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Prevalence of Self-Care and Ambulatory Disability in Baby Boom and Generation-X Birth-Cohorts by Intersectional Markers of Social Stratification

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Abstract Are differences in disability prevalence between individuals at the top and bottom strata of society a product of non-random processes? Under the assumption that genetic mutations are unlikely to account for the notable differences by makers of social stratification, the research presents a class, race, and then sex (CSR) hypothesis. The cross-sectional study, situated in the continental USA, uses information on 4,914,628 community-dwelling individuals from the Baby Boom (born 1951–1961) and Generation-X (born 1971–1981) birth-cohorts. When population-weighted, the sample is said to represent 96,639,980 of their counterparts. The data come from the American Community Survey Public Use Microdata Sample 2008–2012 file. Findings indicate that *intersectional* markers of social stratification help explain the prevalence and risk of self-care and ambulatory disability as predicted by the CSR hypothesis. The analysis provides novel evidence for the plausibility of a "Mexican Paradox" for disability. Amongst those from the Generation-X birth-cohort, low-education Mexican-origin Latinos had lower risk of disability than low-education non-Latino whites. Ageing studies should consider using intersectional markers of social stratification.

Keywords Self-care · Ambulatory · Mexican · Minorities · ACS · PUMS · Race · Disparities

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Introduction

Identifying health differences between groups in the USA has been deemed important for helping reduce "health disparities" (i.e. between-group differences in health). In general, health disparities are framed as the product of non-random processes like human-made systems (e.g. racial discrimination, Feagin 2013). For example, studies in general find that "women experience poorer health than men despite their longer life expectancy" (Malmusi et al. 2014)—a health disadvantage which may presumably be partially influenced by social processes (e.g. gender discrimination, Gardeazabal and Ugidos 2005). Work has also shown between-group differences in risk of disability by class (Minkler et al. 2006; Melzer et al. 2000), race (McDonald et al. 2007; Warner and Brown 2011), and sex (Melzer et al. 2000; Leveille et al. 2000). This analysis focuses on sex (i.e. anatomy of an individual's reproductive system) and not gender (i.e. social roles based on sexual orientation). Using findings over the years, researchers have argued that observed racial disparities in health are likely to be partially influenced from differences in access to economic and social resources (Thorpe et al. 2014).

There are three important phases in health disparities research: detecting where disparities exist; identifying determinants; and proposing interventions for reducing disparities (Kilbourne et al. 2006). The current study contributes to the first phase by providing a novel approach for detecting health disparities. Within epidemiologic research interested in identifying social determinants of decease, the term "risk of disability" refers to factors found to be statistically associated with earlier onset or more severe development of disability. For example, the female status is frequently found to be associated with higher risk of disability. This investigation uses language from sociology

and epidemiology to discuss how disability clusters by class, race, and sex.

Although disability is an umbrella term that includes many different measures, in this report, disability refers to self-reporting difficulty with dressing, bathing, walking, or climbing stairs. The measurement of "self-care" and "ambulatory" disability is explained in greater detail in the description of the data. Studying self-reported difficulties with self-care and/or ambulatory tasks is important as it provides a way to estimate the prevalence of physiological decline in functional mobility—an upstream target for intervention. Racial variations with mobility disability have been found amongst various grouping schemes (Goode et al. 2014), including older adults (Patel et al. 2007) where race differential in disability-free years at older ages has been observed (Solé-Auró et al. 2014). Measures of self-reported self-care and ambulatory difficulties are important as they are commonly used in observational studies, reliable, easily accessible, and replicable.

Disability has been found to systematically vary by class, race, and sex. In general, individuals in lower socioeconomic strata are found to be at greater risk of developing disability earlier in life and experiencing greater severity of limitations than those at upper socioeconomic strata (Cleveland et al. 2014). Racial minorities and females are frequently found to be at greater risk of early onset and more severe disability than racial majorities and males, respectively (Siordia 2014a). As per the conceptual framework being used in this analysis, class, race, and sex are posited to have the ability to affect an individuals' access to social and economic resources. Access to resources is important because it may influence health over the life course (Siordia 2014a). These assumptions are made based on research, where empirical findings consistently find a direct relationship between disability and social stratification (Jenkins 1991).

Public health researchers should seek out novel ways of highlighting important differences in disability prevalence and risk by making use of markers for social stratification (Siordia 2013). This is important because finding new ways to identify between-group differences may help promote creativity in the development of sustainable interventions aimed at mitigating early onset and severity of disability at older ages. Increasing the potential to impact public health by reducing health disparities demands specific attention is given to new grouping schemes (Gulley et al. 2014). One way to advance public health research is to recommend promising new avenues for identifying where health disparities cluster. This study presents a novel way for grouping individuals and adds to previous work by including the Mexican-origin Latino group and dividing groups by birth-cohort.

Research should consider combining class, race, and sex to produce *intersectional* markers of social stratification—a three-dimensional grouping scheme capable of providing novel insights on how health disparities cluster by acquired (class) and inherited (race and sex) characteristics. An intersectionality approach (Crenshaw 1989), born from feminist perspectives (Carastathis 2014), seeks to understand how race and gender interact with class to affect outcomes such as family formation (Cho et al. 2013), social justice (Dill and Kohlman 2012), crime (Burgess-Proctor 2006), and political economy (Collins 2000). The main idea in the approach is that intersections have the potential to create oppression and opportunities (Shields 2008). The intersectional framework helps emphasize important differences amongst different intersectional positions—where cumulative disadvantage can be identified in highly vulnerable groups (e.g. non-Latino black females with moderate levels of education). More nuanced presentations on the epistemology of the intersectional approach have been presented before (Collins 2015; McCall 2014).

Unlike existing discussions on intersectionality, the current work is quantitative and focuses on examining an easy to replicate operationalization of the concept. The approach in this investigation fills a gap in the literature by providing a clear delineation for how researchers can capture intersectional markers of social stratification. Guided by findings in scientific investigation, the class, race, and then sex (CSR) hypothesis has been presented before (Siordia 2014a). In this analysis, the CSR hypothesis is expanded to include one more minority group: Mexican-origin Latinos. Because low-income/education Latinos are frequently found to have an advantage for lower mortality or adverse risk, the inclusion of Latino groups in health research can complicate conceptualization between socioeconomic status and health. The inclusion of the Mexican-origin Latino group helps advance the nuances of the CSR hypothesis. The core assumption in the empirically informed CSR hypothesis is that prevalence and risk of disability first cluster by class, then by race, and lastly by sex. Class, race, and then sex are ordered to reflect a theoretical mechanism where economic resources are framed as being more important than social resources. Thus, class is hypothesized to be more important than race and the latter than sex. From a quantitative perspective, the fact that education accounts for the bulk of between-people variance in disability, followed by race and then sex, the CRS hypothesis helps operationalize the expected gradient risk of disability by intersectional markers of stratification. The hypothesized clustering of disparities in this order for the three elements does not imply a temporal element. Instead, it simply posits that health disparities may cluster first as a function of class, then race, and lastly sex. The CSR hypothesis particularly applies to how prevalence and risk of disability vary amongst midlife age ranges in residents of the USA.

The CSR hypothesis combines measures of class, race, and sex to create novel intersectional markers of social stratification. Although the coding of the categories is discussed in detail in Methods section, Fig. 1 visually represents the conceptual model of the CSR hypothesis. As can be seen from Fig. 1, the CSR hypothesis predicts prevalence and risk of disability will be *lowest* amongst "high" education males from the race-majority group. Members of the race-majority group (i.e. non-Latino whites) may be frequently found to have better health because they may have greater access to social and economic resources—a phenomenon which may be partially explained by their large group membership.

The CSR hypothesis also predicts disability prevalence and risk will be *highest* amongst "low"-education females from the racial-minority group. Socioeconomic class, as measured by educational attainment, is posited a pre-eminent to race and gender because it is a more direct measure of access to social and economic resources. Because research has provided evidence of a "Hispanic Paradox" (Lariscy et al. 2014), the CRS hypothesis posits a "Mexican advantage". Because almost seven out of every ten Hispanics in the US are of Mexican-origin (Siordia 2015) and becuase researchers have argued the Hispanic Paradox should be labeled the "Mexican Paradox" (El-Sayed et al. 2014; Martinez et al. 2014). The analysis only focuses on US-born Hispanics with a Mexican origin. What is sometimes called the Hispanic Paradox refers to findings that risk of adverse health does not follow a clear socioeconomic gradient amongst Latinos as with other race–ethnic groups (Gómez-Puerta et al. 2014). The Hispanic Paradox has not always been found for disability-related outcomes (Hayward et al. 2014). Note that the Hispanic Paradox has not been systematically tested with randomized control trials (Young and Hopkins 2014). The current analysis expands on previous work by expanding the CRS hypothesis to include Mexican-origin Latinos and discuss complexities found within the group as it regards their prevalence and risk of disability.

The progression in midlife from vitality, to frailty, to disability (i.e. change from healthy to disable) is represented in Fig. 1 by the greying zones on the right side of the bars. More generally, the CRS hypothesis captures how low-education, racial-minority, and female "disadvantages" compound to increase prevalence and risk of disability by intersectional markers of social stratification. The arrangement of groups represents the expected "education–race–sex–disability" gradient in the CRS hypothesis. Note that although Mexican-origin Latinos/as above non-Latino blacks belong to race-minority groups in the USA, the CRS hypothesis posits less disability amongst the former. This is done as research frequently finds evidence that the

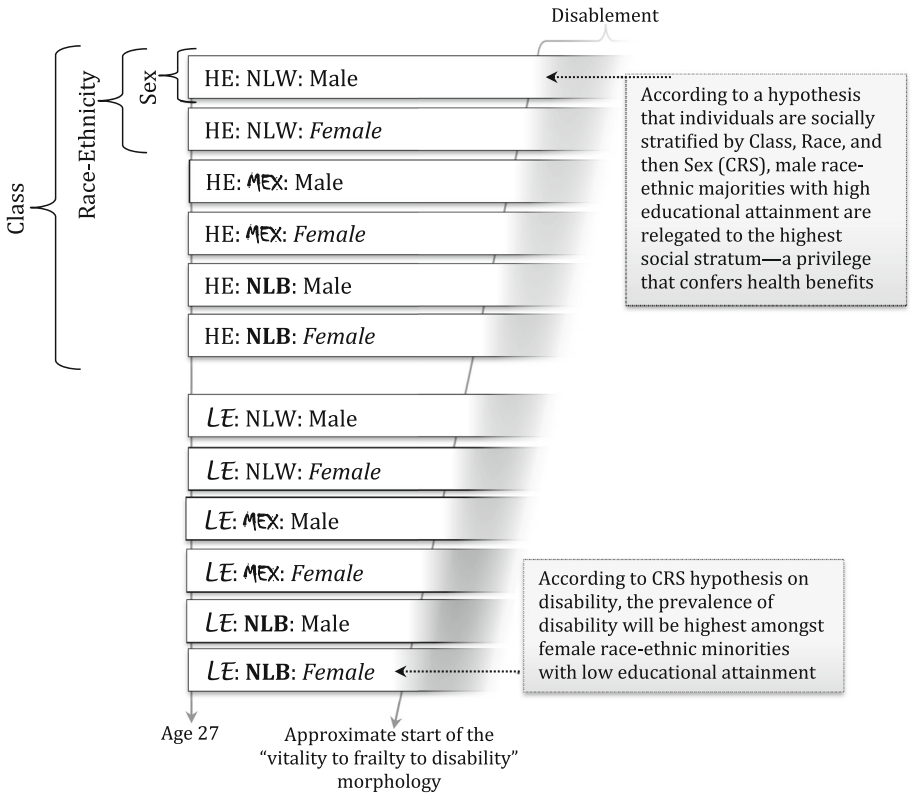


Fig. 1 Conceptual representation of disability in middle ages by social stratum. *HE* high education, *LE* low education, *NLB* non-Latino black, *NLW* non-Latino white

socioeconomic-health gradient commonly found in non-Latino whites and non-Latino blacks does not apply to Mexican-origin Latinos/as (Castro 2013).

Investigating social determinants of disability via the CRS hypothesis requires that the basic elements of chronological age, social context, and birth-cohort are accounted. Disentangling the statistical relationship between health, age, period effects, and birth-cohort is a complex task (Lauderdale 2001). In general, risk of adverse health increases with chronological age—as pathophysiological events accumulate to form system dysregulation (Lin et al. 2012). In turn, social context (e.g. war time) may play a key role in how individuals progress through disablement processes (Lawrence and Jette 1996; Verbrugge and Jette 1994). Birth-cohort is a proxy measure of population structure within an individual's generation—where large birth-cohorts are associated with greater risk of lower socioeconomic and physical well-being (Siordia and Leyser-Whalen 2014).

Because age, period effects, and birth-cohort may matter for health, a host of research has examined health outcomes by birth-cohort in order to account for the fact that small birth-cohorts are typically associated with better health and economic well-being (Siordia 2014d). Birth-cohort captures the timing of period effects (Wilder et al. 2009)—i.e. at what stage in the life course social events (e.g. economic booms) are experienced. As a result, previous work has used birth-cohort to explore health outcomes (Yoshimasu et al. 2010) including studies that focus on how disability trends vary by birth-cohort and socioeconomic status (Morciano et al. 2015).

As indicated in the brief review of the literature, previous work has not investigated prevalence of and risk of self-care and ambulatory disability with intersectional markers of stratification. Investigating how prevalence of and risk of disability vary by groups classified over three dimensions—class, race, and sex—may provide public health policy with knowledge of where to target federal resources aimed at promoting health equity. In order to fill a gap in the literature, the specific aim of this study was to investigate between-group differences in prevalence and risk of self-care and ambulatory disability using an intersectionality approach. The project adds to the literature by using an epidemiologic and social perspective in the introduction of the CSR hypothesis and provides evidence for its applicability in US populations.

Methods

Data

The analysis uses cross-sectional data on community-dwelling adults from the 5-year 2008–2012 Public Use Microdata Sample (PUMS) American Community Survey (ACS) file (Siordia 2013). The US Census Bureau combines 5 years of respondents into one "5-year" ACS PUMS file—it does so under the assumption that existing sampling protocols do not allow people to participate more than once with the ACS during the 5-year survey period (Siordia 2014b). The ACS is a national and yearly survey administered to about 1 % of population (>3 million people) (Siordia 2014c). Data from the ACS are used by US federal government to allocate billions of dollars each year (Siordia 2014d). For example, in 2008, information gathered by the ACS influenced the distribution of $562.2 billion in grants and $520.7 billion in direct payments from federal agencies to state programs (Reamer 2010). The ACS is the primary data source for understanding prevalence of disability in the US population (Siordia 2014d).

Sample

From the 15,318,124 observations available in the ACS 2008–2012 PUMS file, the analysis used individual-level information on 4,914,628 (32 %) respondents. When population weights are applied (Siordia and Le 2013), the 4,914,628 observations are said to represent about 96,639,980 people. The study uses individuals born from 1951 to 1961 and refers to them as the Baby Boom birth-cohort (Siordia 2014d; Siordia and Leyser-Whalen 2014). It also includes individuals born from 1971 to 1981 and labels them as the Generation-X birth-cohort (Robinson et al. 2012).

Because the file contains individuals from five different survey years (from about the start of 2008 to about the end of 2012), people aged 47–61 make up the Baby Boom birth-cohort and those aged 27–41 the Generation-X birth-cohort. There are 2,835,287 individuals in the Baby Boom birth-cohort—when population weights are applied, they are said to represent 51,452,378 of their counterparts in the population. There are 2,079,341 individuals in the Generation-X birth-cohort—when population weights are applied, they represent 45,187,602 of their counterparts in the population. When combined, there are 4,914,628 "actual" observations—which when "weighted" equal 96,639,980 individuals.

In addition to selecting those aged 27–41 (Generation X) and aged 47–61 (Baby Boom), the analysis only includes those who are born in a state within the contiguous USA and who resided in the continental USA during survey period. From this group, only non-Latino whites (NLWs), non-Latino blacks (NLBs), and Mexican-origin Latinos (MEXs) were included in the analysis. In the USA, individuals must identify a "race" (e.g. white, black) and "ethnic" (e.g. Latino or non-Latino) category. NLWs are those who only identify with the "white" race group and deem themselves to have no Latino ethnicity. NLBs are those who only identify with the "black" race group and

deem themselves to have no Latino ethnicity. MEXs are those who only identify themselves of Latino ethnicity and to be of a "Mexican origin". Note MEXs can be of *any* race group and that amongst Baby Boom MEXs, 71 % identify as white, 24 % as some other race, and the rest as something else. Amongst Generation X MEXs, 68 % identified as white, 27 % as some other race, and the rest as something else. In combination, NLWs, NLBs, and MEXs account for almost nine out of every ten people in the contiguous USA (Siordia 2014b).

Disability

Reports on "difficulty" with self-care and ambulation were used in the analysis. Self-care disability was assessed by asking survey participants the following: "Does this person have difficulty dressing or bathing?" Ambulatory disability was assessed by asking survey participants the following: "Does this person have serious difficulty walking or climbing stairs?" Those with a "yes" response are said to have a disability. Self-care and ambulatory questions may be said to be related to basic activity of daily living. Issues with disability questions in ACS have been discussed extensively elsewhere (Siordia 2013). Using population-weighted counts and amongst those from the Baby Boom birth-cohort, there are 1,662,159 (3.2 %) with a self-care disability and 5,0556,569 (9.8 %) with an ambulatory difficulty. Using population-weighted counts and amongst those from the Generation-X birth-cohort, there are 529,541 (1.17 %) with a self-care disability and 1,253,001 (2.8 %) with an ambulatory difficulty. More disability is present amongst Baby Boom respondents than amongst Generation X, primarily and presumably because the former are of an older age.

Class, Race, and Sex

Identifying people by nominal labels such as race and class is difficult to do without a host of assumptions (Samuels 2014). They remain common measures in quantitative research as they provide one avenue for quantifying patterns of social phenomenon. The study uses educational attainment to measure "class", race, and ethnic origin to measure "race" and "sex". The project separated those with a bachelor's degree and beyond into the "high-education" group and those with less than bachelor's degree into the group labelled "low-education". Educational attainment is a widely used proxy measure for social class in many disciplines (Rubin and Wright 2014). For example, formal education provides documentation necessary for stable and high-paying occupations; it is often used as a measure of social class in epidemiologic (Liberatos et al. 1988) and economic studies (Serido et al. 2014). Despite its popularity, using education as a proxy for the lager construct of SES is a limitation as it is one element within the large construct of SES.

Although race and ethnicity are combined to create race–ethnicity groups, the term *race* is used to identify the grouping scheme for the sake of simplicity. As made clear in publications by the US Census Bureau, they do *not* conceptualize race or ethnicity as genetically determined characteristics—they are social constructs and not biologically defined phenotype. The approach used in this study assumes that the three elements of education, race, and sex are mutually exclusive—i.e. the categories possess systemic features in their own right, and they reflect important social stratification processes. The "hybrid" *education–race–sex* categories—derivative from the distinct elements—are framed as representing mutually exclusive groups with social meaning. The 12 education–race–sex *intersectional groups* are shown in Fig. 1. Each education–race–sex group is treated as an informative and intersectional marker of social stratification.

Statistical Approach

A SAS® 9.3 algorithm produced population-weighted estimates of total number of individuals in each education–race–sex group size (i.e. denominators) and the number of disable within each (i.e. numerators) by birth-cohort. These population-weighted estimates were used to compute the ratios (interpreted as per cent) to discuss prevalence of disability by education–race–sex groups and birth-cohort. Four multivariable logistic regressions are used to predict likelihood of having self-care and ambulatory disability by birth-cohort. The four models include the 12 education–race–sex categories and adjust for age. Although testing the main effects and interactions for the class, race, and sex would provide a more quantitatively driven response on whether the ordering of the constructs is appropriate, they are avoided because the dependent variables are binary (where testing interactions is less facile). The analysis focuses on prevalence and log-likelihood to communicate the sensibility of placing class first, then race, and sex in the third position. Prevalence and likelihood for disability are presented in different tables as the first only identifies the frequency of disability by cross-sectional markers of stratification, while the latter focuses on assigning a risk factor (while controlling for age) to each of the CRS categories.

Results

Prevalence of Disability: Baby Boom

Table 1 indicates the prevalence of *self-care* disability ranges amongst those from the Baby Boom birth-cohort

Table 1 Population-weighted prevalence of self-care and ambulatory disability by birth-cohort

	Baby boom						
	Counts			Self-care		Ambulatory	
	Wgt[a]	unWgt[b]	PIR[c]	Wgt[d]	%[e]	Wgt[f]	%[g]
HE[h]-NLW[i] male	6,713,917	371,614	18	66,615	0.99	195,461	2.91
HE-NLW female	6,673,319	379,766	18	75,171	1.13	252,946	3.79
HE-MEX[j] male	129,892	6402	20	1906	1.47	5275	4.06
HE-MEX female	136,538	7100	19	1705	*1.25*	6719	4.92
HE-NLB[k] male	443,267	20,019	22	9465	2.14	29,217	6.59
HE-NLB female	684,909	32,698	21	15,378	2.25	57,440	8.39
LE[l]-NLW male	14,383,029	811,896	18	524,334	3.65	1533,594	10.66
LE-NLW female	15,020,955	862,847	17	555,857	3.70	1,756,208	11.69
LE-MEX male	917,606	43,283	21	37,608	4.10	101,696	*11.08*
LE-MEX female	945,614	45,590	21	41,324	4.37	121,731	12.87
LE-NLB male	2,565,472	118,840	22	144,867	5.65	421,617	16.43
LE-NLB female	2,837,860	135,232	21	187,929	6.62	574,665	20.25
	Generation X						
	Counts			Self-care		Ambulatory	
	Wgt	unWgt	PIR	Wgt	%	Wgt	%
HE-NLW male	5,791,487	281,044	21	16,923	0.29	36,596	0.63
HE-NLW female	6,847,176	346,781	20	21,492	0.31	49,690	0.73
HE-MEX male	245,724	10,456	24	1417	0.58	2749	1.12
HE-MEX female	342,812	15,517	22	1038	*0.30*	3297	*0.96*
HE-NLB male	506,904	17,948	28	2398	*0.47*	6006	1.18
HE-NLB female	847,565	33,129	26	4700	*0.55*	12,220	1.44
LE-NLW male	11,427,484	540,639	21	168,751	1.48	378,580	3.31
LE-NLW female	10,105,524	485,607	21	165,241	1.64	411,769	4.07
LE-MEX male	1,815,418	71,104	26	22,581	*1.24*	50,015	*2.76*
LE-MEX female	1,681,573	66,515	25	20,035	*1.19*	42,393	*2.52*
LE-NLB male	2,755,685	107,142	26	53,058	1.93	124,612	4.52
LE-NLB female	2,820,250	103,459	27	51,907	1.84	135,074	4.79

Italics indicate where disability prevalence deviates from the predictions by the CRS hypothesis

[a] Population-weighted counts

[b] Unweighted counts

[c] Person inflation ration = (Wgt ÷ unWgt)

[d] Population-weighted count of people with self-care difficulties

[e] Percent = (Self-CareWgt ÷ Wgt)

[f] Population-weighted count of people with ambulatory difficulties

[g] Percent = (AmbulatoryWgt ÷ Wgt)

[h] High-education

[i] Non-Latino white

[j] Mexican-origin Latino

[k] Non-Latino blacks

[l] Low education

range from 0.99 to 6.62 %. As predicted by the CSR hypothesis, self-care disability is lowest amongst high-education males from the race-majority group (i.e. HE-NLW males) and highest amongst low-education females from the race-minority group (i.e. LE-NLB females). As predicted by the CRS hypothesis, prevalence of self-care disability in those from the Baby Boom birth-cohort follows a clear gradient: where low-education, minority-race,

and female disadvantage compound to increase prevalence of self-care disability. Table 1 shows the prevalence of *ambulatory* disability ranges amongst those from the Baby Boom birth-cohort range from 2.91 to 20.25 %. As predicted by the CSR hypothesis, ambulatory disability is lowest amongst HE-NLW males and highest amongst LE-NLB females. As with self-care disability and as predicted by the CRS hypothesis, prevalence of ambulatory disability in those from the Baby Boom birth-cohort has a clear gradient: low-education, minority-race, and female disadvantage compound to increase prevalence of ambulatory disability. Deviations from the CRS hypothesis are utilized in Table 1. Amongst Baby Boomers, HE-MEX female had a lower (1.25 %) prevalence of self-care disability than HE-MEX males (1.47 %) and LE-MEX male had a lower (11.08 %) prevalence of ambulatory disability than LE-NLW females.

Prevalence of Disability: Generation X

Table 1 indicates the prevalence of *self-care* disability ranges amongst those from the Generation-X birth-cohort range from 0.29 to 1.84 %. For the most part and as predicted by the CSR hypothesis, self-care disability is lowest amongst high-education males from the race-majority group (i.e. HE-NLW males) and highest amongst low-education females from the race-minority group (i.e. LE-NLB females). As predicted by the CRS hypothesis, prevalence of self-care disability in those from the Generation-X birth-cohort follows a clear gradient: where low-education, minority-race, and female disadvantage compound to increase prevalence of self-care disability.

There are several deviations from the CRS hypothesis amongst the Generation-X birth-cohort. The most notable exception is found amongst the low-education group: where the predicted *minority-race disadvantage* is not present for Mexican-origin Latinos. The CRS hypothesis incorrectly predicted that MEXs of low-education would have higher self-care disability prevalence than NLWs. This suggests that amongst those from the Generation-X birth-cohort, within the low-education group, and specifically for Mexican-origin Latinos, the "race-minority disadvantage" is *not* present.

Table 1 shows the prevalence of *ambulatory* disability ranges amongst those from the Generation-X birth-cohort range from 0.63 to 4.79 %. For the most part and as predicted by the CSR hypothesis, ambulatory disability is lowest amongst HE-NLW males and highest amongst LE-NLB females. As with self-care disability and as predicted by the CRS hypothesis, prevalence of ambulatory disability in those from the Generation-X birth-cohort has a clear gradient: low-education, minority-race, and female disadvantage compound to increase prevalence of ambulatory disability.

As with self-care disability, the most notable exception is again found amongst the low-education group: where the predicted *minority-race disadvantage* is not present amongst Mexican-origin Latinos. The CRS hypothesis incorrectly predicted that MEXs of low-education would have higher ambulatory disability prevalence than NLWs. This suggests that amongst those from the Generation-X birth-cohort, within the low-education group, and specifically for Mexican-origin Latinos, the "race-minority disadvantage" is *not* present.

Likelihood of Disability: Baby Boom

Table 2 presents the results for Model-1: multivariable logistic regression predicting the likelihood of having self-care difficulty for those in the Baby Boom birth-cohort. There are a few deviations (italicized in Table 2) from what would have been expected from the CRS hypothesis. For the most part and as predicted by the CSR hypothesis, risk of self-care disability is lowest amongst HE-NLW males and highest amongst LE-NLB females. That is, low-education, minority-race, and female disadvantage compound to increase the risk of self-care disability. One exception (i.e. not predicted by CRS hypothesis) is that HE-MEX females have a lower (OR = 1.35) risk of self-care disability than HE-MEX males (OR = 1.52).

Model-2, predicting the likelihood of having ambulatory difficulty for those in the Baby Boom birth-cohort, consistently shows that—as predicted by the CSR hypothesis—risk of ambulatory disability is lowest amongst HE-NLW males and highest amongst LE-NLB females: i.e. low-education, minority-race, and female disadvantage compound to create the *class–race–sex–disability gradient* as risk of ambulatory disability increases with each element. All coefficients in Model-1 and Model-2 are statistically significant at the 0.01 level or lower. Although not shown here, analysis was conducted using different thresholds to identity "high education" and similar results were found. Instead of using the "bachelor's degree" threshold presented in the current analysis, the following were used in the exploratory analysis: high school graduate; some college, but <1 year; and 1 or more years of college credit, no degree.

Likelihood of Disability: Generation X

Table 2 also gives results for Model-3: logistic regression predicting the likelihood of having self-care difficulty for those in the Generation-X birth-cohort. Note that all the models adjust for age. All coefficients in Model-3 and Model-4, except for HE-NLW female and HE-MEX female, are statistically significant at the 0.01 level or lower. Model-3 shows that for the most part and as

Table 2 Logistic models predicting likelihood of disability by birth-cohort

	Baby boom					
	Model-1 self-care			Model-2 ambulatory		
	OR[b]	LCL[c]	UCL[d]	OR	LCL	UCL
HE[e]-NLW[f] male	1.00	ref	ref	1.00	ref	ref
HE-NLW female	1.16	1.11	1.22	1.36	1.33	1.40
HE-MEX[g] male	1.52	1.23	1.87	1.57	1.38	1.77
HE-MEX female	*1.35*	*1.09*	*1.67*	1.89	1.69	2.11
HE-NLB[h] male	2.45	2.22	2.70	2.65	2.50	2.81
HE-NLB female	2.57	2.37	2.78	3.41	3.27	3.56
LE[i]-NLW male	4.07	3.93	4.22	4.24	4.16	4.33
LE-NLW female	*4.02*	*3.89*	*4.17*	4.63	4.54	4.73
LE-MEX male	4.80	4.53	5.08	4.89	4.72	5.06
LE-MEX female	5.04	4.77	5.33	5.62	5.44	5.82
LE-NLB male	7.09	6.81	7.39	7.78	7.59	7.98
LE-NLB female	8.14	7.83	8.46	10.01	9.78	10.25
	Generation X					
	Model-3 self-care			Model-4 ambulatory		
	OR	LCL	UCL	OR	LCL	UCL
HE-NLW male	1.00	ref	ref	1.00	ref	ref
HE-NLW female	1.03[a]	0.94	1.13	1.14	1.07	1.22
HE-MEX male	1.54	1.14	2.08	1.72	1.41	2.11
HE-MEX female	1.12[a]	0.84	1.50	*1.61*	*1.35*	*1.92*
HE-NLB male	2.00	1.63	2.46	2.29	1.99	2.62
HE-NLB female	*1.93*	*1.64*	*2.27*	*2.59*	*2.34*	*2.87*
LE-NLW male	5.46	5.08	5.87	5.79	5.51	6.10
LE-NLW female	5.88	5.47	6.32	7.07	6.71	7.43
LE-MEX male	*4.96*	*4.51*	*5.45*	*5.45*	*5.10*	*5.82*
LE-MEX female	*4.69*	*4.26*	*5.17*	*5.01*	*4.68*	*5.36*
LE-NLB male	8.07	7.45	8.75	9.17	8.67	9.70
LE-NLB female	7.72	7.12	8.37	10.00	9.46	10.58

All four models adjust for age

[a] Only coefficients not statistically significant; all others have an $\alpha \leq 0.01$

[b] Odds ratio

[c] Lower 95 % Wald confidence limit

[d] Upper 95 % Wald confidence limit

[e] High-education

[f] Non-Latino white

[g] Mexican-origin white

[h] Non-Latino black

[i] Low education

predicted by the CSR hypothesis, risk of self-care disability is lowest amongst HE-NLW males and highest amongst LE-NLB females. That is, low-education, minority-race, and female disadvantage compound to increase the risk of self-care disability.

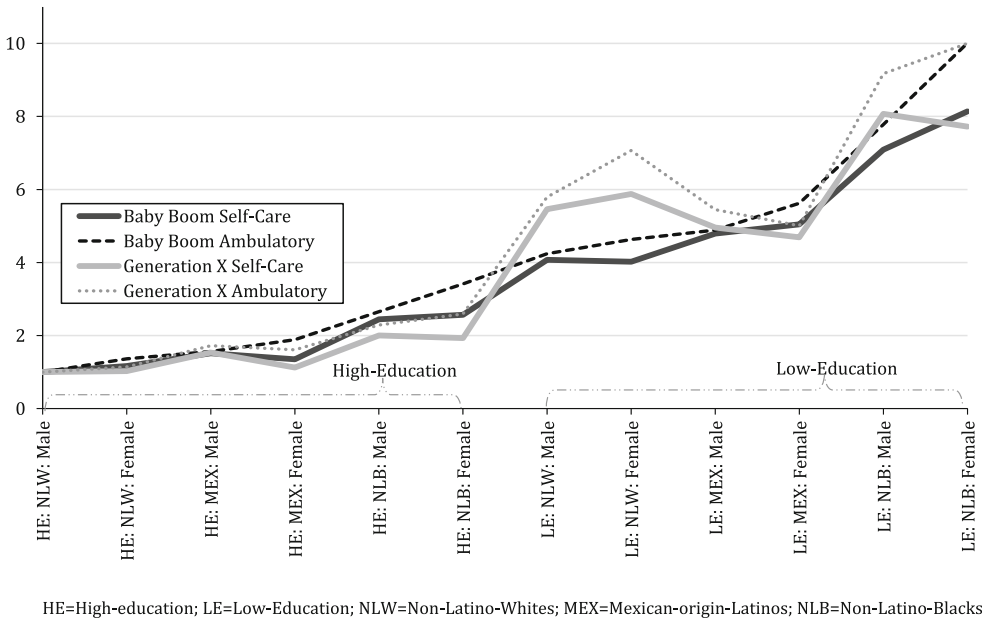
One exception (i.e. not predicted by CRS hypothesis) is that HE-NLB females have a lower (OR = 1.93) risk of self-care disability than HE-NLB males (OR = 2.00). Model-4, predicting the likelihood of having ambulatory difficulty for those in the Generation-X birth-cohort, for the most part indicates that—as predicted by the CSR hypothesis—risk of ambulatory disability is lowest amongst HE-NLW males and highest amongst LE-NLB females: i.e. low-education, minority-race, and female disadvantage compound to create the *class–race–sex–disability gradient* as risk of ambulatory disability increases with each element. The most notable exception in modelling ambulatory disability amongst those from Generation X is found amongst the low-education group: where the predicted *minority-race disadvantage* is not present amongst Mexican-origin Latinos—they exhibit lower risk of disability than their low-education NLW counterparts. As in the previous section, analysis (not shown) was conducted using different thresholds (high school graduate; some college, but <1 year; and 1 or more years of college credit, no degree) to identity "high-education" and similar results were found.

Class–Race–Sex–Disability Gradient

Figure 2 graphs the odds ratios from Models 1 through 4 (presented in Table 2). As the graph suggests, in general, there is a notable gradient in how risk of self-care and ambulatory disability becomes distributed by class, race, and sex. The education–race–sex–disability gradient predicted by the CRS hypothesis is most constant amongst those from the Baby Boom birth-cohort. The absence of the minority-race disadvantage predicted by the CSR hypothesis for low-education Mexican-origin Latinos is absent in the Generation-X birth-cohort. As identified in the graph, this is the most notable exception to CSR hypothesis. The risk of self-care and ambulatory disability, for the most part, has the granular scale predicted by the CRS hypothesis. The CRS hypothesis was challenged because a lower risk in low-education MEX males was found than in low-education NLW males, which contradicts CRS hypothesis, and because a lower risk in low-education MEX females was found than in low-education NLW females.

Conclusions

The basic idea in the CRS hypothesis—that a low-education, minority-race, and female disadvantage affect disability prevalence and risk—finds support. Except for the results for Mexican-origin Latinos—where an unexpected "female advantage" was observed—all of the results were predicted by CSR hypothesis and in-line with previous



HE=High-education; LE=Low-Education; NLW=Non-Latino-Whites; MEX=Mexican-origin-Latinos; NLB=Non-Latino-Blacks

Fig. 2 Odds ratios for risk of self-care and ambulatory disability by education–race–sex group and birth-cohort. *HE* high education, *LE* low education, *NLW* non-Latino whites, *MEX* Mexican-origin-Latinos, *NLB* non-Latino blacks

research. In addition, a constant exception is found for those in the Generation-X birth-cohort, within the low-education group, and specifically for Mexican-origin Latinos (MEXs): they do *not* have the minority-race disadvantage predicted by the CRS hypothesis. Thus, the CRS hypothesis could be modified to place low-education Mexican-origin Latinos over low-education non-Latino whites.

Although speculative, the fact that the CRS hypothesis was more applicable for Baby Boomer than for Generation-Xers may be partially explained by the fact that Mexican-origin Latinos may differ significantly between the two birth-cohorts. For example, the Generation-X birth-cohort may have a relatively larger number of third- and fourth-generation Mexican-origin Latinos with low-educational attainment than the Baby Boom group. More technically, the Mexican Paradox may be more pronounced in Generation-Xers because of the potentially wider intergroup heterogeneity amongst Mexican-origin Latinos. Deviations from the CRS hypothesis were slightly more frequent with self-care disability. This may be the case because reporting about perceived ability to dress and bathe may be at greater risk of measurement error than reports on ability to walk and climb steps.

Deviations from CRS hypothesis could be explained by methodological issues. It may be that Mexican-origin Latinos underreport their ability to perform bathing, dressing, walking, and step climbing abilities, while NLBs overreport their inability when compared to NLWs. It may also be that rather deviations from the CRS hypothesis were observed not because of methodological issues with measurement, but because assumptions about resource differentials by class, race, and sex are wrong. For example, it may be that low-education Mexican-origin Latinos are most frequently involved with occupations that require physical fitness than low-education NLWs. If so, the occupational need to stay physically fit may extend a benefit for disability during middle- and late-age stages. Future research should seek to explore whether deviations from the CRS hypothesis are primarily a product of measurement limitations or true events. It may be that a more complex relationship exists between class, race, sex, and disability that posited by the CRS hypothesis.

Finding that amongst Generation-Xers, low-education Mexican-origin Latinos had a lower risk of disability than NLWs contributes to expanding current understanding of the "Mexican Paradox" (Castro 2013)—the fact that Mexican-origin Latinos in the USS exhibit better health than majority-race counterparts. Findings suggest that in general and for individuals in the Baby Boom and Generation-X birth-cohorts, disability prevalence and risk cluster first by class, then race, and finally sex.

During the introduction, the CRS gradient was presented as an "additive" model—where three factors sum to explain risk of disability. The deviations from the CRS hypothesis (e.g. Mexican and female advantage) suggest that risk of disability may be also explained by a "multiplicative" model—where interactions between factors are significant. The study adds to current knowledge on social determinants of disability by showing that risk of self-care and ambulatory disability is most highly concentrated in non-Latino black females with a low education. Although the investigation clearly shows that markers of social stratification help explain between-group differences in

prevalence and risk of disability, future work should continue to explore how social stratification processes get under the skin. For example, work could use testing the CRS hypothesis while accounting for measures of the environment—where things like systemic discrimination in health care services could affect physical well-being (Feagin and Bennefield 2014).

There are some limitations with the current study. For example, disability is measured by self-report. Issues with subjective measures of disability are discussed elsewhere (Siordia 2014d; Chandola and Jenkinson 2000). In addition, the cross-sectional approach does not allow us to investigate whether the presences of differences in disability prevalence by educational attainment at midlife are the product of "health on class" or *class on health*—the discussion assumes the latter is more likely to be the case. The bidirectional association between social stratification and disability (Trani and Loeb 2012) could be argued which is most frequently initiated by socioeconomic disadvantaged. In general, it may be that class disadvantage precedes the presentation and severity of disability (Lusting and Strauser 2007). This investigation only provides cross-sectional evidence that prevalence and risk of disability are most concentrated in those at lower strata of society.

Future studies should continue to explore the causal relationship between social disadvantage and disability as evidence of a gradient between disability and socioeconomic status persists (Pandey 2012; Adler and Ostrove 1999). It should also be noted that the data source did not allow for the models to include important measures: such as comorbidity, body mass index, or more sophisticated measures of social status. Researchers should investigate the CRS hypothesis with more health-detailed data sources and test alternate thresholds in educational attainment (Ryan and Siebens 2012).

The intersectionality approach (Mason 2013; Anthias 2013; Siordia 2014c) used in this study should be considered in public health research. The results suggest that *intersectional* markers of social stratification are predictive of prevalence and risk of self-care and ambulatory disability as predicted by the CRS hypothesis. In particular, intersectional markers provide better insight on how differences in disability prevalence between individuals at the top and bottom strata of society are products of non-random processes. Including markers of social process could lead to a better understanding of the pathophysiology of disability. As such, ageing studies should consider using intersectional markers of social stratification when modelling disability prevalence and risk.

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