Cross-Sectional Markers of Stratification:

Risk for Ambulatory Disability as per the Class, Race, and Sex (CSR) Hypothesis

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BACKGROUND

The presence of health differences by race, sex, and socioeconomic status are frequently found in research [1]. Consequently, the growth for promoting a better understanding of the social determinants of health inequalities has risen in recent decades in both observational [2] and clinical [3] research. The goal in this line of research is to impact public health by reducing health inequalities [4]. Merging views from sociology and epidemiology may help these efforts. For example, few studies have made use of *cross-sectional markers of stratification*. The use of markers of stratification as social determinants of health are important as the systematic relegation to lower social strata eventually becomes embodied inequality through increase in risk for morbidity [1]. Cross-sectional markers of stratification refer to multidimensional measures. For example, the Class, Race, and then Sex (CRS) hypothesis of disability posits risk for disability is most concentrated in low-socioeconomic status minority females [1]. This brief report uses cross-sectional markers stratification to show risk for ambulatory disability.

DATA & SAMPLE

The analysis used data from the American Community Survey (ACS) Public Use Microdata Sample (PUMS) 5-year 2008-2012 file. From the 15,318,124 observations in the full PUMS file, a total of **5,832,297** survey participants are included in the analytic sample. The sample includes individuals residing in the US during the 2008-2012 survey period, between the ages of 45 and 85, citizens of the US either by birth or naturalization, and Non-Latino-Whites, Non-Latino-Blacks, or Mexican Latin@s.

AMBULATORY DISABILITY

The ACS measures "disability" by evaluating a person's difficulty with six different functional impairment tasks (hearing, vision, cognitive, ambulatory, self-care, and independent living). This report only focused on "ambulatory disability". Survey participants were asked: *Does this person have serious difficulty walking or climbing stairs*? Those with a "yes" response are labeled in our analysis as reporting/having ambulatory disability (i.e., difficulty with walking and/or climbing stairs).

CROSS-SECTIONAL MARKERS OF STRATIFICATION

The analysis separated participants by socioeconomic status (as measured by educational attainment), race-ethnicity, and sex. Individuals with an associate's degree and beyond are labeled as "high class". Participants are group by race-ethnicity as follows: Non-Latino-Whites; Mexican Latin@s; and then Non-Latino-Blacks. We use the "Mexican Latin@s" label to highlight the fact that in the US, there are individuals who identify a Mexican ancestry but not a Mexican ethnicity. Our sample only includes Mexicans who identify a Hispanic/Latino ethnicity. Because health in Mexican Latin@s has been linked with an epidemiologic paradox [5-8], they are expected to have better health than Non-Latino-Blacks. When combined with sex, we obtained a total of 12 groups, who were arranged from "most privileged" to "least privileged". As per the CRS hypothesis, prevalence and risk for ambulatory disability is expected to increase from the most advantaged group to the least advantaged group [1].

PREVELANCE OF AMBULATORY DISABILITY

Table 1 presents unweighted (i.e., actual observations) and population-weighed counts. The "weighted" counts can be used to generalize findings to the US population. After applying population weights, information on the 5,832,297 individuals in the data is used to generalize to a population of **101,733,846** people in the US. There are 5,027,092 Non-Latino-Whites; 585,916 Non-Latino-Blacks; and only 219,289 Mexican Latin@s. The largest group, when weighted, are Non-Latino-White females with less than an associate's degree (n=28,947,863). The smallest group, when weighted, are Mexican Latino males with an associate's degree or more (n=357,519).

As shown in Table 1, disability prevalence is lower for those with high socioeconomic status (green section in table) than those with lower socioeconomic status. For example, while Non-Latino-White males with an associate's degree or more have a 5.8% ambulatory disability prevalence, Non-Latino-Black females with less than an associate's degree have a 25.7% ambulatory disability prevalence. As predicted by the CRS hypothesis, results indicate disability varies over the cross-sectional groups. This suggests using cross-sectional markers of stratification may be useful in research exploring social determinants of ambulatory disability in the community-dwelling population of the US. The results also make it abundantly clear that minority females with moderate educational attainment have the highest prevalence of ambulatory disability.

Table 1
Sample size and percent disable by cross-sectional markers of stratification

	Unweighted	**Weighted**	Row % from 101,733,846	**Disable**	Row % from row Weighted
Has an associate's degree or more					
Non-Latino-White					
Males	910,034	15,919,445	15.6%	928,237	5.8%
Females	902,680	15,555,680	15.3%	1,125,895	7.2%
Mexican Latino					
Males	18,081	357,519	0.4%	24,601	6.9%
Females	19,016	364,765	0.4%	30,059	8.2%
Non-Latino-Black					
Males	53,506	1,144,929	1.1%	105,555	9.2%
Females	82,877	1,682,663	1.7%	203,796	12.1%
Less than an associate's degree					
Non-Latino-White					
Males	1,482,547	25,096,407	24.7%	3,651,661	14.6%
Females	1,731,831	28,947,863	28.5%	5,167,019	17.8%
Mexican Latino					
Males	86,136	1,743,072	1.7%	247,799	14.2%
Females	96,056	1,882,089	1.9%	349,522	18.6%
Non-Latino-Black					
Males	202,205	4,163,336	4.1%	801,747	19.3%
Females	247,328	4,876,078	4.8%	1,254,534	25.7%
Total	5,832,297	101,733,846		13,890,425	

REGRESSION RESULTS

Table 2 presents the results of a multivariable logistic model predicting likelihood of having an ambulatory disability. Because population structures are different in all three race-ethnicity groups, the regression model adjusts for age. Although the beta coefficient (β) and odds ratio are presented, only "percent change in the expected likelihood of having ambulatory disability" are discussed. Percent change in the expected likelihood of having ambulatory disability was computed as follows:

$$Percent\ Change = \left[100 \times \left(e^{\beta_i}\right)\right]$$

…which is equivalent to:

$$Percent\ Change = [100 \times (Odds\ Radio - 1)].$$

From Table 2, we see the likelihood for having *serious difficulty* with walking or climbing stairs (i.e., ambulatory disability) increases gradually as predicted by the CRS hypothesis. For example, when compared to the reference group of Non-Latino-White males with an associate's degree or more: Mexican Latino males have a 45% greater likelihood of having an ambulatory disability after adjusting for age; and Non-Latino-Black females with less than an associate's degree are 5 times (i.e., percent change=520%) more likely to have ambulatory disability. As indicated by the clear gradient in prevalence and risk for ambulatory disability over the cross-sectional markers of stratification, lower extremity physical functional impairment is not randomly distributed in the US population. In other words, ambulatory disability is more commonly *inflicted* on those at lower social stratum.

Table 2
Logistic regression models predicting likelihood of having ambulatory difficulty

	β	Odds Radio	Percent Change	α
Has an associate's degree or more				
Non-Latino-White				
Males	Ref	1.00	**Ref**	
Females	0.29	1.34	**34%**	***
Mexican Latino				
Males	0.37	1.45	**45%**	***
Females	0.64	1.90	**90%**	***
Non-Latino-Black				
Males	0.72	2.06	**106%**	***
Females	1.01	2.74	**174%**	***
Less than an associate's degree				
Non-Latino-White				
Males	0.97	2.63	**163%**	***
Females	1.11	3.02	**202%**	***
Mexican Latino				
Males	1.15	3.15	**215%**	***
Females	1.37	3.95	**295%**	***
Non-Latino-Black				
Males	1.53	4.60	**360%**	***
Females	1.82	6.20	**520%**	***
Age	0.05	1.05	5%	***

*** $p < 0.001$

CONCLUSIONS

Results provided evidence that systematic discrimination by education, race, ethnicity, and sex may partially contribute towards health disadvantages in disabling processes. Previous work has presented conceptual frameworks on systematic discrimination [9], how laws offer unequal protection [10], how shifting from structural to individual attributions of disadvantage is possible [11], and ideas for grouping socially marginalized individuals [12]. Because unjust discrimination may partially coalesce to create informal (e.g., residential segregation) and formal (e.g., school funding) structures capable of contributing to adverse health, measuring social environmental exposures is important. The findings are important for public health because they provide empirical evidence that the maintenance of physiological homeostasis—necessary for obtaining and maintaining ambulatory physical function—may be affected by social structures in the environment. This implies that both personal agency (i.e., free will) and social structures (e.g., access to health care) participate in the formation and maintenance of health. While public health interventions aimed at altering behaviors may help reduce morbidity, engaging political systems may improve public health's impact on health disparities.

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