health inequalities; History of medicine; Veterans disability claims; Obesity

Introduction

Type 2 diabetes mellitus is an important cause of morbidity and mortality in the United States in the 21st Century, especially among minority populations. In 2004, the age-adjusted prevalence of diagnosed diabetes was nearly 50% higher among African-American than among white men, and diabetes is increasing among all demographic groups in the US. Age-adjusted prevalence increased from 1980 to 2004 by 76% among white males, 65% among white females, 68% among black males, and 37% among black females (US Centers for Disease Control, 2006a).

A number of factors may account for this rapid increase. The most likely causes include life style changes associated with economic growth, such as increased nutritional intake, decreased physical activity, resulting in obesity, and increased longevity

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doi:10.1016/j.socscimed.2006.12.004

resulting in greater exposure time for expression of a genetic predisposition to diabetes. Increased body mass index (BMI), a measure of obesity, is among the most important risk factors. A very large study of men 40–75 years of age found that men with a BMI of >35 were 42 times more likely to develop diabetes compared with men whose BMI was less than 23 (Chan, Rimm, Colditz, Stampfer, & Willett, 1994). Obesity rates are higher among African-Americans than among whites; however, less is known about the relative importance of the underlying causal factors in African-Americans than in Caucasian populations (Tull & Roseman, 2006).

Awareness of high diabetes rates among African-American populations is fairly recent. Through the end of World War II, the ethnic group thought to be particularly prone to diabetes was the Jewish population of northeastern US cities. Only in the 1950s did physicians begin to comment on the rising prevalence of diabetes in blacks, and formulate policy to combat the trend (Tuchman, 2006). This raises the question of whether diabetes was truly an emergent disease among African-Americans during the past half century in the US, or whether it was present but merely underdiagnosed before the 1950s.

Federal pension program data on both white and black Civil War Union Army veterans have recently become available in machine-readable form. This is a unique data source in providing national data from physicians' examinations of US men from the Civil War through about 1930.

The period from the 1890s through the first decades of the 20th Century is especially interesting as it immediately precedes the discovery of insulin in 1920, and the hormone's widespread clinical application in the following decades (Bliss, 1982). Except possibly for a limited calorie diet, there was no therapy for diabetes that would be recognized as efficacious today prior to this innovation. The most prominent dietary regimens in the early decades of the 20th Century were high in fat and protein, and very low in carbohydrates. These were coupled with a regimen of fasting to initially reduce blood sugar, followed by the gradual introduction of proteins, fats, and scant carbohydrates while the urine glucose was monitored. This method was applied in hospitals to persons diagnosed with both type 1 and type 2 diabetes (Westman, Yancy, & Humphreys, 2006).

Almost all cases of diabetes in our study of adults in middle age and late life were presumably of type 2, the type of diabetes mostly characterized by adult onset, and tied to the efficiency of insulin receptors rather than to the destruction of pancreatic islet cells (where insulin is produced). It is very unlikely that a person with type 1 diabetes would have been in the army during the Civil War or would have survived a quarter century or more after the War. Based on contemporary information about diabetes, we formulated several hypotheses about race-specific prevalence of type 2 diabetes and characteristics of persons diagnosed with disease among males at the turn of the 20th Century.

The first hypothesis was that more blacks would have diabetes than whites, mirroring the situation prevailing in the US currently. This would occur to the extent that blacks are more genetically predisposed to be overweight and/or to develop diabetes, and that these dispositions themselves are time invariant (Brancati, Kao, Folsom, Watson, & Szklo, 2000; Pi-Sunyer, 1990). Second, we hypothesized that men in these two cohorts diagnosed with diabetes would tend to be obese, as are many type 2 diabetics in the US currently. Third, since prevalence of type 2 diabetes increases with age, prevalence of diagnosed diabetes should also increase as the veterans aged. We also sought to determine if whites and blacks differed significantly in age, so we could eliminate age as a potential confounder for any observed differences. Fourth, prevalence of diabetes would be higher for men in higher-earning occupations associated with less physical activity.

Offsetting hypothesis 1 are both the lower income and greater physical demands of jobs performed by blacks in Jim Crow America during this time period. This would have decreased prevalence of diabetes in this group. These factors might offset any genetic predisposition African-Americans might have to be overweight and to develop diabetes.

Fifth, given the well-known association of diabetes with atherosclerosis, poorly healing infections, kidney failure, and other diseases, and given the lack of effective therapy available during the study, we expected the diabetics to be short lived, certainly more short lived than their non-diabetic peers (Haffner, Lehto, Ronnemaa, Pyorala, & Laakso, 1998; Stamler, Vaccaro, Neaton, & Wentworth, 1993). Since some sequelae of diabetes do not appear until several years from diagnosis, we questioned whether we would be able to observe such sequelae at all in this presumably short-lived population. Sixth, we hypothesized the medical technology and expertise for diagnosing diabetes

differed by region because of patterns of technology and knowledge diffusion.

Methods

Background

Effective in 1862, all Civil War veterans of the Union Army with service-related disabilities were entitled to pensions. To obtain a pension, veterans had to be examined by a panel of physicians who determined whether the veteran's illness or injury qualified for compensation under the federal program. Prior to 1890, only war-related disabilities were compensated. In 1890, the law was amended to include compensation for conditions unrelated to the war. This statutory change led to a major increase in veterans having examinations for the purpose of obtaining a pension. In 1907, the program was further amended to include compensation of veterans on the basis of age as well as condition. Although old age was not recognized by statute as a sufficient basis for receiving a pension until 1907, a minimum pension was granted to all those aged 65+ during the 1890–1907 period unless the veterans were unusually vigorous (Costa, 1995; Shaffer, 2004).

Data

The data used in this study were produced in machine-readable form from written records by the Center for Population Economics at the University of Chicago (CPE). A sample of 35,747 white males in 303 Union Army companies was selected by CPE from among the over 20,000 company records stored at the National Archives in Washington DC. Three public data files were used in our analysis, "Surgeon's Certificates," "Military, Pension, and Medical Records," and "Census Records" (Interuniversity Consortium for Political and Social Research (ICPSR) Series 3417, 6836, 6837, respectively). The CPE project has been recently extended to include a cohort of about 6000 black veterans (Fogel & the Center for Population Economics, 2006). Information on each Union Army veteran, white and black, from each of the files is linked via a unique identification number, allowing for longitudinal tracking of military, medical, and socioeconomic information for individual veterans.

The Surgeon's Certificates data contain medical records used by the US Bureau of Pensions to evaluate pension applications. Each record contains results of physical examinations performed by 3 physicians. Veterans could apply for a pension more than once, and claim more than one disability at each application, which in turn was accepted or rejected by the examining surgeons. Surgeon's Certificate data were classified by the CPE into 21 primarily organ system-based health screens. Our analysis used the general information screen, including age, region of the US, weight, and height, and screens for endocrine diseases and genito-urinary disease. The latter screen contains information on urinalysis performed during the physical examination.

We used the Military, Pension, and Medical Records for dates of death. We used data on occupation and location of residence for the years 1850, 1860, 1900, and 1910 from the Census Records file, which contains data from Decennial Census records on men in the sample. Birth dates were recorded in all three data files.

In total, the sample includes 17,721 whites and 1953 blacks who survived to 1890 and had at least one examination for pension. The analysis sample consisted of 16,006 white and 1759 black veterans for whom data on birth date, age, death, first examination date, weight, and height were available.

We determined diabetes status in 1 of 3 ways: (1) whether or not a diagnosis was coded in the endocrine disease screen, (2) a search within the comment variable of this screen for the term "diabetes," or (3) a search for a finding of "glucose" or "sugar" in the urinalysis variable in the genito-urinary screen. Testing for blood glucose was not clinically available at the time of these examinations, and there is no way to determine sensitivity or specificity of the urinalysis kits then in use compared to modern diagnostic tools. We considered diabetes present from the date of first diagnosis until death, whether or not subsequent examinations mentioned a diagnosis of diabetes. We computed prevalence in a year as the ratio of the number of veterans diagnosed with diabetes at an examination through that year over the number of veterans alive in that year who had been examined at least once.

Characteristics of persons diagnosed with diabetes were determined in the following ways. We calculated BMI using the US Centers for Disease Control formula: Weight (lb)/ Height $(\text{in})^2 \times 703$. Socioeconomic status was determined using occupational information from the 1900 Census records and a modification of Wilcox's method for

classifying occupations according to their prestige (Wilcox, 1992).

The occupational classification system used in our study grouped men into these occupational categories: farmer/agricultural labor; professionals and proprietors; semiskilled and manual labor; artisans; and unproductive—the final category consisting of individuals not at work. For 50% of the white veterans, occupation was not available. For blacks, for whom data were assembled by CPE more recently, information was lacking in only 1.7% of observations. In applying Wilcox's classification approach, we encountered difficulty with the category "farmer."

The original Wilcox classification distinguishes between 1, "farmer, agriculturist" and 9, "farm/agricultural labor;" however, if the census report read "farmer" it was impossible to know if the man owned a thousand acre farm with hired hands who did most of the physical work, or the man was a sharecropper just getting by. Among blacks, 53% were listed as category 1 and only 3.4% as category 9. Although it seems plausible that most of these black veterans in category 1 are agricultural laborers with low income and jobs with high physical effort, we cannot document this. Accordingly we combined the two categories.

Priority in determining the veterans' birth date was given to the military record, the date recorded in the report of the first examination, and the US Census, in descending order. If the birth date was not recorded in any of these sources, we inferred the date of birth from the veteran's age at the first physical examination.

Statistical analysis

Pairwise *t*-tests, χ^2-tests and regression analysis were performed using STATA, version 7.0. The regression used a logit model to predict diabetes status at first examination from each of race, standardized on white, BMI category at first examination, underweight (<18.5), overweight (25–34.9), and obese ($\geqslant 35$), standardized on normal (18.5–24.9), age at first examination, 45–54, 55–64, 65–74, standardized on <45, and region of first examination, Upper South and Lower South, standardized on Non-South. "Lower South" refers to Georgia, South Carolina, Florida, Mississippi, Louisiana, Alabama, and Texas. "Upper South" refers to Arkansas, North Carolina, Maryland, Virginia, Tennessee, Missouri, and Kentucky. "Non-South" refers to all other states, including those in the Northeast, Midwest, and far West. Because so many values of occupation for whites were missing and we did not find differences in diabetes prevalence by occupation, we did not include occupation variables in the regression analysis. The regression analysis was based on a sample of 17,729 observations.

Results

Of 16,006 white male veterans examined, 619 men had a diagnosis of diabetes during 1890–1910, 3.9% of the population. Among the 1759 black veterans examined, 2.3% men were diagnosed with diabetes during this period ($p = 0.38$).

The percentage of persons diagnosed with diabetes increased over time (Fig. 1), both among whites and blacks. By 1910, between 4% and 5% of whites and slightly over 3% of blacks were diagnosed with diabetes. The percentages declined during the second half of the 1890s among blacks. These declines reflected the deaths exceeding the number of newly diagnosed veterans. The greater volatility among blacks diagnosed with diabetes reflects the smaller sample for this group, particularly after 1910. Although the percentages continued to increase after 1910, they are based on much smaller sample sizes due to deaths.

The mean BMI for white and black men with diabetes was within the normal range (18.5–24.9, US Centers for Disease Control, 2006b); but the mean was higher for black than for white diabetics (Table 2, $p = 0.015$). The same pattern held for non-diabetic men ($p < 0.001$), but the difference in mean BMI between white and black men was smaller. Both white and black diabetics were heavier on average than their non-diabetic counterparts, although this difference was statistically significant only for whites ($p = 0.001$).

Men with diabetes were about twice as likely to have been obese at the first examination (BMI > 30.0) than were men without this diagnosis (Table 1). There were statistically significant differences in the frequency distributions for whites with and without diabetes ($p = 0.01$) by underweight, normal, overweight, and obese status, but not for blacks ($p = 0.27$), using a χ^2-test.

Occupational status differed only slightly between persons diagnosed with diabetes and others for both races (Table 2). However, blacks overall were much more likely be employed in agriculture than were

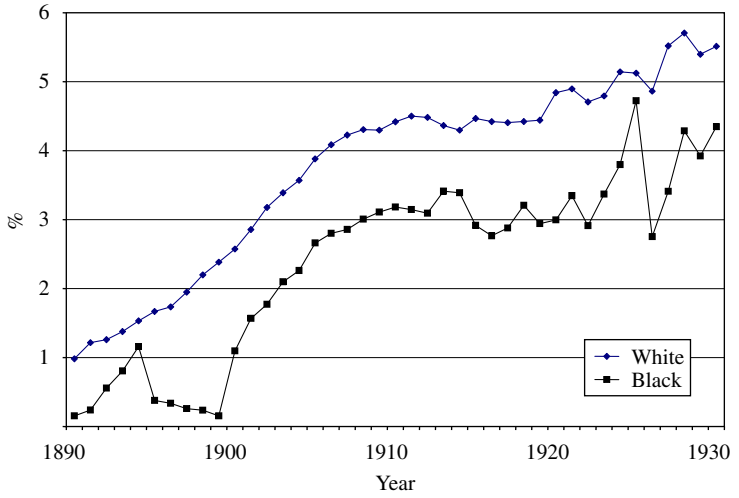

Fig. 1. Percentage of veterans diagnosed with diabetes by race.

Table 1
Distribution of mean body mass index at first examination (%)[a]

Race	Underweight (BMI < 18.5)	Normal (BMI 18.5–24.9)	Overweight (BMI 25.0–29.9)	Obese (BMI ⩾ 30)
Panel A. Veterans with diabetes				
White	11.4	63.0	19.2	6.5
Black	2.6	69.2	20.5	7.7
Panel B. Veterans without diabetes				
White	3.3	76.5	16.6	3.6
Black	1.0	71.6	24.4	3

[a] χ^2 analysis for whites with and without diabetes ($p = 0.01$), and for blacks with and without diabetes ($p = 0.27$).

whites. "Unproductive" was the term used for non-employed individuals. 57.8% of black veterans were employed as farmers and 35.8% as manual laborers, whereas only 39.2% of white veterans were farmers and 9.4% were manual laborers. This supports the notion that whites tended to be in more sedentary occupations. However, given the high percentage of missing values for occupation among whites, we did not include occupation as covariates in the regression analysis presented below.

Surprisingly, for both white and black veterans, those diagnosed with diabetes in fact lived longer than did their undiagnosed counterparts (Table 3). White veterans diagnosed with diabetes were, on average, 74.4 years of age at death as compared with 72.0 years of age for those with no diagnosis of diabetes ($p < 0.001$). For blacks those averages were 73.8 years and 70.1 years for those with and without a diagnosis of diabetes ($p = 0.043$). To further investigate whether diabetes mellitus was associated

Table 2
Occupation in 1900 and Diabetes status[a]

Occupation in 1900 census	Diabetes	Non-diabetes	All
Panel A. White Veterans			
Farmer/agricultural labor	44.4	39.0	39.2
Professionals and proprietors	17.1	18.3	27.8
Semiskilled/manual labor	17.4	19.0	9.4
Artisans	12.4	13.7	13.6
Unproductive	8.7	10.1	10.0
Total	322	7626	7948
Panel B. Black Veterans			
Farmer/agricultural labor	60.5	57.7	57.8
Professionals and proprietors	2.6	2.7	2.7
Semiskilled and manual labor	31.6	35.9	35.8
Artisans	5.3	3.4	3.4
Unproductive	0.0	0.3	0.3
Total	38	1691	1729

[a] χ^2 analyses showed no significant differences between veterans with and without a diagnosis of diabetes among either whites ($p = 0.40$) or blacks ($p = 0.95$).

with increased mortality in this sample, we conducted multivariate hazard analysis on the white male population (not shown). Holding various comorbidities, occupations, marital status, and literacy constant, the death rate for white diabetics was 3% lower than for persons without diabetes, but this difference was not statistically significant ($p = 0.63$ with a hazard ratio of 0.97). Occupation was included in the hazard analysis which is not shown but not in the logit analysis shown in Table 5.

Even before the Civil War, the South was less industrialized than the rest of the US. The War devastated much of the South. For both reasons, one would expect lower rates of technological diffusion, including methods of diagnosing diabetes, in the South than elsewhere. The vast majority of white veterans were first examined in states outside the South (Upper and Lower South) (Table 4). However, blacks were more likely to be first examined in these states, especially the Upper South. While for whites, the distribution of persons diagnosed with diabetes by location of first examination was similar to that for persons not diagnosed, for blacks, the likelihood of being diagnosed with diabetes was higher if examined outside the South, which is consistent with the view that medical care was less up-to-date in the South, leading to lower rates of diagnosed diabetes in the South.

Table 3
Mean ages at death

Group	White (SD)	Black (SD)	*p*-value (row)
Diabetic	74.4 (10.4)	73.8 (11.1)	0.749
Non-diabetic	72.0 (11.7)	70.1 (11.5)	<0.001
p-value (column)	<0.001	0.043	

Fig. 2 supports our expectation that veterans with known diabetes would have received urinalysis tests more often and earlier than the non-diabetic population, even when all the rates exceed 90% in the first years of the 20th Century. Urinalysis screening suddenly increased around 1897. Judging from the fractions of blacks and whites receiving urinalysis tests, there is no sign of discriminatory care in these data; blacks, if anything, were more likely to be asked for a urine specimen than white (Fig. 2).

The regression revealed black veterans were 42% less likely to be diagnosed with diabetes at first examination than were whites (Table 5). In addition to diabetes, the regression included covariates for BMI, age, and region in which the examination occurred. Obese individuals were nearly twice as likely to be diagnosed with diabetes compared to those with normal BMI. Overweight individuals were slightly more likely to be diagnosed with diabetes, and underweight individuals showed no difference compared to those with normal BMI. Diabetes status at first exam did not vary systematically with the age of veterans. The regression analysis confirmed that those first examined in the Upper South were much less likely to be diagnosed with diabetes than were those first examined outside the South. There was no statistically significant difference in the probability of being diagnosed with diabetes between the Lower South and states outside the South.

Discussion

Prevalence of diabetes among black veterans did not differ statistically from that of whites; however, accounting for other factors, including BMI and region of examination, blacks were much less likely

Table 4
Location of first examination[a]

Region[b]	White			Black		
	Non-diabetic	Diabetic	All	Non-diabetic	Diabetic	All
Non-South	90.4	89.7	90.4	34.6	46.2	34.9
Lower South	0.7	0.3	0.7	15.2	23.1	15.4
Upper South	8.9	10.0	8.9	50.2	30.8	49.7

[a]Eight thousand fifty-eight observations for white veterans were missing because the board's address was not recorded. These observations were excluded from the estimates presented here.

[b]"Lower South" refers to: Georgia, South Carolina, Florida, Mississippi, Louisiana, Alabama, and Texas. "Upper South" refers to: Arkansas, North Carolina, Maryland, Virginia, Tennessee, Missouri, and Kentucky. "Non-South" refers to all other states, including those in the Northeast, Midwest, and far West.

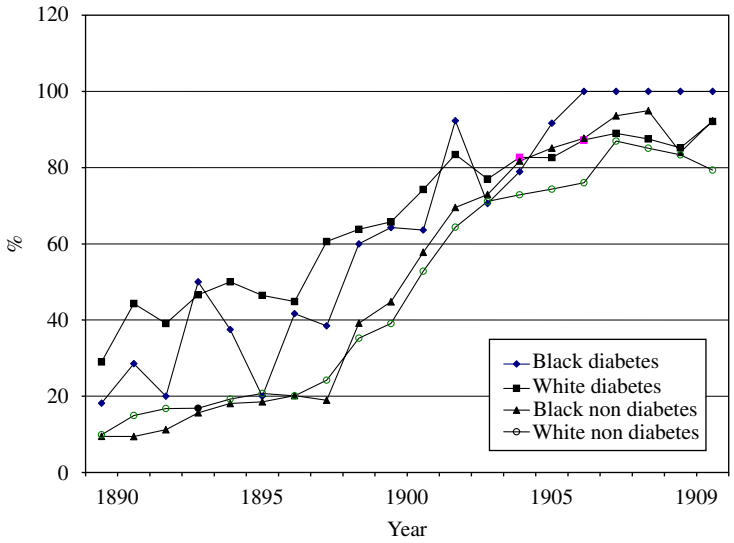

Fig. 2. Percentage of examinations at which urinalysis was conducted.

Table 5
Logit analyses of determinants of diabetes status at first examination[a] ($N = 17{,}729$)

	Odds ratio	95% confidence interval	
Race			
Black	0.581	0.413	0.818
BMI category			
Underweight	0.988	0.611	1.597
Overweight	1.229	1.005	1.503
Obese	1.977	1.429	2.735
Age			
Age 45–54	1.022	0.859	1.216
Age 55–64	0.609	0.480	0.771
Age 65–74	0.381	0.232	0.626
Age 75+	0.504	0.185	1.370
Region[b]			
Lower South	1.335	0.728	2.449
Upper South	0.617	0.457	0.832

[a]Regression standardized on race = white, BMI Category = normal (18–25), age < 45, Region of first examination = Non-South

[b]"Lower South" refers to: Georgia, South Carolina, Florida, Mississippi, Louisiana, Alabama, and Texas. "Upper South" refers to: Arkansas, North Carolina, Maryland, Virginia, Tennessee, Missouri, and Kentucky. "Non-South" refers to all other states, including those in the Northeast, Midwest, and far West.

to have been diagnosed with diabetes than were whites. This is the most important finding, implying that current differences in rates of diabetes among males did not exist a century earlier and are of more recent origin.

Although there was an increase in prevalence as the cohort aged for both races, age did not have a systematic relationship with the probability of having diabetes in multivariate analysis. Importantly, we found no racial differences in rates at which urinalysis was applied, thus ruling out discrimination in testing as a reason for the lower reported rates of diabetes for black veterans.

Patterns of diagnosed diabetes among men in the late 1800s and early 1900s were vastly different from the diabetic population in the modern US. Recent data from the mid-1990s US show that among men in the 45–64 age range, the diabetes prevalence rate for whites was 5.2% and 12.8% for blacks (US Centers of Disease Control, 2006a). Thus, our sample has a markedly lower prevalence of diabetes than the modern US, especially among black males.

The paucity of diabetes cases among African-Americans is supported by the turn of the century medical literature. Morrison (1916, p. 56) noted about blacks in Boston, "Only in eleven instances was diabetes the cause of death in negroes; this is in accord with the general observation that diabetes is not common among the colored races." Fitz and Joslin (1898) reported that they could find only one black man among 172 19th Century diabetes cases at the Massachusetts General Hospital. In commentary on the paper published just after it, other physicians agreed that even in parts of the country with a larger black population than Boston, diabetes was rare among them. Stern (1901, p. 228) found similar results in New York City. While it is

true that lower socioeconomic status and the social barriers of Jim Crow America limited the contact between African-American patients and physicians, we suspect that the prevalence data is correct, and that type 2 diabetes mellitus was much less of a problem among black Americans at the turn of the century than among whites, and certainly than it is today.

In contrast to both black and white Civil War veterans, the mean age-adjusted BMI among adult white males in the United States was 28.0 in the year 2000 (Su, 2005). These veterans, diabetic and non-diabetic, black and white, were much thinner than modern Americans.

As in more recent years, obesity had a very important effect on the probability of being diagnosed with diabetes. Comparison of the Civil War veterans with diabetes to a more modern American sample are revealing. The National Health and Nutrition Examination Survey from the late 1970s recorded BMI as well as the presence or absence of type 2 diabetes. Two to three times as many men with diabetes were normal weight in the earlier sample compared to those in the more modern US. Also striking is the fact that while rates of overweight and obesity were similar for the Civil War soldiers of both races, for the modern sample the white men tended to be normal to moderately overweight, while a large proportion of the black men were obese. The modest difference in BMI evident in the veterans sample has expanded markedly in the intervening years.

Although a link between obesity and a diagnosis of diabetes is evident from our analysis, it was only late in our observational period, 1916, that Elliott Joslin, one of the first diabetes experts in the US, linked obesity and diabetes (Joslin, 1916; Presley, 1991) Our data would suggest that it was not that he missed this obvious connection earlier, but that the population of obese diabetics had not yet emerged in large numbers. This suggests that some aspect of American culture began to change in the first two decades of the twentieth century that affected the pattern of diabetes. Closer examination of both patterns of food intake and measures of physical activity during these decades might illuminate the reasons why the link between obesity and diabetes became more obvious at this time.

Blacks were much more likely to be in agricultural and manual labor occupations than were whites, although there were no differences according to whether or not the veteran had been diagnosed with diabetes. There is, perhaps, a portent in the relative BMIs in the Civil War veteran samples. Some 94% of the black veterans worked in jobs involving a substantial amount of manual labor, compared to about 50% for whites. Yet in spite of disadvantages of being in lower income occupations, they weighed a little more than their white veterans. This supports David Barker's "fetal origins hypothesis," which argues that low birth weight babies, especially those whose size reflects maternal malnutrition, retain a life-long tendency toward obesity and insulin resistance. Their bodies adapted in utero to maximize calories and retain that ability even if in later life calories become abundant, so that obesity and type 2 diabetes follow. (Barker, 1999; see also Kuzawa, 2005). Although direct evidence of birth weights of our black cohort is not available, Steckel (1986) has shown that American slave children were unusually short, a sign of chronic malnutrition in childhood and suggestive evidence of initial low birth weight.

Veterans diagnosed with diabetes lived longer than others, a very surprising finding, suggesting that the cases must have been mild on average. It is quite possible that many of those with severe diabetes did not survive to be examined. Another possibility is that persons with diagnosed diabetes received more medical care and survived longer for this reason.

From analysis of individual records of veterans diagnosed with diabetes we performed, persons with diagnosed with diabetes were rarely afflicted with the secondary sequelae of diabetes, and in general appeared to have suffered little from this diagnosis. These results lend support to the argument that the oft-noted modern sequelae of diabetes, including lost years of life, might be more due to the concomitant obesity than to insulin resistance itself.

The data do not indicate if any of the men with diabetes in our sample were under a physician's care and following a treatment regimen, as the doctors doing the pension exams were not the veterans' primary physicians. The pension examiners did not follow the patients, or prescribe for them; their job was strictly to document disability. But we think it likely that most of these men would be among the last Americans to live (and die) with type 2 diabetes before effective therapy became available. (Presley, 1991; Westman et al., 2006).

Rates of examinations, which included a urinalysis, increased over time. This increase is understood as a consequence of diffusion of technology and of

changes in instructions to the examiners. As early as 1891, examining surgeons were told "No examination will be considered satisfactory which does not include appropriate tests of the urine for albumen, sugar, etc. And if it contains blood or other abnormal deposits, a microscopical examination should be made to determine their character and cause" (Ingram, 1891). Later editions of the examining surgeon's manual expanded the description of urinalysis to include "give the color, specific gravity, and reaction of the urine" in addition to noting albumin and sugar (Houston, 1902).

We could not identify the reason for the change in urinalysis testing policy in the late 1890s. Perhaps the commercial distribution of urinalysis test kits became more universal in that year. Certainly by 1911 the Burroughs-Wellcome company was marketing their kits to physicians at the American Medical Association convention in Los Angeles, where they passed out a lavishly illustrated booklet on the history of urinalysis, complete with ads for various diagnostic kits (Anonymous, 1911; Davison & Cheyne, 1974; Guthrie & Humphreys, 1988; Litwins, 1977).

We acknowledge several study limitations. First, our study unavoidably includes no women, and says nothing about their status. Second, although the physicians examining these veterans used a number of the same tools and concepts of modern medicine, there was still a wide disparity in diagnostic categories and understanding that qualifies the conclusions one might draw from the data reported upon. A third issue is the differences in size between the white and black samples, a fact that weakens our power to compare the two groups. Fourth, we could not control for "era" effects as we have only one cohort to follow and so can not adjust for such idiosyncratic events as, say, the panic of 1893. Finally, we could not correct or fill in missing data, as our primary data recorders, the examining physicians or census takers, are long dead. However flawed, this is a valuable data set, perhaps unique in that it is not hospital based and attempts to create a fairly representative sample of American manhood from the mid-19th Century.

Acknowledgments

The Social Science Research Institute at Duke University supported this research, in addition to grants from the National Library of Medicine (MH; G13-LM008350), the National Institute on Aging (FS and DB; 2R27-AG-17473-05A1), the Duke University Provost's Common Fund (IB), and the National Institute of Diabetes & Digestive & Kidney Diseases (TO; R01 DK64986 and R01 DK 075439). Our colleagues in the SSRI faculty seminar were critical supporters of this project, including Barak Richman, Lynn Smith-Lovin, Emilio Parrado, Yvonne Wasilewski, and Miller McPherson. We would also like to thank Dora Costa (MIT) and Joseph Burton (Center for Population Economics, University of Chicago) for releasing the information on black soldiers in advance of its publication.

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