

Racial Differences in Reported Lyme Disease Incidence

Alan D. Fix,¹ César A. Peña,² and G. Thomas Strickland¹

In the United States, the incidence of Lyme disease is considered to be disproportionately high among Whites because of risk of exposure. For assessment of racial differences in Lyme disease incidence and the role of risk exposure, incidence rate ratios (IRRs) for Lyme disease and its manifestations between Whites and African Americans in Maryland and in its focus of endemicity, the Upper Eastern Shore, were calculated. Calculations were based on reported cases of Lyme disease in Maryland during the years 1992–1996. The IRR for Lyme disease between Whites and African Americans was 6.3 (95% confidence interval (CI): 5.0, 8.0), decreasing to 1.8 (95% CI: 1.2, 2.7) for the Upper Eastern Shore. Statewide, there was a significant difference between the White to African American IRR for erythema migrans and for Lyme disease-associated arthritis, at 17.7 (95% CI: 11.2, 27.8) and 2.3 (95% CI: 1.7, 3.2), respectively. On the Upper Eastern Shore, the IRR for arthritis reversed, indicating higher incidence among African Americans than among Whites: IRR = 5.7 (95% CI: 2.4, 13.9) for erythema migrans and IRR = 0.7 (95% CI: 0.4, 1.1) for arthritis. White patients were more likely to have erythema migrans (risk ratio = 2.8, 95% CI: 1.9, 4.1) and less likely to have arthritis than were African Americans (risk ratio = 0.4, 95% CI: 0.3, 0.5). Among all patients, there was a significant negative association between arthritis and erythema migrans. Although much of the racial disparity in incidence rates diminishes in a rural, endemic area, consistent with exposure risk being responsible for much of the variation, a difference remains. This may be due to failure to recognize early disease (erythema migrans) among African Americans, resulting in increased rates of late manifestations. Geographic spread of the disease warrants efforts to increase awareness of Lyme disease and its manifestations among people of color and the health care providers who serve them. *Am J Epidemiol* 2000;152:756–9.

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The reported incidence of Lyme disease among African Americans in the United States is substantially below that of Whites (1–3). The disparity in incidence of the disease between Whites and African Americans has been attributed to differences in risk of exposure, primarily due to area of residence (2).

Area of residence has consistently been proposed as a major risk factor for Lyme disease (1, 4–8). If so, African Americans and Whites residing in endemic areas should have similar rates of disease. Maryland is an ideal location to study this assumption. The state has definite foci of endemicity, as has been described in other states with high Lyme disease incidence (4, 9). In Maryland, these areas are primarily rural (10–12), and in some areas, African Americans comprise a substantial portion of the population.

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Abbreviations: CI, confidence interval; CDC, Centers for Disease Control and Prevention; DHMH, Department of Health and Mental Hygiene; IRR, incidence rate ratio.

¹Department of Epidemiology and Preventive Medicine, University of Maryland School of Medicine, Baltimore, MD.

²Epidemiology and Disease Control Program, Maryland Department of Health and Mental Hygiene, Baltimore, MD.

Reprint requests to Dr. Alan D. Fix, Department of Epidemiology and Preventive Medicine, University of Maryland School of Medicine, 660 West Redwood Street, Baltimore, MD 21201.

The purpose of this report is to assess whether differences in incidence rates of reported Lyme disease between Whites and African Americans are due to differences in risk of exposure to infected ticks on the basis of area of residence.

MATERIALS AND METHODS

Surveillance procedures

In 1993, the University of Maryland, Baltimore, and the Department of Health and Mental Hygiene (DHMH) created the Maryland Lyme Disease Registry to provide a database for assessing outcomes of antibiotic therapy and to provide thorough, statewide surveillance for Lyme disease. Lyme disease cases reported to the DHMH during 1992 were appended to the data collected by the Lyme Disease Registry during 1993–1996 (13).

Initial identification of potential cases of Lyme disease came from one of three sources: physician report of cases of Lyme disease, laboratory report of positive diagnostic tests for Lyme disease, or patient self-report. Case report forms were mailed to each patient's physicians. These forms included questions about demographics, tick exposure, presence of general symptoms, erythema migrans, extracutaneous manifestations (rheumatologic, neurologic, and cardiac symptoms), antibiotic therapy, and antibody testing for

Borrelia burgdorferi. Patients were interviewed later by telephone to verify and clarify physician reports and to gather additional information.

Only cases that met the national surveillance definition of the Centers for Disease Control and Prevention (CDC) with a known date of onset of symptoms during the 5-year period from 1992 through 1996 were included in this report. This definition includes cases with erythema migrans of more than 5 cm or at least one rheumatologic, neurologic, or cardiac manifestation with laboratory confirmation of infection (14). Racial designation was made on the basis of patient confirmation of initial designation on the report form. Incidence rates per 100,000 population per year for Lyme disease and its various manifestations were calculated as an average for the period from 1992 through 1996 for the entire state and for its jurisdictions, including the Upper Eastern Shore, which comprises five predominately rural counties. Denominators for calculation of the rates were derived from the 1990 census statistics. Analysis and rate calculations by race were restricted to those who classified themselves as either White or African American, which included most of the subjects in the data set.

Chi-square tests were used to compare proportions. Incidence rate ratios and their 95 percent confidence intervals were used to compare incidence rates of Whites and African Americans, calculating asymptotic 95 percent confidence intervals on the assumption that the number of cases has a Poisson distribution (15).

RESULTS

A total of 1,554 Lyme disease cases reported to the DHMH and Lyme Disease Registry with a date of onset between 1992 and 1996 met the national surveillance case definition, 1,451 (93.4 percent) of whom were either White or African American. The incidence rates for Maryland and its jurisdictions appear in table 1. During this period, the total statewide annual incidence rate of Lyme disease was 6.5 per 100,000. The area of the state with the highest incidence rate was the Upper Eastern Shore (42.6 per 100,000). Statewide, the rates were 8.1 and 1.3 per 100,000 for Whites and African Americans, respectively, resulting in an incidence rate ratio (IRR) of 6.3 (95 percent confidence interval (CI): 5.0, 8.0). The IRR between Whites and African

Americans on the Upper Eastern Shore (IRR = 1.8, 95 percent CI: 1.2, 2.7) was lower than IRRs for any other area of the state.

Compared with African Americans, Whites with Lyme disease were more likely to have noted erythema migrans (25.0 and 69.7 percent, respectively, $p < 0.0001$) and less likely to have had arthritis (56.5 and 20.9 percent, respectively, $p < 0.0001$). Overall, cases with arthritis were significantly less likely to have noted erythema migrans than were those without arthritis (17.0 and 81.9 percent, respectively, $p < 0.0001$).

The incidence rates of manifestations of Lyme disease for the state overall and for the Upper Eastern Shore, in particular, by race appear in table 2. The data indicate consistently higher statewide incidence rates for Whites for the cutaneous and extracutaneous manifestations; however, the IRR for erythema migrans was much greater than that for extracutaneous manifestation. On the Upper Eastern Shore, two phenomena are readily apparent: 1) the much lower IRR for erythema migrans for this area than for the state as a whole, and 2) the reversal of the IRR for arthritis, the most common extracutaneous manifestation, with greater report of this manifestation (and all extracutaneous manifestations together) among African Americans than among Whites in this area (IRR = 0.7, 95 percent CI: 0.4, 1.1).

DISCUSSION

Surveillance reports from the CDC indicate that Lyme disease disproportionately affects the White population (K. A. Orloski, CDC, personal communication, 1998), and the rare reports of race in Lyme disease have demonstrated similar results (1–3, 16). Lyme disease has been described as a disease of place, with residence in an endemic area being the principal risk factor. It has been proposed that the difference in rates among races “reflects the nonurban nature of risk,” with concentration of cases in areas of the country where minority populations are underrepresented. (2, p. 35).

Previous reports of racial distribution of reported cases of Lyme disease in Maryland have indicated that African Americans account for a higher proportion of cases (as high as 9.8 percent of all cases) (10, 11, 17) than has been reported in other areas of the United States. African Americans comprise 26 percent of the state’s population, but

TABLE 1. Lyme disease incidence rates in Maryland, by region, 1992–1996

Jurisdiction	Incidence rate*			IRR†	95% CI†
	Overall	White	African American		
Maryland State	6.5	8.1	1.3	6.3	5.0, 8.0
Baltimore metropolitan area	6.4	8.2	0.9	9.7	6.5, 14.3
Counties in Washington, DC, vicinity	2.9	3.8	0.7	5.2	3.2, 8.6
Lower Eastern Shore	6.1	7.5	1.5	5.2	1.6, 16.7
Southern Maryland	11.1	12.1	3.3	3.7	1.6, 8.4
Upper Eastern Shore	42.6	42.0	23.4	1.8	1.2, 2.7
Western Maryland	1.2	1.2	0		

* Per 100,000 population per year.

† IRR, incidence rate ratio, White/African American; CI, confidence interval.

TABLE 2. Lyme disease incidence rates for diagnoses, by race, state of Maryland and the Upper Eastern Shore, 1992–1996

Jurisdiction and manifestation	Incidence rate*			IRR†	95% CI†
	Entire population	White	African American		
State of Maryland					
Erythema migrans	4.3	5.7	0.3	17.7	11.2, 27.8
Extracutaneous manifestations	2.7	3.1	1.0	3.1	2.4, 4.0
Arthritis	1.6	1.7	0.7	2.3	1.7, 3.2
Upper Eastern Shore					
Erythema migrans	27.0	28.0	4.9	5.7	2.4, 13.9
Extracutaneous manifestations	18.9	17.4	18.5	0.9	0.6, 1.5
Arthritis	12.8	11.0	16.6	0.7	0.4, 1.1

* Per 100,000 population per year.

† IRR, incidence rate ratio, White/African American; CI, confidence interval.

in this data set, they accounted for only 5 percent of reported cases in the state. The focus of endemicity in Maryland is in a rural area (the Upper Eastern Shore) (10–12) in which African Americans account for 13 percent of the population. If residence is truly the primary risk factor for disease, with most of the risk being peridomestic (5–8, 18, 19), a difference in incidence rates of Lyme disease in that area would not be expected.

The data from this report indicate that, although there is diminution of the differences in incidence of Lyme disease between Whites and African Americans in a rural area of endemicity (the Upper Eastern Shore) relative to the state as a whole, discrepancies remain. Among the manifestations of Lyme disease, the greatest difference was for incidence of erythema migrans, both across the state and on the Upper Eastern Shore. However, on the Upper Eastern Shore, the incidence for extracutaneous manifestations was approximately equal, and that for arthritis was greater among African Americans than among Whites. There is a clear negative association between the extracutaneous manifestation of arthritis and the early marker of infection, erythema migrans. This may well explain the residual differences in incidence rates between Whites and African Americans in this rural, endemic area.

Previous study has indicated that among patients with erythema migrans who are untreated 20 percent will have no further complications and that the most common complication, arthritis, occurs in up to 60 percent of these untreated patients (20). Assuming similar incidence of infection between Whites and African Americans, if erythema migrans is being differentially underrecognized among African Americans, one would expect increased rates of complications among this population, particularly for arthritis. This is supported by the clear negative association between arthritis and erythema migrans for all cases, the higher proportion of arthritis and the lower proportion of erythema migrans among African Americans relative to Whites with Lyme disease, and the dramatic difference in IRRs for erythema migrans and arthritis between Whites and African Americans. Underrecognition of erythema migrans among people of color rather than differences in

incidence of infection may account for much of the difference in incidence of reported disease in endemic areas. Difficulty in recognizing the rash may well be a major reason for underrecognition; however, there are other potential reasons, such as lack of awareness of the significance of the rash and poor access to care. Race is an important determinant of access to care (21), and differences in such access may explain some of the racial disparities in rates of reported Lyme disease. In addition, it is possible that some of the residual difference in the incidence of reported Lyme disease is due to bias of diagnosis by health providers who believe that Lyme disease is relatively rare in African Americans or to differential reporting of Lyme disease.

In this investigation, the designation of race for both our numerator (case reports) and denominator (census data) data is by self-designation. Although misclassification may occur, it seems reasonable to assume that self-designation would correlate highly with skin color. We believe that the superficial marker of phenotypic variation, skin color, is a relevant biologic characteristic that may affect recognition of early Lyme disease (erythema migrans) (22, 23).

Although it is likely that residence in the predominantly rural communities of the Upper Eastern Shore would put residents at similar risk, not only has Lyme disease been shown to be regionally focal, but it is focal at the community level (4, 9, 24, 25). At the community level, racial differences in residence or outdoor activities may result in variations in risk, accounting for disparities in disease rates, even on the Upper Eastern Shore. However, such differences would not explain the dramatic contrast in IRRs for erythema migrans and arthritis noted in these communities.

Much of the disproportionate incidence of reported Lyme disease for Whites and African Americans is probably due to differences in exposure risk. However, these data suggest that early Lyme disease among African Americans in some endemic areas is underrecognized. The increased occurrence of arthritis among African Americans in this endemic area may be the result of underrecognition of erythema migrans. Efforts to increase awareness of Lyme disease and its manifestations among African Americans and the health care providers who serve them seem prudent, especially in light

of the expanding geographic area affected by the disease (26–30), including into urban areas (26, 31).

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