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Environmental Factors of Obesity in Communities with Native Hawaiians

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Abstract

Objective—To compare the fast food outlets and exercise resources across 3 communities with varying percentages of Native Hawaiians (NH) and to correlate these findings with obesity prevalence.

Methods—Data on all food and exercise resources were collected from January through July 2006 within a 1-mile radius in 3 distinct communities (site A=higher %NH to site C=lower %NH). Comparisons between communities were analyzed in 2007 using Fisher's Exact and ANOVA.

Results—Trends in obesity prevalence paralleled the percentage of NHs. After adjusting for population size, site B had a greater number of fast food outlets ($p < 0.001$) than site A or C, and more exercise facilities compared to site A ($p = 0.05$). Availability of fast food outlets was significantly greater at site A compared to site C ($p = 0.03$). Usage of exercise facilities was not significantly different between sites although exercise resources were in 'poorer' condition at site A compared to site B or C ($p \leq 0.05$).

Discussion—Results confirm the increased frequency of obesogenic environmental factors and their correlation with obesity trends across 3 distinct NH communities. These results suggest that environmental factors may offer another means for reducing obesity disparities in minority communities.

Introduction

In the US, recent studies have highlighted the disproportionate rates of obesity in ethnic/racial minority populations including Native Hawaiians (NHs) with a prevalence of up to 70-80%.¹⁻⁵ Although the multiple causes for obesity disparities among NHs and other racial minorities are not clearly understood, several studies have found that environmental factors, including the availability of healthy food options or exercise facilities, affect the development of excess weight.⁶⁻⁸ In addition, despite some mixed results⁹⁻¹¹, the majority of studies suggest a higher prevalence of fast food outlets and lower prevalence of recreational facilities in minority

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communities compared to non-minority communities.¹²⁻¹⁵ To date little is known about access to food outlets or exercise resources in communities that are predominantly Native Hawaiian and/or other Pacific Islander even though they are known have increased obesity disparities.

The purpose of this study was to examine the quantity, usage, and quality of fast food outlets and exercise resources in 3 distinct communities distinguished by the proportion of NHs living in each community.

Methods

Assessments of food and exercise resources were collected using the study protocol of the PILI 'Ohana Program – Community Assessment Study from January – July 2006. Three non-contiguous geographical areas on the island of Oahu were selected for assessment. Each site had varying percentage of NHs with Site A having the highest and Site C with the lowest (Table 1). Within each geographical area, a 1 mile radius was constructed around a centrally located public facility (i.e., community health center, elementary school, etc.). Due to the coastal geography of Site A, 2 semi-circles were constructed around 2 focal points to approximate a complete 1-mile radius.

Assessments were conducted on both weekdays and weekends at various time points by trained researchers using standardized forms. Food resources were categorized as follows: 1) supermarket (at least 5 aisles of household staple foods), 2) fast food (no wait staff, meal obtained in 10 minutes or less), 3) restaurant (patrons seated at tables and served by wait staff), or 4) specialty food (narrow range of non-meal food, e.g. smoothies, desserts). Exercise resources (excluding those located on private property) were divided into: 1) beaches, 2) swimming pools, 3) gym/exercise facilities, 4) walking/running trails, or 5) playgrounds/fields/courts. Each resource was evaluated visually for physical condition and utilization and assigned a score from 1 (poor condition or low utilization) to 3 (good condition or high utilization).

The distribution of resources was compared using Fisher's Exact test (categorical data) and analysis of variance (ANOVA, continuous data). All data analyses were carried out in 2007 using SAS 9.1 and $p \leq 0.05$ was considered statistically significant. This study was approved by the University of Hawaii, Committee on Human Studies.

Results

The prevalence of obesity paralleled the trend in percentage of Native Hawaiians in each of the 3 sites (Table 1); however, the trend in percent below poverty level did not. Sites A and B had a similar number of fast food eateries (Site A = 29; Site B = 31) although Site A had a slightly larger proportion of fast food establishments compared to other food resources (n=29 fast food resources; 22 other food resources). Assessment of exercise facilities at each site showed that Site B had the lowest number of exercise resources (n=14) compared to Site A (n=20) or C (n=32).

After adjusting for population density, Site C was found to have a significantly lower frequency of fast food resources or outlets than Site B ($p < 0.001$) and Site B had a significantly higher frequency of fast food outlets compared to site A ($p < 0.001$) (Table 2). Both Site B ($p = 0.05$) and Site C ($p = 0.02$) had significantly more exercise resources compared to Site A even after adjustment for population density.

Site A had the highest usage of fast food outlets (usage score 2.8 of 3.0) compared to all other community sites (all $p < 0.05$) (Table 2). Site B had the lowest usage (usage score 1.9 of 3.0) of fast food outlets despite the higher absolute number of fast food establishments in Site B.

The relative proportion of fast food resources per total food resources in a community site, an estimate of the availability of fast food in a community, was only significant for Site A which had a significantly higher proportion of fast food outlets per total food resources compared to Site C ($p=0.03$). By contrast, mean usage of exercise resources was similar in all 3 community sites (all $p>0.05$). However, the exercise resources at Site A was found to be in ‘poorer’ condition when compared to either Site B or Site C. (both $p\leq 0.05$).

Discussion

Communities with a higher proportion of NHs had a greater proportion of fast food outlets and the least number of exercise facilities per 10,000 population. Our results are consistent with previous literature which suggests that minority communities have a higher availability of fast foods and a lower number and quality of exercise resources.^{8, 15-21} Similarly, we found that the proportion of NHs in a community is directly correlated to the estimated obesity in the community. Our study also found that all 3 sites utilized existing exercise resources in their communities at near maximum. This suggests that even communities with a high proportion of NHs (Site A) are frequent users of exercise resources despite increased obesity prevalence and could probably benefit from increased access to exercise resources of sufficient quality. These results are consistent with prior studies that have shown that public access to exercise resources, i.e. parks, sidewalks, etc., are associated with a greater likelihood of being more physically active.^{8, 22, 23}

One unexpected finding was the high number of fast food eateries with a low number of exercise resources in Site B. This increased availability of fast food eateries may increase the risk for the future development of obesity in Site B. As Site B is an emerging community that is likely to attract younger families, creating more exercise resources may be one means for reducing the risk for obesity in this community as few exercise resources were initially identified in this study.

Limitations of this study include restricting assessments to a 1-mile radius, using obesity estimates derived from self-reported data, and not examining socioeconomic status (SES) and its relationship with environmental factors of obesity. The cross-sectional nature of the study also does not allow for causal inferences. In future studies, multiple assessments should be made of the communities at different time points to gain a better representation of the resources and their utilization.

Despite these limitations, our study is the first to provide confirmatory evidence that increased obesogenic environmental factors are more frequent in communities with a higher proportion of Native Hawaiians and that there is a trend of increasing environmental factors associated with increasing obesity prevalence. In emerging communities, the increased number of fast food outlets and few exercise resources, such as in Site B, poses a potential risk for future obesity trends, especially among young families. The results of this study may help to identify communities at high risk for obesity, and also to inform the development of health policies to encourage built environments that promote and support healthier lifestyle practices.

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References

1. Flegal KM, Carroll MD, Ogden CL, Johnson CL. Prevalence and trends in obesity among US adults, 1999-2000. *JAMA* Oct 9;2002 288(14):1723-1727. [PubMed: 12365955]
2. Florentina RS, N D, Huang T. 2001-2003 State of Hawaii by Ethnicity- Hawaiian behavioral risk factor surveillance system. *Health Statistics*. 2004
3. Grandinetti A, Chang HK, Chen R, Fujimoto WY, Rodriguez BL, Curb JD. Prevalence of overweight and central adiposity is associated with percentage of indigenous ancestry among native Hawaiians. *Int J Obes Relat Metab Disord* Jul;1999 23(7):733-737. [PubMed: 10454107]
4. Johnson DB, Oyama N, LeMarchand L, Wilkens L. Native Hawaiians mortality, morbidity, and lifestyle: comparing data from 1982, 1990, and 2000. *Pac Health Dialog* Sep;2004 11(2):120-130. [PubMed: 16281689]
5. Aluli NE. Prevalence of obesity in a Native Hawaiian population. *Am J Clin Nutr* Jun;1991 53(6 Suppl): 1556S-1560S. [PubMed: 2031487]
6. Wang MC, Cubbin C, Ahn D, Winkleby MA. Changes in neighbourhood food store environment, food behaviour and body mass index, 1981-1990. *Public Health Nutr* Sep 26;2007 :1-8.
7. Maddock J. The relationship between obesity and the prevalence of fast food restaurants: state-level analysis. *Am J Health Promot* Nov-Dec;2004 19(2):137-143. [PubMed: 15559714]

8. Cohen DA, McKenzie TL, Sehgal A, Williamson S, Golinelli D, Lurie N. Contribution of public parks to physical activity. *Am J Public Health* Mar;2007 97(3):509–514. [PubMed: 17267728]
9. Abercrombie LC, Sallis JF, Conway TL, Frank LD, Saelens BE, Chapman JE. Income and racial disparities in access to public parks and private recreation facilities. *Am J Prev Med* Jan;2008 34(1):9–15. [PubMed: 18083445]
10. Powell LM, Chaloupka FJ, Bao Y. The availability of fast-food and full-service restaurants in the United States: associations with neighborhood characteristics. *Am J Prev Med* Oct;2007 33(4 Suppl):S240–245. [PubMed: 17884571]
11. Moore LV, Diez Roux AV, Evenson KR, McGinn AP, Brines SJ. Availability of recreational resources in minority and low socioeconomic status areas. *Am J Prev Med* Jan;2008 34(1):16–22. [PubMed: 18083446]
12. Burdette HL, Whitaker RC. Neighborhood playgrounds, fast food restaurants, and crime: relationships to overweight in low-income preschool children. *Prev Med* Jan;2004 38(1):57–63. [PubMed: 14672642]
13. Hillsdon M, Panter J, Foster C, Jones A. The relationship between access and quality of urban green space with population physical activity. *Public Health* Dec;2006 120(12):1127–1132. [PubMed: 17067646]
14. Jeffery RW, Baxter J, McGuire M, Linde J. Are fast food restaurants an environmental risk factor for obesity? *Int J Behav Nutr Phys Act* 2006;3:2. [PubMed: 16436207]
15. Block JP, Scribner RA, DeSalvo KB. Fast food, race/ethnicity, and income: a geographic analysis. *Am J Prev Med* Oct;2004 27(3):211–217. [PubMed: 15450633]
16. Baker EA, Schootman M, Barnidge E, Kelly C. The role of race and poverty in access to foods that enable individuals to adhere to dietary guidelines. *Prev Chronic Dis* Jul;2006 3(3):A76. [PubMed: 16776877]
17. Jetter KM, Cassady DL. The availability and cost of healthier food alternatives. *Am J Prev Med* Jan;2006 30(1):38–44. [PubMed: 16414422]
18. Moore LV, Diez Roux AV. Associations of neighborhood characteristics with the location and type of food stores. *Am J Public Health* Feb;2006 96(2):325–331. [PubMed: 16380567]
19. Morland K, Wing S, Diez Roux A, Poole C. Neighborhood characteristics associated with the location of food stores and food service places. *Am J Prev Med* Jan;2002 22(1):23–29. [PubMed: 11777675]
20. Powell LM, Slater S, Chaloupka FJ, Harper D. Availability of physical activity-related facilities and neighborhood demographic and socioeconomic characteristics: a national study. *Am J Public Health* Sep;2006 96(9):1676–1680. [PubMed: 16873753]
21. Sloane DC, Diamant AL, Lewis LB, et al. Improving the nutritional resource environment for healthy living through community-based participatory research. *J Gen Intern Med* Jul;2003 18(7):568–575. [PubMed: 12848840]
22. Cohen DA, Ashwood JS, Scott MM, et al. Public parks and physical activity among adolescent girls. *Pediatrics* Nov;2006 118(5):e1381–1389. [PubMed: 17079539]
23. Giles-Corti B, Donovan RJ. Socioeconomic status differences in recreational physical activity levels and real and perceived access to a supportive physical environment. *Prev Med* Dec;2002 35(6):601–611. [PubMed: 12460528]

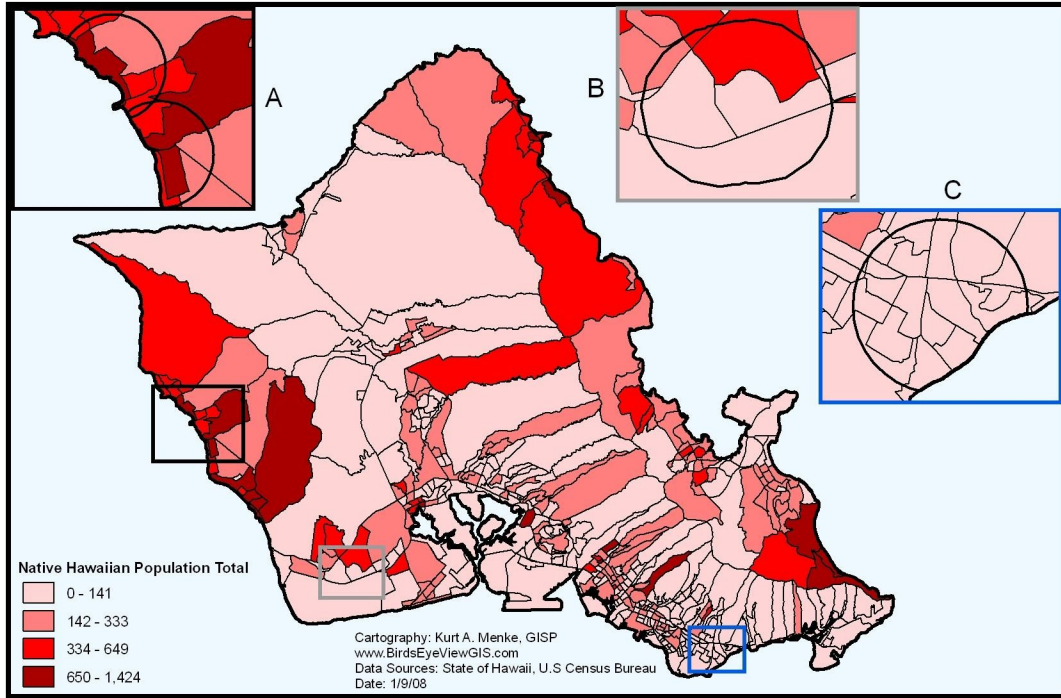


Figure 1.
Map of Study Sites

Table 1
Description of Communities by Sites ; Oahu, Hawai'i (2005-2006)

Community Sites	A	B	C
Community Characteristics			
Native Hawaiian Population (%) ^a	55.7	21.0	13.2
Estimates of Total Population per Site ^a	23,824	5,845	11,576
Obesity Prevalence (%) ^b	39.4	21.8	9.2
Below Poverty Level (%) ^a	21.7	5.0	8.7
Environmental resources ^c			
Number of Fast Food Outlets	29	31	19
Number of Supermarkets	4	3	4
Number of Other Food Resources ^d	18	22	23
Number of Exercise Resources	20	14	32

^a Estimate based Census 2000 adjusted to 1-mile radius using census tracts and/or GIS software.

^b Estimate of obesity was based on Behavioral Risk Factor Surveillance System data for 2006 and was defined as body mass index ≥ 30 kg/m².

^c Ascertained within defined 1 mile radius

^d Other Food Resources defined as all non-Fast Food Resources (including supermarkets).

Table 2
Comparison of Fast Food and Exercise Resources Between Communities

Community Sites	A	B	C	C vs. A	C vs. B	B vs. A
Fast Food Resources						
Relative frequency ^a	--	--	--	1.3, p=0.59	0.3, p=0.00	4.4, p=0.00
Mean usage ^b	2.8	1.9	2.4	p ≤ 0.05	p ≤ 0.05	p ≤ 0.05
Availability ^c	57%	55%	41%	p = 0.03	p = 0.07	p = 0.89
Exercise Resources						
Relative frequency ^a	--	--	--	3.5, p=0.02	1.2, p=0.69	3.0, p=0.05
Mean usage ^b	2.3	2.0	2.2	p > 0.05	p > 0.05	p > 0.05
Mean condition ^d	1.8	3.0	2.6	p ≤ 0.05	p > 0.05	p ≤ 0.05

^a Per 10,000 population, based on the US Census 2000

^b Defined as the mean ability of the resource to accommodate additional users on a scale of 1-3 where 1 represents minimal utilization and 3 represents utilization that is approaching full capacity.

^c Availability defined as the number of fast food resources divided by the total food resources ascertained in a given community.

^d Defined as the mean overall condition of the resource on a scale of 1-3 where 1 represents a resource that is not safe or aesthetically welcoming (i.e. "poor physical condition") and 3 represents a resource that is above average in safety and aesthetically appealing (i.e. "good physical condition").