Poverty Area Residence and Changes in Physical Activity Level: Evidence From the Alameda County Study

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ABSTRACT

Objectives. Evidence from the Alameda County Study indicated that residential area has an independent effect on mortality risk. The current research examined the effect of poverty area residence on change in physical activity (n = 1737).

Methods. Data were from a longitudinal population-based cohort. Multiple linear regression analyses were used.

Results. Age- and sex-adjusted change scores between 1965 and 1974 for physical activity were 0.67 units lower for people living in poverty areas ($P = .0001$). Independent of individual income, education, smoking status, body mass index, and alcohol consumption, poverty area residence remained associated with physical activity change.

Conclusion. These results further support the hypothesis that place affects health behaviors. (*Am J Public Health.* 1998;88:1709–1712)

A large body of literature has established links between individual-level measures of socioeconomic status and disease outcomes.[1–4] Increasingly, studies are also focusing on the socioeconomic characteristics of areas. Indeed, evidence of the effect of characteristics of areas on mortality and morbidity has been presented in several studies. Haan et al.[5] used the Alameda County Study to demonstrate that residence in a poverty area was associated with an approximately 50% increased risk of all-cause mortality over 9 years, even after adjusting for individual-level confounders. Other studies have shown that area characteristics influence health.[6–13]

How might area characteristics be associated with increased disease risk independent of individual characteristics? Risk factor trajectories may be influenced by area characteristics. Because the Haan et al. study and the few other cohort studies that examined area characteristics generally adjusted for baseline risk factor levels only, they would miss the impact of differential risk factor trajectories by area. In the current analyses, we focus on whether poverty area residence predicts changes in an important health behavior. Specifically, does residence in a poverty area lead to decreased physical activity? Area characteristics could influence physical activity levels because of lighting, amount of criminal activity, and access to recreational facilities.

Methods

The Alameda County Study

Data for the Alameda County Study were collected by the Human Population Laboratory of the California Department of Health Services. The Alameda County Study began in 1965 as a population-based cohort with a random stratified household sample of noninstitutionalized adult residents of the county. Of the eligible respondents, 86% returned self-administered questionnaires for a respondent sample of 6928. In 1974, of the 6246 respondents not known to be dead 5974 (95.6%) were successfully located and 5722 were given questionnaires. Completed questionnaires were received from 4864 for a response rate of 85.0%. More detailed study procedures are described elsewhere.[14,15] The analyses presented here focused on the 1737 people aged 20 years and older who were residents in 1965 of Oakland, Calif, the largest city in Alameda County, and who responded in 1974.

Poverty Areas

The poverty area in Oakland was an approximately 10-mile strip on the western edge of the city. Poverty areas were groupings of contiguous census tracts based on 1965 federal criteria: proportion of families with low income, proportion of substandard housing, proportion of adults with low educational attainment, proportion of unemployed (1960 census: male unemployment ≥ 9%), proportion of unskilled male laborers, and proportion of children in homes with a single parent.[16]

Physical Activity

Physical activity level in 1965 and 1974 was measured with a summative score based on responses to a question about frequency of participating in active sports, swimming or taking long walks, working in the garden, and doing physical exercises. Responses were coded 4 for "often" (2 for gardening), 2 for "sometimes" (1 for gardening), and 0 for "never." The score equaled the sum of the 4 items and ranged from 0 to 14. Change in physical activity was calculated as the 1974 physical activity score minus the 1965 score and ranged from –14 to 14. This score for physical activity has been used previously[17] and was associated with mortality risk.[18–20]

Independent Variables

Income. Categories were based on total 1965 family income adjusted for family size

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by federal and state criteria[21]: very adequate (30.8%), adequate (39.6%), marginal (15.9%), and inadequate (13.7%).

Education. Education level in 1965 was categorized as less than high school (≤11 years of schooling: 33.0%), high school graduate (12 years: 30.3%), and more than high school (≥13 years: 36.7%).

Race/Ethnicity. Blacks (19%) were compared with all others (81%). All others included White (72%), Asian (4%), Latino (4%), and other (1%).

Smoking status. Status in 1965 was categorized as current smoker (40.6%), former smoker (15.2%), or never smoker (44.2%).

Body mass index. Body mass index was calculated as 1965 weight in kilograms divided by 1965 height in meters squared: obese (10%), underweight (7%), and rest (83%). Categories were created based on the second National Health and Nutrition Examination Survey standards. Obese was defined as the top 15th percentile, and underweight was defined as the bottom 15th percentile.[22]

Alcohol consumption. Number of drinks of wine, beer, and liquor per month in 1965 was classified into 0 (abstainers: 20%), greater than 60 (heavy: 10%), and others (reference: 70%).

Analysis

We used multiple linear regression analyses in 3 stages: (1) age- and sex-adjusted models; (2) adjustment for individual income level, education, race/ethnicity, smoking status, body mass index, and alcohol consumption; and (3) interaction effects models to examine whether the poverty area effect varied by any of the independent variables. If interaction effects were observed, then further models were tested, adjusting for confounders, which were statistically significant in the models examined in step 2. Because income and education are strongly associated with each other ($\chi^2 = 174.49$, $P < .0001$), they were not included in the same model. Because we view the confounders as potentially in the pathway through which area affects physical activity, for models in step 2 we chose to adjust separately for potential confounders rather than to include all confounders in the same model. All models included 1965 physical activity scores in order to adjust for baseline levels.[23]

TABLE 1—Covariates Stratified by Type of Residential Area: Alameda County Study, 1965 and 1974 (n = 1451)

Variable	Poverty Area (n = 354)	Nonpoverty Area (n = 1097)
Sex: female, no. (%)	204 (58)	629 (57)
Age, y, mean	44.4	44.1
Income*, no. (%)		
Inadequate	94 (27)	103 (9)
Marginal	85 (24)	149 (14)
Adequate	133 (38)	441 (40)
Very adequate	42 (12)	404 (37)
Education*, no. (%)		
<11 years	197 (56)	277 (25)
High school graduate	86 (24)	361 (33)
≥13 years	71 (20)	459 (42)
Race/Ethnicity*, no. (%)		
White	107 (30)	948 (86)
Black	198 (56)	69 (6)
Other	49 (14)	80 (7)
Smoking status, no. (%)		
Current	150 (42)	439 (40)
Former	42 (12)	176 (16)
Never	162 (46)	482 (44)
Body mass index*, no. (%)		
Underweight	18 (5)	81 (7)
Normal	245 (69)	883 (80)
Obese	91 (26)	133 (12)
Alcohol consumption*, no. (%)		
Abstain	128 (36)	169 (15)
Normal	204 (58)	808 (74)
Heavy	22 (6)	120 (11)
Leisure-time physical activity		
In 1965, mean (SD)	4.9 (3.4)	6.0 (3.2)
In 1974, mean (SD)	4.6 (3.6)	5.8 (3.4)

Note. Percentages may not add to 100 because of rounding error.
*$P = .001$.

TABLE 2—Poverty Area and Change in Leisure-Time Physical Activity: Alameda County Study, 1965 and 1974 (n = 1451)

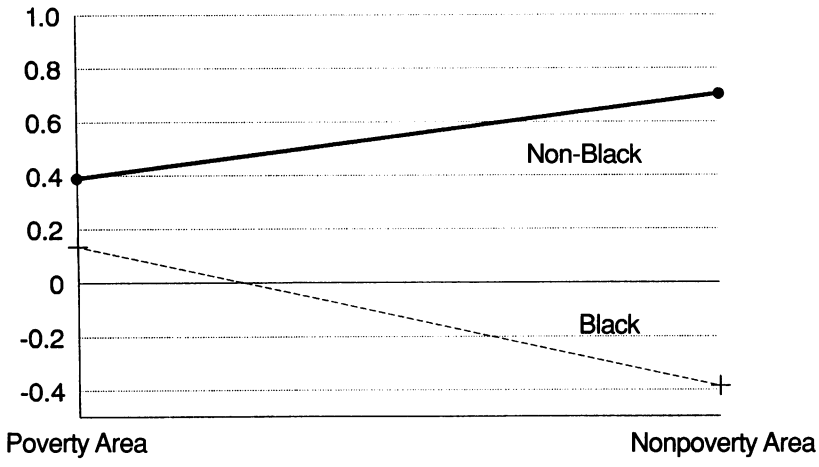
Model	β Estimate for Poverty Area (1 = Poverty Area; 0 = Nonpoverty Area)	*P*
Basic (age in 1965, sex, leisure-time physical activity score in 1965)	−0.67	.0001
Basic + smoking status	−0.66	.0001
Basic + race/ethnicity	−0.31	.1320
Basic + individual income	−0.50	.0051
Basic + education	−0.45	.0108
Basic + perceived health status	−0.58	.0008
Basic + body mass index	−0.65	.0002
Basic + alcohol consumption	−0.59	.0007

Results

There were 1737 people older than 20 years in the Alameda County Study living in Oakland in 1965 who responded to the 1974 questionnaire. After removing people with missing values for the covariates, 1451 people remained. The 1965 sample had a mean age of 44 years, more women (57%) than men, 73% White people, 18% Black people, 30% with inadequate or marginal income, 33% who did not graduate from high school, and 24% who lived in the poverty area (Table 1).

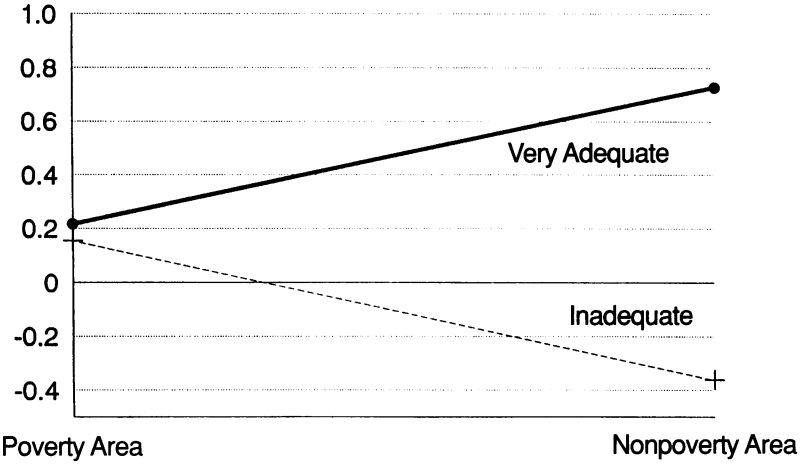
Physical activity decreased between 1965 and 1974 (mean score in 1965 = 5.75; mean score in 1974 = 5.50; $t = -3.16$, $P < .01$). The mean physical activity level was lower in the poverty area in both years: 4.9 (SD = 3.4) in the poverty area vs 6.0 (SD = 3.2) in the nonpoverty area in 1965; 4.6 (SD = 3.6) in the poverty area vs 5.8 (SD = 3.4) in the nonpoverty area in 1974.

After adjusting for age, sex, and baseline score, those living in a poverty area showed a



Note. Estimated from linear regression model for 45-year-old male nonsmoker with very adequate income. Model covariates: age, sex, baseline physical activity level, smoking status, income.

FIGURE 1—Change in mean leisure-time physical activity: race/ethnicity differences in the Alameda County Study, 1965–1974.



Note. Estimated from linear regression model for 45-year-old non-Black (defined as White, Latino, Asian, and other) male nonsmoker. Model covariates: age, sex, baseline physical activity level, smoking status, race/ethnicity.

FIGURE 2—Change in mean leisure-time physical activity: income group differences in the Alameda County Study, 1965–1974.

greater decrease in physical activity between 1965 and 1974 compared with those living in a nonpoverty area ($\beta = -0.67$, $P = .0001$). The association was unchanged with adjustment for smoking status and body mass index. The poverty area effect remained after adjusting for education and income level but was decreased by 55% with adjustment for race/ethnicity; alcohol consumption had minimal confounding effects (Table 2).

In further analyses, the association between poverty area residence and change in physical activity was dependent on race/ethnicity and income level (Figures 1 and 2). For those who lived in the poverty area, changes in physical activity were similar between Blacks and non-Blacks (defined as White, Latino, Asian, and other); for those who lived in the nonpoverty area, Blacks showed a greater decrease in activity (poverty area × race/ethnicity, $P = .062$), adjusting for age, sex, income, perceived health status, and alcohol consumption.

Interaction effects were also observed with individual income level. For those who lived in the poverty area, changes in physical activity were similar for people with different income levels; for those who lived in the nonpoverty area, people with inadequate income showed a greater decrease in physical activity (poverty area × adequate income, $P = .99$; poverty area × marginal income, $P = .10$; poverty area × inadequate income, $P = .08$), adjusting for individual confounding variables. No interaction was seen between poverty area and education. No 3-way interaction existed between poverty area, race/ethnicity, and income.

Discussion

The results indicated that poverty area residence is associated with a decline in physical activity, adjusting for age, individual income, education, smoking status, body mass index, and alcohol consumption, but that the effects of poverty area residence differed depending on income and race/ethnicity. Changes in physical activity over time in the poverty area were similar for Blacks and non-Blacks and for people with different income levels. This finding suggests that the poverty area has a leveling effect. The differences in the amount of change in leisure-time physical activity were much larger for those who resided in the nonpoverty area, depending on race/ethnicity or income adequacy. Blacks and people with marginal or inadequate income had larger declines in activity levels than their counterparts residing in the poverty area. Thus, access to the resources (such as parks, recreational facilities, and commercial gyms) in the nonpoverty area may differ depending on one's race/ethnicity. The findings showing differing effects depending on income level are similar to those Blaxter[24] reported from the United Kingdom. The findings showing differing effects depending on race/ethnicity are similar to those of studies reporting higher mortality risk for Blacks who live in a predominantly non-Black environment,[25] because the nonpoverty area is predominantly White.

A few methodological limitations deserve mention. The 9-year span between the waves of data collection is a long period. It is impossible to know when the observed changes occurred. These analyses assume that exposure to the poverty area in 1965 is responsible for physical activity changes between 1965 and 1974. Length of residence at the subject's address in 1965 and residential

mobility are not considered. In both instances, the resulting misclassification would lead to an underestimate of the association or a bias toward the null.

Conclusion

The results indicate that place of residence prospectively influences health behavior. Further work to clarify the specific role of place is necessary.[26,27] Interventions that focus on individuals may have limited long-term success if they do not also consider the environments in which people live. The ability to identify characteristics of places that influence risk factors and health status may lead to wider-reaching and longer-lasting change. □

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