Diabetes Care Among Older Urban American Indians and Alaska Natives

Objective: To assess the prevalence of, and quality of care for, diabetes mellitus among the understudied, yet growing, population of older, urban American Indians and Alaska Natives (AI/ANs).

Design: Medical record review.

Setting: Urban Indian primary care clinic in Seattle, Washington.

Patients: All (N=550) AI/AN patients ≥50 years of age.

Main Outcomes Measures: Provider-documented medical diagnoses and indicators of quality of care of diabetes.

Results: Diabetes mellitus was documented in 113 (21%) of the medical records. Persons with diabetes were more likely than those without (P≥.05) to be obese, and to have hypertension, coronary artery disease, and depression. Most patients with diabetes were treated with either insulin (43%) or oral hypoglycemic medication (39%), but 16% received neither. Screening rates within 12 months were high for glycosylated hemoglobin (72%), lipid profile (84%), and foot examination (72%), but were low for urinalysis (23%), ophthalmology referral (23%), and influenza vaccination (46%). Only 46% of patients had ever received pneumococcal vaccination, and even fewer (26%) had received tuberculin skin testing (24%). Although 65% of patients had ever been referred to a dietitian, only 40% had received exercise counseling. The total number of health problems was the factor most often associated with quality of care indicators.

Conclusions: The prevalence rate of diabetes among this urban clinic population of older AI/ANs was high. Although performance of quality indicators was suboptimal, it was comparable to, or better than, that found in other older populations for many measures. (*Ethn Dis*. 2004;14:574–579)

Key Words: Aged, Indians North American, Quality of Care, Type 2 Diabetes Mellitus, Urban

Dorothy A. Rhoades, MD, MPH; Yvette Roubideaux, MD, MPH; Dedra Buchwald, MD

From the Native Elder Research Center, University of Colorado Health Sciences Center, Denver, Colorado (DR, YR, DB); Department of Medicine, University of Washington, Seattle, Washington (DB); and College of Public Health, University of Arizona, Tucson, Arizona (YR).

Introduction

Type 2 diabetes mellitus, a major cause of morbidity and mortality in the United States, affects 11% of Americans aged ≥65 years.[1] However, the burden falls disproportionately on American Indians and Alaska Natives (AI/ANs), affecting 22% in this age group.[1] Likewise, although prevalence rates vary widely among AI/ANs aged 45 years and older (19% to 72%),[2] they are much higher than rates among their White counterparts (5%).[1] Furthermore, diabetes mortality rates among AI/ANs are 2.5 to 3.5 times those of non-AI/ANs in both urban and rural populations.[3,4]

Studies of the medical conditions of, and the quality of health care received by, older AI/ANs in urban, non-reservation settings are very rare. Most studies of diabetes or its care among AI/ANs have been conducted in communities served by the Indian Health Service or tribal health programs, and none have focused on older persons not living on or near reservations. Older AI/ANs are among the fastest growing populations in the United States, and 41% of AI/AN elders now live in urban areas, and do not receive direct health care from the Indian Health Service or tribal health programs.[5] Several urban Indian health programs were developed in the 1970s in recognition of the unmet healthcare needs of AI/ANs, many of whom relocated to urban areas in the 1950s, as the result of formal federal policy. However, little is known about the quality of care provided by these urban programs.

Address correspondence and request for reprints to: Dorothy A. Rhoades, MD, MPH; 4034 30th Ave West; Seattle, WA 98199; 303-724-1477; 303-724-1474 (fax); drhoades@u.washington.edu

Since previous work has suggested that the quality of diabetes care for older persons may vary by race,[6] or by socioeconomic status,[7,8] the purpose of this study was to assess the quality of diabetes care among older AI/ANs in a low-income, urban, primary care setting. In addition, factors associated with performance of quality of care indicators were assessed.

Methods

Clinical Setting

According to the 1990 census, nearly 17,800 AI/ANs resided in King County, Washington, with 7,325 living in Seattle. The Seattle Indian Health Board is a multidisciplinary, community-based organization that provides diverse services for the King County AI/AN population, serving >6,000 AI/AN individuals of all ages, who are affiliated with approximately 250 different AI tribes or AN villages. More than half of the clinic's clientele are ≥45 years of age, almost half are unemployed, 58% have no form of health insurance, and 80% have incomes below the federally determined poverty line. Persons seeking medical services are eligible for care regardless of financial status or race/ethnicity.

Study Population

Employing the clinic's computerized records, a list was generated of all (N=550) self-identified AI/AN elders who made ≥1 visit between June 1994 and June 1995, the only years for which data were available. Elders were defined as persons ≥50 years of age because, in AI/AN culture, "elder" status is often conferred at ages younger than 65 years, *Older AI/ANs are among the fastest growing populations in the United States, and 41% of AI/AN elders now live in urban areas, and do not receive direct health care from the Indian Health Service or tribal health programs.*[5]

since age-related disability occurs nearly 20 years earlier among AI/ANs compared to Whites; therefore, lower age eligibility criteria exist for federal programs targeting the elderly.[9–11]

Medical Records Review

Under the supervision of a general internist (DB), a professional abstractor, with a degree in gerontology and extensive experience reviewing medical records, abstracted the charts of all 550 patients. A sample of study forms was reviewed for discrepancies in categorization and completeness between the internist and the abstractor. Because training was an iterative process, tests of inter-rater reliability were not applied.

Persons were classified as having diabetes if diabetes was listed as a diagnosis at least once in the medical record, or if they were using insulin and/or oral hypoglycemic medications. Demographic information included age, sex, marital status, and major form of insurance coverage. Clinical data consisted of smoking status and weight status based on the following body mass index (BMI in kg/m^2) classifications[12]: normal weight (BMI 18.5–24.9), overweight (BMI 25.0–29.9), obesity class I (BMI 30.0–34.9), obesity class II (BMI 35.0–39.9), and obesity class III (BMI ≥40). Persons were classified as having hypertension, coronary artery disease (angina, myocardial infarction), or depression if these conditions were listed as diagnoses at least once in the medical record. Up to 17 different clinical diagnoses were collected from each medical record, and totaled to obtain the number of health problems for each patient.

Diabetes Quality of Care Indicators

During the study period, the Seattle Indian Health Board used the Indian Health Service guidelines for the care of diabetes,[13] and diabetes education and training were available through the Indian Health Service. This was the first assessment of quality of diabetes care at this site, since urban Indian clinics were not routinely included in the Indian Health Service's Diabetes Care and Outcomes Audit,[14] a comprehensive, annual chart review of diabetes care. Measures included responses of "ever" or within "12 months" when asked if the following tests had been performed, or services provided: glycosylated hemoglobin, fasting glucose, lipid profile, urinalysis, blood pressure, foot examination, and ophthalmology referral; and whether the following had "ever" been performed or provided: pneumococcal vaccination, tuberculin skin testing, dietitian referral, and exercise counseling. These measures were also included in the American Diabetes Association guidelines,[15] with the exception of urinalysis within 12 months, and tuberculin skin testing, which were specifically added by the Indian Health Service due to the high prevalence rates of renal disease and tuberculosis among AI/ANs.

Statistical Analyses

The data did not permit analysis by tribal affiliation or income. Differences in proportions and means between patients with and without diabetes were assessed using the chi-square statistic or 2-paired *t* test as appropriate. Factors examined in association with receipt or completion of the indicators were assessed separately and included age, sex, marital status, insurance coverage, smoking status, depression, hypertension, coronary artery disease, number of health problems, insulin therapy, and duration of diabetes. Frequencies of selected tests were also examined for persons aged ≥65 years of age (N=43). Due to a strong correlation between age and insurance, analyses involving insurance were stratified by age (<65 years, ≥65 years). Associations between patient factors and performance of the quality indicators and total number of indicators were assessed using logistic and linear regression, respectively, in a 2 step process: age and sex were forced into the model, and individual factors were then selected using stepwise forward conditional regression. Statistical significance (P value) was set at ≤.05. All analyses were conducted using SPSS for Windows Release 11.0.0 (SPSS, Inc.).

Among patients with diabetes, data were missing for smoking (N=3), BMI (N=11), blood pressure within 12 months (N=3), and duration of diabetes (N=18). Among patients without diabetes, missing data consisted of marital status (N=1), insurance (N=2), smoking (N=24), BMI (N=90), and blood pressure within 12 months (N=30). Data were missing significantly more often for patients without diabetes only for BMI (P<.01).

RESULTS

The study sample comprised all (N=550) AI/ANs aged ≥50 years. Thirty-nine percent of the total study population of elders were men. The mean age was 61.1 years, with few (3%) patients aged ≥80 years, and 27% were married. A provider diagnosis of diabetes was noted in the medical records of 113 (21%) patients. Among all persons aged 50–64 years, the frequency of diagnosed diabetes was 18% (men=17%, women=18%), compared to 28% (men=30%, women=26%) of those

Table 1. Receipt or performance of quality indicators among the 113 older AI/AN patients with diabetes

Measure	Ever %	Last 12 Months %	Guideline
Monitoring and screening			
Glycolsylated hemoglobin	85	72	IHS, ADA
Lipid profile*	92	84	IHS, ADA
Urinalysis	80	23	IHS
Blood pressure reading	100	97	IHS, ADA
Foot examination	81	72	IHS, ADA
Ophthalmology referral	35	14	IHS, ADA
Prevention of infectious disease			
Influenza vaccine	70	46	IHS, ADA
Pneumococcal vaccine	43	N/A	IHS, ADA
Tuberculin skin testing	24	N/A	IHS
Lifestyle counseling			
Nutrition referral	65	N/A	IHS, ADA
Exercise counseling	40	N/A	IHS, ADA

N/A = not applicable; IHS = Indian Health Service[13]; ADA = American Diabetes Association.[15]
* Includes cholesterol.

aged ≥65 years. The mean duration of diabetes among the 95 patients with a documented date of onset was 8.5 years (SD=6.9).

Compared to patients without diabetes, patients with diabetes were older (mean age of 63 years vs 61 years, respectively, $P \leq .01$), were more likely to be insured by Medicare (46% vs 29%, respectively, $P \leq .01$), were less likely to be smokers (25% vs 41%, respectively, $P \leq .01$), and had a greater tendency to be obese (59% vs 37%, respectively, $P \leq .01$). Patients with diabetes were also more likely to also have a diagnosis of hypertension (56% vs 33%, respectively, $P \leq .01$), coronary artery disease (22% vs 9%, respectively, $P \leq .01$), and depression (31% vs 22%, respectively, $P = .05$). Sex and marital status were not significantly associated with diabetes. Most patients with diabetes were treated with insulin (43%) or oral hypoglycemic therapy (39%), but few (3%) used both, and 16% received no pharmacotherapy.

The rate of performance of each quality measure for persons with diabetes ($N = 113$) is presented in Table 1. The majority received glycosylated hemoglobin and lipid profiles. Although most patients had a documented urinalysis, receipt within 12 months was low, and not accounted for by the 5% of patients with previously diagnosed renal insufficiency. Foot examinations and nutrition referrals were common; however, ophthalmology referrals, influenza vaccination within one year, pneumococcal vaccination, tuberculin skin testing, and exercise counseling, were performed or provided less frequently. Rates of tests within the past year for persons aged ≥65 years did not differ significantly from those for persons aged 50–64 years (data not shown).

Table 2 exhibits age- and sex-adjusted odds ratios for factors significantly associated with each quality indicator as identified using forward stepwise conditional logistic regression. The total number of health problems as noted in the medical record was the factor most commonly associated with performance of quality indicators. Marital status, duration of diabetes, and insurance (in age-stratified analyses) were not associated with receipt of quality measures. After adjustment for age and sex, the number of health problems was the only factor significantly associated with total number of indicators performed (beta coefficient=0.377, $P < .01$).

CONCLUSIONS

This is the first study to examine diabetes care among any population of older AI/ANs not receiving direct care

Table 2. Adjusted odds ratios for patient factors associated with quality of care indicators

Quality of Care Indicator	Factor(s)	Odds Ratio*	95% Confidence Interval
Glycosylated hemoglobin, last 12 months	No. of health problems	1.4	1.1–1.7
Lipid profile, last 12 months	No. of health problems	1.3	1.0–1.6
Urinalysis, last 12 months	Insulin therapy	0.3	0.1–0.9
Foot examination, last 12 months	No. of health problems	1.6	1.2–2.1
Ophthalmology referral, last 12 months	Insulin therapy	3.6	1.1–11.6
Influenza vaccine, last year	No. of health problems	1.2	1.1–1.4
Pneumococcal vaccine, ever	No. of health problems	1.2	1.1–1.4
Tuberculin skin testing, ever	None	—	—
Dietitian referral, ever	Smoking	0.3	0.1–0.8
Exercise counseling, ever	Smoking	0.3	0.1–0.9

* Each odds ratio has been adjusted for age and sex.

. . . among people aged ≥65 years, the frequency (28%) [of diabetes] exceeded that of both Indian Health Service outpatients (22%)[1] and Medicare beneficiaries (12%).[1,6]

from Indian Health Service or tribal healthcare programs, which means no reliable surveillance studies exist in the peer-reviewed literature on diabetes among comparable groups of AI/ANs. The rate in the group aged 50–64 years (18%) was similar to that reported for Indian Health Service outpatients aged 45–64 years (19%)[1]; however, among people aged ≥65 years, the frequency (28%) exceeded that of both Indian Health Service outpatients (22%)[1] and Medicare beneficiaries (12%).[1,6] Although diabetes was documented in 21% of this population of elders, this may be an underestimate, since the prevalence of undiagnosed diabetes in one study of older American Indians was approximately 15%.[16]

Although men aged ≥65 years carried a diagnosis of diabetes more often than did women, this difference was not statistically significant. In contrast, population-based studies of AI/ANs have demonstrated significantly higher rates for AI/AN women.[1,2] The higher prevalence among men in this study may be due to chronically ill men being overrepresented, as well as to the small sample size. Depression was also more commonly documented in patients with diabetes, a finding not previously described in AI/ANs.

Adherence to recommended diabetes care practices has been suboptimal in a wide variety of clinical settings and populations.[6,17–19] However, very few investigations of quality of diabetes care among older persons utilizing a review of medical or administrative records have been conducted, limiting the comparability of this study's findings. For patients aged ≥65 years in this study, the percent who received glycosylated hemoglobin measurements within 1 year (74%) was much higher than that for participants in the Medicare Current Beneficiary Survey (26%),[6] or urban Medicare fee-for-service beneficiaries in Washington state (56%),[19] but was comparable to the national median of Medicare fee-for-service recipients (71%).[20] Rates for cholesterol determination (86%) were also higher than those among the Medicare Current Beneficiary Survey participants (56%–68%)[6] but only slightly higher than those among Indian Health Service clients aged ≥65 years (80%)[21] However, ophthalmology referrals were uncommon in this age group (12%), compared to rates of ophthalmic eye examinations among Medicare patients (40%–72%),[6,19] or the Indian Health Service (58%).[21] Finally, the proportion of patients aged ≥65 years in this study who had received a urinalysis in the past year (19%) was much lower than that found among Indian Health Service patients in the same age group (84%).[21] The infrequent screening for proteinuria is disturbing, since rates of end-stage renal disease due to diabetes are increasing,[19,22] and early treatment of asymptomatic proteinuria may slow the progression of renal disease.

The risk of respiratory diseases is higher among AI/ANs and persons with diabetes. Influenza and pneumonia mortality rates among AI/ANs in the Indian Health Service are 1.7 times those for the general US population. The Washington state rate for all races,[4] and for rates among urban AI/ANs, are 1.8 times that among urban Whites.[3] Therefore, although the rate of documented influenza vaccination (46%) was comparable to the self-reported rate for persons with diabetes aged 45–64 years in the general US population (45%),[23] it was disconcertingly low for persons aged ≥65 years (49%). In comparison, the rate among Indian Health Service patients with diabetes aged ≥65 years was 61%.[21] For many years, the Indian Health Service has recommended tuberculin skin testing for AI/AN persons with diabetes regardless of age,[13] since AI/ANs die of tuberculosis 6 times more often than their counterparts in the general population, and 9 times more often than US Whites,[4] and because those with diabetes are at higher risk for reactivating tuberculosis. Treatment of latent infection, which is identified by tuberculin skin testing, reduces this risk. However, the American Diabetes Association guidelines at the time did not emphasize this aspect of care,[15] perhaps contributing to the low rates of tuberculin skin testing in this study.

Lifestyle modifications are effective in improving the control of diabetes, but are typically difficult to implement. Nutrition referrals were relatively common in this study, however, which may be explained by the presence of a nutritionist on site. Although exercise counseling was infrequently documented, information regarding counseling during a clinic visit may not be routinely recorded in the medical record.[24]

We were unable to assess the effect of income on diabetes treatment and quality of care. However, this population is relatively poor, which may limit available treatment options. Lower performance of quality of care indicators in other socioeconomically disadvantaged settings has been noted.[7,8] Although insurance coverage was not significantly associated with any of the outcome measures in this study, the sample size limited the ability to detect modest associations. Nonetheless, it is notable that the quality of care in this low-income population was, in many aspects, as good as, or better than, that among the comparable US Medicare population.

Of the factors associated with performance measures, the number of health problems was the most common. Persons with more health problems may make more frequent clinic visits, therefore, having more opportunities to receive appropriate care. However, due to the relatively small size of this diabetes sample, other potentially important factors may not have reached statistical significance. Age and gender were infrequently associated with receipt of quality measures, suggesting that the quality of care did not vary substantially by these factors. This is similar to the findings of a study of Washington state Medicare fee-for-service patients,[19] but not those of the Medicare Current Beneficiary Survey.[6] In contrast to another study (not limited to the elderly),[25] insurance status did not affect quality of care, even when analyses were limited to persons aged <65 years. Lastly, consistent with a previous study,[25] patients on insulin more often received retinopathy screening, perhaps because they were perceived as having more severe disease, or made more frequent visits, thus having more opportunities for preventive care.[25]

Limitations

Several limitations of this study deserve mention. First, these findings are based on diagnosed cases of diabetes, and are therefore likely to underestimate the prevalence of diabetes in this population. Second, these results are subject to the well-known limitations of chart reviews, including incomplete data, ascertainment bias, and non-standardized measurements. Third, this study reflected the practice styles of a small group of providers in a well-run unit, and was limited to clinic users within a 1-year period, thereby excluding individuals who did not seek care during this time. Therefore, findings from this clinic user sample cannot be generalized to other urban AI/AN populations. Notably, the clinic clientele is largely poor and unemployed, and may not represent urban AI/ANs who did not seek care at this clinic. Fourth, as in many other clinic-based investigations, performance of measures may be underestimated, since other sources of care could not be assessed. Finally, the quality of care during the study period likely underestimates current practices, since greater emphasis has been placed currently on diabetes care.

Since <1% of the total Indian Health Service budget is allocated for urban programs,[26] urban AI/ANs, who have worse health status than Whites for many indicators,[3] generally do not have access to resources provided to many reservation-based AI/ANs. Despite this, the quality of care for elders with diabetes in this study was, in many respects, as good as, or better than, that for other older populations, particularly Medicare beneficiaries. This finding is encouraging, since urban Indian health programs have limited resources, and serve a largely low income clientele. Nonetheless, several opportunities exist to improve the management of diabetes, and prevent its complications. The quality of diabetes care among reservation communities is routinely examined by the Indian Health Service,[17] and these findings may inform allocation of limited resources for urban AI/AN diabetes programs.

While the prevalence of diabetes in the general population is rising rapidly, it remains lower than the prevalence among AI/ANs. As a result, AI/AN healthcare programs have made concerted efforts to improve the quality of diabetes care. This study suggests that, although Indian health programs have room for improvement, they may serve as models for improving care for all persons with diabetes, including those who are socioeconomically disadvantaged.

ACKNOWLEDGMENTS

Supported in part by grants 1P30AG/NE15292 from the National Institute of Aging and the National Institute of Nursing Research, 90-AM-0757 from the Administration on Aging, and P0143471 from the National Institute of Mental Health. The authors thank the Seattle Indian Health Board and its Executive Director, Ralph Forquera, MPH, for facilitating this work, and Mark Doescher, MD, MPH, for review of the manuscript.

REFERENCES

1. Prevalence of diagnosed diabetes among American Indians/Alaskan Natives—United States, 1996. *MMWR.* 1998;47(42):901–904.
2. Lee ET, Howard BV, Savage PJ, et al. Diabetes and impaired glucose tolerance in three American Indian populations aged 45–74 years. The Strong Heart Study. *Diabetes Care.* 1995;18(5):599–610.
3. Grossman DC, Krieger JW, Sugarman JR, Forquera RA. Health status of urban American Indians and Alaska Natives. A population-based study. *JAMA.* 1994;271(11):845–850.
4. Division of Program Statistics. *Trends in Indian Health 1998–99.* Rockville Md: Indian Health Service, Department of Health and Human Services; 2000.
5. John R, Baldridge D. *The NICOA Report. Health and Long-Term Care for Indian Elders.* Washington, DC: National Indian Council on Aging (NICOA); 1996.
6. Chin MH, Zhan JX, Merrell K. Diabetes in the African-American Medicare population: morbidity, quality of care, and resource utilization. *Diabetes Care.* 1998;21(7):1090–1095.
7. Zaslavsky A, Hochheimer J, Schneider E, et al. Impact of sociodemographic case mix on the HEDIS measures of health plan quality. *Med Care.* 2000;38(10):981–992.
8. Chin MH, Auerbach SB, Cook S, et al. Quality of diabetes care in community health centers. *Am J Public Health.* 2000;90(3):431–434.
9. Kramer BJ. Health and aging of urban American Indians. *West J Med.* 1992;157(3):281–285.
10. National Indian Council on Aging. *American Indian Elderly: A National Profile.* Albuquerque, NM: NICOA/Cordova; 1981.
11. Hayward MD, Heron M. Racial inequality in active life among adult Americans. *Demography.* 1999;36(1):77–91.
12. National Heart Lung and Blood Institute. *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults. The Evidence Report.* Bethesda, Md: National Institutes of Health, Public Health Service, US Dept of Health and Human Services; 1998. NIH Publication No. 98-4083.
13. Stracqualursi F, Gohdes D, Rith-Najarian S, Hosey G, Lundgren P. Assessing and implementing diabetes patient education programs for American Indian communities. *Diabetes Educ.* 1993;19(1):31–34.
14. Acton K, Valway S, Helgerson S, et al. Im-

proving diabetes care for American Indians. *Diabetes Care.* 1993;16(1):372–375.

15. American Diabetes Association. Standards of medical care for patients with diabetes mellitus. *Diabetes Care.* 1994;17(6):616–623.
16. Lee ET, Howard BV, Go O, et al. Prevalence of undiagnosed diabetes in three American Indian populations. A comparison of the 1997 American Diabetes Association diagnostic criteria and the 1985 World Health Organization diagnostic criteria: the Strong Heart Study. *Diabetes Care.* 2000;23(2):181–186.
17. Acton KJ, Shields R, Rith-Najarian S, et al. Applying the diabetes quality improvement project indicators in the Indian Health Service primary care setting. *Diabetes Care.* 2001; 24(1):22–26.
18. Levels of diabetes-related preventive care practices—United States, 1997–1999. *MMWR.* 2000;49(42):954–959.
19. Rosenblatt RA, Baldwin L-M, Chan L, et al. Improving the quality of outpatient care for older patients with diabetes: lessons from a comparison of rural and urban communities. *J Fam Pract.* 2001;50(8):676–680.
20. Jencks SF, Cuerdon T, Burwen DR, et al. Quality of medical care delivered to Medicare beneficiaries. *JAMA.* 2000;284(13):1670–1676.
21. Acton KJ, Gohdes D. Comparison of benchmarks for diabetes care in elderly populations. *Diabetes.* 1998;47(suppl 1):182A.
22. End-stage renal disease attributed to diabetes among American Indians/Alaska Natives with diabetes—United States, 1990–1996. *MMWR.* 2000;49(42):959–962.
23. Influenza and pneumococcal vaccination rates among persons with diabetes mellitus—United States, 1997. *MMWR.* 1999;48(42):961–967.
24. Dresselhaus T, Peabody J, Lee M, Wang M, Luck J. Measuring compliance with preventive care guidelines. *J Gen Intern Med.* 2000; 15(11):782–788.
25. Beckles GL, Engelgau MM, Narayan KV, Herman WH, Aubert RE, Williamson DE. Population-based assessment of the level of care among adults with diabetes in the U.S. *Diabetes Care.* 1998;21(9):1432–1438.
26. Johnson EA, Rhoades ER. The history and organization of Indian Health Services and Systems. In: Rhoades ER, ed. *American Indian Health. Innovations in Health Care, Promotion, and Policy.* Baltimore, Md: Johns Hopkins University Press; 2000:74–92.

AUTHOR CONTRIBUTIONS

Design and concept of study: Roubideaux, Buchwald
Acquisition of data: Buchwald
Data analysis and interpretation: Rhoades, Roubideaux, Buchwald
Manuscript draft: Rhoades, Roubideaux, Buchwald
Statistical expertise: Rhoades
Acquisition of funding: Buchwald
Administrative, technical, or material assistance: Roubideaux, Buchwald
Supervision: Buchwald