



Disparities in food insecurity at the intersection of race and sexual orientation: A population-based study of adult women in the United States

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ABSTRACT

Food insecurity affects 1 in 8 American adults annually, and is more prevalent in Black and sexual minority women. We applied an intersectional approach to investigate food insecurity prevalence in women with intersecting minority race and sexual orientation. We used two United States surveillance systems—National Health Interview Survey (NHIS) 2013–2018 and National Health and Nutrition Examination Survey (NHANES) 2005–2014, to estimate how race and sexual orientation jointly influence food insecurity prevalence in women aged 18–59 years (NHIS: N = 47596; NHANES: N = 5106). All analyses were stratified for Supplemental Nutrition Assistance Program (SNAP) use. Relative measures estimated weighted prevalence ratios (PR) comparing Black and White sexual minority women (SMW) to heterosexual White women. Absolute prevalence measures estimated the excess prevalence of food insecurity due to multiple marginalization. Patterns of food insecurity prevalence were similar across NHIS and NHANES, and differed only for non-SNAP users. Relative prevalence of food insecurity was greater in Black SMW than heterosexual White women in NHIS (PR: 2.16; 95% confidence interval [CI], 1.41–3.30) and NHANES (PR: 2.79; 95% CI, 1.73–4.51). The strength of the association between multiple marginalization and food insecurity was stronger for Black SMW than White SMW. Absolute measures were significant only for NHIS and did not support our a priori hypothesis: For non-SNAP users, being Black and sexual minority reduced the joint disparity in food insecurity by approximately 50% (Synergy Index: 0.52; 95% CI, 0.11–0.93). Overall, our study illuminated population-level differences in food insecurity among women of diverse minority races and sexual orientations. Black SMW experienced high rates of food insecurity, which may contribute to chronic disease disparities. Yet, intersecting minority social positions (race and sexual orientation) reduced food insecurity; these findings are unexpected and must be further investigated. Increasing SNAP use among multiply marginalized women may attenuate food insecurity disparities.

Introduction

Food insecurity—or the “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways” (Anderson, 1990)—is an understudied social determinant of health that disproportionately affects vulnerable low income and minority adults. In 2018, over 37 million (11.5%) of Americans experienced food insecurity (Coleman-Jensen et al., 2019a). Of these, two-thirds (24.6 million)

experienced disruptions in the quality, quantity, and desirability of food available to them (Coleman-Jensen et al., 2019a). Alarming, the remaining 12.7 million people were severely food insecure such that household members experienced disrupted eating patterns and reduced food intake due to lack of money and other resources (Coleman-Jensen et al., 2019a). Nutritional insufficiency associated with food insecurity takes a substantial toll on health: Food insecure adults are more likely to experience obesity and related chronic diseases—including cancer, chronic obstructive pulmonary disease, coronary heart disease, diabetes,

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and stroke than their food secure counterparts (Gregory & Coleman-Jensen, 2017; Gundersen & Ziliak, 2015). Food insecure adults also self-report more chronic conditions and poorer health (Gregory & Coleman-Jensen, 2017). Consequently, addressing food insecurity is key to decreasing morbidity and premature mortality for millions of American adults.

Historically, public health has investigated food insecurity from a unitary perspective that emphasizes single social positions (e.g., race, sexual orientation) that reflect social systems of inequity and oppression (e.g., racism, heterosexism), and their individual relationship with food insecurity. However, unitary perspectives are insufficient for addressing and understanding food insecurity for people who have multiple, intersecting, marginalized, individual level, social positions (e.g., Black and lesbian) that uniquely position them within complicated systems of interlocking oppression (Bowleg, 2012; Bowleg et al., 2003). For example, evidence concerning food insecurity disparities in sexual minority people unitarily emphasizes how sexual orientation positions sexual minority women (i.e., lesbian and bisexual women; SMW) at risk for food insecurity. Yet, SMW are not a monolithic group, but rather comprised of diverse individuals with intersecting, races and sexual orientations. Unitary perspectives are inadequate for addressing these complexities.

Intersectionality is a theoretical framework borne from the knowledge that Black women experience intersecting social categories that are linked with discrimination and exclusion, as both Black people and as women, that position them socially to experience the deleterious effects of racism and sexism; also named, multiple marginalization (Collins, 2004; Crenshaw, 1989; Hooks, 1981). Intersectionality is a conceptual framework for acknowledging the complexities experienced by people who occupy multiple social positions, and for underscoring that groups are not monolithic in nature. It is also used as a guide for public health investigations and addresses the possible health effects of holding multiple intersecting sociodemographic categories—such as sexual orientation, race, and gender—on health and health disparities, including food insecurity. No published, population-level, epidemiologic studies have applied an intersectional perspective to investigate patterns and prevalence of food insecurity experienced by women with intersecting minority social positions (i.e., race and sexual orientation). We aimed to address this gap.

Empirical evidence, from a unitary perspective, hints at the value of an intersectional perspective for advancing understanding about food insecurity among Black SMW. Food insecurity is more prevalent in racial and ethnic minority populations, including non-Hispanic Black adults (Nam et al., 2015). In 2018, 21.2% of non-Hispanic Black households were food insecure and 9.1% were severely food insecure (vs. 8.1% and 3.1% of non-Hispanic White households, respectively) (Coleman-Jensen et al., 2019a). Despite evidence that food insecurity may be decreasing for many in the general population, there remains a persistent racial disparity where 14.2% more Black households than White households, continue to experience food insecurity (McDonough et al., 2019). Theoretically, within non-Hispanic Black communities, women may experience excess risk for food insecurity arising from oppression due to their intersecting minority race and gender. For example, Black women experience greater rates of poverty than Black men and all other racial groups (DuMonthier et al., 2017). Black women make up the highest labor force participation among women, yet their earnings lag behind other racial and ethnic groups, and 28% of working Black women are employed in service occupations, among the lowest paid positions in the United States (US) (DuMonthier et al., 2017). Compromised economic resources are a leading cause of food insecurity, and may increase Black women's susceptibility to disruption in food security. The United States Department of Agriculture's (USDA) Census-based estimates of food insecurity do not examine food insecurity prevalence at the intersection of race and gender (Coleman-Jensen et al., 2019a, 2019b); however, regional and qualitative evidence indicates that food insecurity is a pressing issue for Black women (Mason, 2015; Zekeri et al., 2016).

There is also preliminary evidence from a unitary perspective of food insecurity in sexual minority populations. Twenty-five percent of sexual minority adults (approximately 2.2 million people) report past-30 day food insecurity (vs. 17% of heterosexual adults) (Brown et al., 2016). Sexual minority populations do not all share the same degree of risk for food insecurity; compared to 22% of sexual minority men, 31% of SMW reported not having enough money to buy food in the past year (Brown et al., 2016). In our previous work, we also found evidence of disparities in food insecurity by sexual orientation: Compared to exclusively heterosexual women, lesbian, bisexual, and heterosexual women reporting same sex behavior (heterosexual WSW) were 34–52% more likely to report food insecurity in the past 12 months, and 50–84% more likely to report severe food insecurity (Patterson et al., 2020).

Strategies for alleviating food insecurity

A common strategy used to alleviate food insecurity is the Federal Supplemental Nutrition Assistance Program (formerly referred to as “food stamps”; SNAP). SNAP is a means-tested program that provides food assistance distributed by state agencies to participating low- and no-income households (United States Department of Agriculture, 2019). In 2017, approximately 13% of the population (42.2 million people) received SNAP benefits (Coleman-Jensen et al., 2018). Population-based studies suggest that low income Black adults are more likely to participate in SNAP (Chang et al., 2017; Purtell et al., 2012).

From the limited evidence available, population-based studies using unitary approaches indicate that sexual minority adults are 1.33–1.73 times more likely than heterosexual adults to receive federal food assistance (Brown et al., 2016; Gates, 2014). Among SMW, SNAP participation is not equally distributed. Descriptive evidence suggests that more bisexual women participate in SNAP (28–34%) than heterosexual women (18–24%), but no differences are observed for lesbians (19–32%) (Brown et al., 2016; Gates, 2014). In our prior work, we evidenced no differences in multivariable analyses of SNAP participation for lesbian, bisexual, or heterosexual WSW compared to exclusively heterosexual women (Patterson et al., 2020).

Multiple studies indicate that receiving SNAP benefits reduces food insecurity by 20–35% (Deb & Gregory, 2018; Ratcliffe et al., 2011; Swann, 2017). Consequently, SNAP use may also attenuate the effect of multiple marginalization on food insecurity. To address this question, studies investigating food insecurity prevalence in multiply marginalized populations must also take SNAP use into account.

Understanding food insecurity among women of diverse races and sexual orientations requires an intersectional approach. Only an intersectional approach will facilitate understanding the unique ways that racism and heterosexism (i.e., multiple marginalization) play out at the individual level in the context of food security for Black and White women of diverse sexual orientations. Food insecurity prevalence is estimated from a variety of sources in the US; however, few data sources ask questions about sexual orientation (Patterson et al., 2017) and food insecurity (Lee, 2013). Two national surveillance programs that employ comprehensive measures of food insecurity (Bickel et al., 2000) and also measure minority sexual orientation are the National Health Interview Survey (NHIS) and National Health and Nutrition Examination Survey (NHANES). Both the NHIS and NHANES are conducted by the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention (CDC). While both surveys use common questions from the USDA US Food Security Survey Module (Keenan et al., 2001) to measure food insecurity, the NHIS measures experiences of food insecurity over the past 30 days (NCHS, 2020) whereas NHANES measures food insecurity within the past 12-months (NCHS, 2015). While not directly comparable, together these surveys can provide a more comprehensive picture of food insecurity among multiply marginalized populations.

The purpose of this study was to investigate how multiple marginalization influences food insecurity in national probability sample of US

women. For the purposes of this study, women's minority race and/or sexual orientation (i.e., Black and/or lesbian or bisexual) represented their unique social positions that confer risk for experiencing racism and/or heterosexism/homophobia. In attributing disparities to race, we mean historical and contemporary racism and White supremacy in the US, including structural oppression (e.g., historical slavery, segregation, Jim Crow, contemporary employment and housing discrimination, mass incarceration) and a culture of violence that systematically disadvantages Black women (Bartels, 2006; Solomon et al., 2019a, 2019b). In attributing disparities to sexual orientation, we mean historical and contemporary heterosexism and homophobia in the US, including oppressive policies (historical sodomy laws, Don't Ask Don't Tell, civil marriage bans, religious freedom laws, employment and housing discrimination) and a culture of violence that systematically disadvantages sexual minorities (Center for American Progress, 2014; DeFilippis, 2016; Eaklor, 2011; Thoreson, 2018). By attributing disparities to the joint effects of multiple marginalization, we mean the ways in which racism differently affects Black heterosexual and SMW, and how heterosexism/homophobia differently affects Black versus White SMW.

We conducted intersectional analyses to investigate how women's race and sexual orientation (i.e., multiple marginalization) independently and jointly influence food insecurity. Specifically, we used both relative and absolute measures to quantify (1) *population-level prevalence* of food insecurity, (2) the *relative prevalence* of food insecurity in Black and White SMW (vs. White heterosexual women), and (3) the *excess prevalence* of food insecurity due to the joint effects of multiple marginalization (i.e., risk arising from the intersection of experiencing racism and heterosexism/homophobia). We hypothesized that (1) population-level prevalence of food insecurity would be highest in Black SMW; (2) given the documented protective effects of SNAP, among women who did not receive SNAP, the prevalence of food insecurity would be relatively higher in Black and White SMW than White heterosexual women; and (3) multiple marginalization would result in excess disparity in food insecurity.

Methods

This study was a secondary analysis of de-identified publicly available data and did not require human subjects review.

Survey descriptions

National Health Interview Survey (NHIS) is a national, probability, repeated cross-sectional survey of US households that assesses basic health and demographic information for all household members; additional information, such as sexual orientation, is collected on 1 randomly selected adult (\geq age 18). NHIS first began collecting sexual orientation information in 2013. Detailed information about the NHIS study design and sampling frame is described elsewhere (NCHS, 2020). NHIS distributes surveys in annual cycles. We pooled NHIS data from 6 survey cycles (2013–2018).

National Health and Nutrition Examination Survey (NHANES) is a national probability, repeated cross-sectional survey of US adults and children \geq 12 years old that assesses health and nutrition status using interviews and medical examinations. Detailed information about NHANES study design and sampling frame is described elsewhere (Johnson et al., 2014). NHANES distributes surveys in 2-year cycles. We pooled 5 cycles of NHANES data from 2005 to 2014.

Sample

While NHIS asks sexual orientation questions of adults \geq age 18 years old, in NHANES women \geq 60 years old are not asked sexual orientation questions. Consequently, we restricted our sample for both NHIS and NHANES to non-Hispanic Black and non-Hispanic White women aged 18–59 years who answered sexual orientation, food

security, and tobacco questions (see Fig. 1). The final analytic sample sizes were $N = 47,596$ (NHIS) and $N = 5106$ (NHANES).

Measures

Both NHIS and NHANES measure food security using the USDA US Food Security Survey Module ($\alpha = 0.74\text{--}0.93$) (Keenan et al., 2001). The survey module asks adults to report their experiences with food security using a scale of 0–10. Levels of food security are designed as “full food security” (0 points), “marginal food security” (1–2 points), “low food security” (3–5 points), and “very low food security” (6–10 points) (Keenan et al., 2001). NHIS measured household food security during the last 30 days (NCHS, 2020). NHANES measured household food security during the last 12 months (NCHS, 2015). The original items were recoded as a binary variable, such that respondents were considered food insecure if their scores ≥ 3 items and food secure if their scores ≤ 2 . Respondents affirming that they or another household member received food stamp/SNAP benefits in the past 12-months were coded as receiving food stamps/SNAP benefits versus those who did not receive past 12-month food stamp/SNAP benefits.

Sexual orientation is a multidimensional construct comprising a person's sexual identity, attraction, and behavior (Badgett, 2009), yet most national health surveillance programs measure sexual orientation by identity, or with a combination of sexual identity and behavior items (Patterson et al., 2017). NHIS measures sexual orientation by sexual identity only, whereas NHANES includes measures of sexual identity and sexual behavior. To facilitate stronger comparisons in our sample, we operationalized sexual orientation by sexual identity only. In NHIS, women were asked, “Which of the following best represents how you think of yourself? Lesbian or gay; straight, that is not lesbian or gay; bisexual; something else; I don't know the answer”. In NHANES, women were asked “Do you think of yourself as heterosexual or straight (i.e., sexually attracted only to men); homosexual or gay (i.e., sexually attracted only to women); bisexual (i.e., sexually attracted to men and women); something else?” Women responding as lesbian or gay (NHIS) or homosexual or gay (NHANES), or bisexual (NHIS/NHANES) were defined as sexual minority.

We selected covariates a priori as potential confounders based on theoretical and empirical evidence. Covariates included age, educational attainment, health insurance coverage, and current smoking, which are all associated with food insecurity and known disparities in SMW (Ciciurkaite & Brown, 2018; Institute of Medicine Committee on Lesbian Health, 2011; Kim-Mozeleski et al., 2018). We defined women as being current smokers if they reported smoking at least 100 cigarettes in their lifetime and currently smoking cigarettes either “every day” or “some days” (US Department of Health and Human Services, 2014). All covariates, excluding education level, are presented in Table 1 in categories retained for multivariable analyses. For multivariable analyses, education was dichotomized as \leq high school/GED and $>$ high school/GED. We included survey year as a covariate to account for unmeasured cohort effects.

Statistical analysis

We analyzed data from the NHIS and NHANES separately per guidelines (Johnson et al., 2013; NCHS, 2018, 2020) using the *survey* package in R (Lumley, 2004; R Core Team, 2019) to account for each surveillance system's complex, multistage, probability sampling design. Sampling weights were adjusted to reflect the numbers of years pooled and stratum indicators were specified when the pooled data fell into distinct sampling periods. Because not all survey respondents were considered, we used a subgroup identifier for women aged 18–59 years old who responded to sexual orientation questions in order to attain correct standard errors. Per NCHS recommendations, variances estimations were calculated using Taylor series linearization (Johnson et al., 2013; NCHS, 2018, 2020).

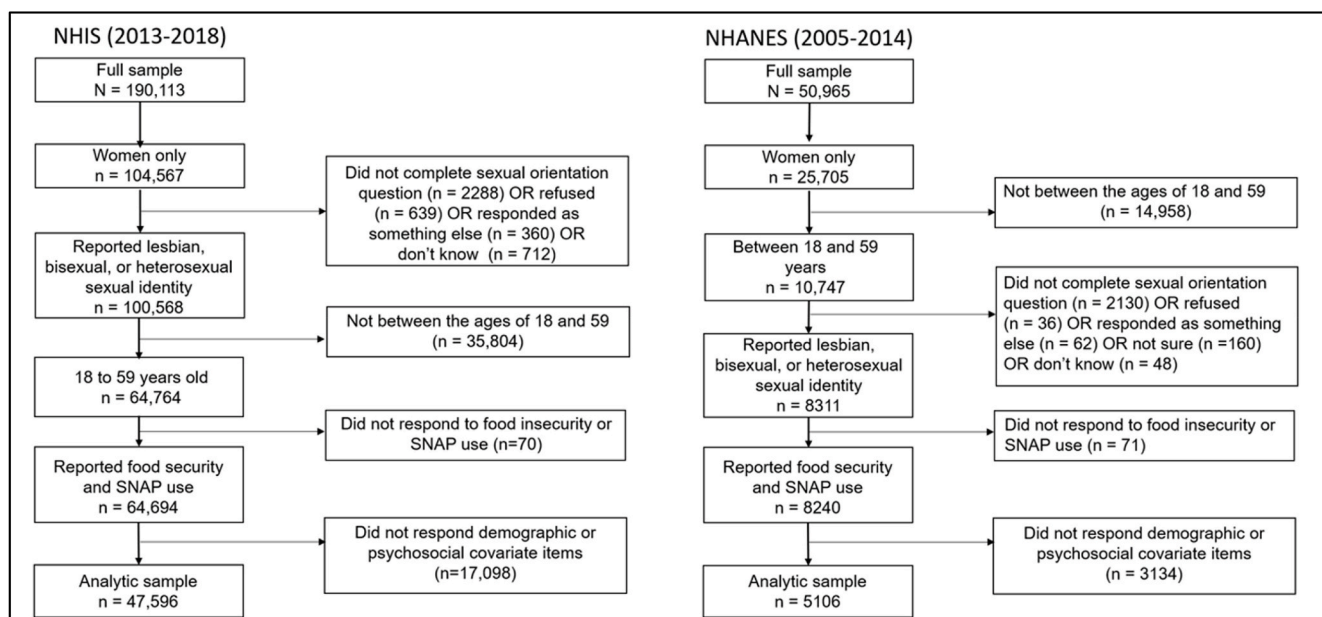


Fig. 1. Flowchart of exclusions for deriving the analytic samples_NHIS 2013–2018 and NHANES 2005–2014.

Table 1

Sample characteristics in women (18–59) by self-reported race and sexual orientation: NHIS 2013–2018 and NHANES 2005–2014.

	NHIS 2013–2018						NHANES 2004–2014					
	Black (n = 9509)			White (n = 38087)			Black (n = 1702)			White (n = 3404)		
	Heterosexual	Sexual Minority	P	Heterosexual	Sexual Minority	P	Heterosexual	Sexual Minority	P	Heterosexual	Sexual Minority	P
	Weighted % (unweighted N)			Weighted % (unweighted N)			Weighted % (unweighted N)			Weighted % (unweighted N)		
Sexual orientation	96.43 (9174)	3.57 (335)		96.26 (36608)	3.74 (1479)		93.03 (1586)	6.97 (116)		94.48 (3199)	5.52 (205)	
Age			<.001			<.001			<.001			<.001
18–25	20.15 (1374)	37.94 (103)		17.00 (5034)	27.58 (344)		16.42 (263)	30.79 (35)		13.12 (458)	31.32 (64)	
26–35	25.14 (2444)	30.22 (114)		22.66 (8725)	29.42 (444)		23.67 (355)	36.00 (42)		21.05 (776)	23.18 (55)	
36–45	22.95 (2090)	19.08 (63)		22.27 (8368)	16.98 (279)		25.87 (392)	17.97 (20)		25.61 (842)	24.90 (50)	
46–59	31.76 (3266)	12.76 (55)		38.07 (14481)	26.02 (412)		34.04 (576)	15.24 (19)		40.22 (1123)	20.61 (36)	
Educational Level			0.012			0.827			0.005			0.033
≤ High school	37.73 (3616)	44.52 (148)		25.99 (9217)	25.42 (345)		37.54 (600)	42.21 (50)		28.76 (1058)	37.06 (86)	
Some college/AA	38.21 (3500)	40.21 (138)		34.24 (12879)	35.20 (512)		41.21 (648)	46.41 (54)		35.02 (1132)	35.86 (74)	
≥ College graduate	24.06 (2058)	15.28 (49)		39.77 (14512)	39.38 (622)		21.25 (338)	11.39 (12)		36.22 (1009)	27.08 (45)	
Insurance Type			0.006			<.001			0.007			<.001
None	13.61 (1329)	20.78 (69)		8.91 (3556)	12.99 (180)		22.32 (344)	37.23 (42)		13.90 (562)	28.18 (73)	
Private	54.70 (4687)	40.86 (129)		76.29 (27028)	68.40 (997)		51.04 (802)	35.76 (38)		37.70 (2068)	54.86 (90)	
Public	31.69 (3158)	38.36 (137)		14.80 (6024)	18.61 (302)		26.65 (440)	37.02 (36)		12.40 (569)	16.96 (42)	
Current Smoker	13.79 (1549)	24.71 (110)	<.001	18.63 (7377)	24.77 (401)	<.001	19.68 (311)	47.00 (54)	<.001	23.57 (907)	41.68 (102)	<.001
Food insecure*	20.07 (2053)	26.40 (97)	0.059	8.63 (3659)	16.12 (271)	<.001	21.66 (353)	38.07 (43)	0.009	9.85 (488)	24.16 (66)	<.001
Received SNAP	33.76 (3401)	46.24 (163)	0.001	11.40 (4712)	17.27 (269)	<.001	31.59 (512)	50.55 (59)	<.001	11.59 (589)	21.37 (63)	0.005

P = adjusted Wald p-value *NHIS and NHANES use the same United States Department of Agriculture Food Insecurity module questions, but different timeframes. NHIS measures past 30-day food insecurity and NHANES measures past 12-month food insecurity.

Summary statistics, including weighted proportions and unweighted number of observations, described the distribution of sociodemographic variables as well as the prevalence of food insecurity and receipt of SNAP across subgroups of multiply marginalized women. We assessed differences in prevalence of sociodemographic variables between sexual minority and heterosexual Black and White women. To estimate population-level prevalence of food insecurity, we estimated weighted prevalence of past 30-day (NHIS) and past 12-month (NHANES) food insecurity in subpopulations of Black and White heterosexual and SMW. We also estimated population-level prevalence of SNAP use. We used adjusted Wald test to estimate p-values for the differences.

We used multivariable Poisson regression models with robust error variance to estimate prevalence ratios (PR) with 95% confidence intervals (CI) to compare subgroups of White SMW, Black SMW, and Black heterosexual women to White heterosexual women. We estimated and presented the interaction between race and sexual orientation using a common reference category (Knol & VanderWeele, 2012).

To estimate absolute measures of food insecurity across the intersection of race and sexual orientation, we followed recommendations for estimating disparities at the intersection of multiple marginalization (Jackson et al., 2016; Knol et al., 2011). We present four measures quantifying the absolute and excess risk for experiencing food insecurity: the relative excess risk for interaction (RERI), attributable proportion (AP), synergy index (SI), and the ratio of observed to expected joint effects on the relative scale (RJE). RERI was computed by dividing the excess intersectional disparity by the mean outcome for the non-marginalized group. In contrast, AP was calculated by dividing the excess intersectional disparity by the mean outcome of the multiply marginalized, which provides an estimate for the multiply marginalized group due to interaction. For synergy index (SI), we computed the increase in the relative risk due to being multiply marginalized and divided this by the sum of the increase in the relative risks of each exposure being present in the absence of the other (VanderWeele & Knol, 2014). For RJE, we divided the observed relative risk for the multiply marginalized by the expected relative risk, which is the sum of the relative risks of each exposure being present in the absence of the other minus the relative risk associated with the absence of both exposures (Gebrekristos & Howe, 2015). Each of these measures allow us to examine for potential additive interactions; with the SI particularly helpful as it assesses the change in joint disparity comparing multiply marginalized groups with those who do not belong to either of the marginalized groups (Jackson et al., 2016). The RJE focuses on the change in joint risk (i.e., the absolute risk among the multiply marginalized group), but can be easier to interpret and understand (Gebrekristos & Howe, 2015). We present 95% CI for these measures using standard errors obtained using the delta method (VanderWeele & Knol, 2014). All analyses were conducted in R (version 3.6) (R Core Team, 2019).

Results

Characteristics of survey respondents are notably different across NHIS and NHANES (Table 1). The weighted percentage of SMW was smaller in NHIS (Black 3.57%; White 3.74%) than NHANES (Black 6.97% and White 5.52%). Regardless of race, SMW were younger in NHIS and NHANES. Fewer Black SMW reported graduating from college (NHIS: 15.28%, NHANES: 11.39%) than Black heterosexual women (NHIS: 24.06%; NHANES 21.25%). In both NHIS and NHANES, more Black and White SMW reported being uninsured or using public insurance than their heterosexual counterparts. Both Black and White SMW reported higher prevalence of current smoking than heterosexual Black and White women.

As measured in NHIS, prevalence of past-30 day food insecurity was significantly higher in White SMW (16.12%) than heterosexual White women (8.63%). All SMW reported greater past 12-month food insecurity (NHANES) than heterosexual women. Over a third of Black SMW

reported past 12-month food insecurity (38.07%) versus 21.66% of Black heterosexual women. Among White women, 24.16% of SMW reported past 12-month food insecurity versus 9.85% of White heterosexual women. In both NHIS and NHANES, prevalence of receiving SNAP was higher among SMW, regardless of race; up to 50.55% of Black SMW and 21.37% of White SMW reported receiving SNAP in the past 12-months.

Table 2 presents multivariable models estimating the prevalence ratio of food insecurity in multiply marginalized women, compared to White heterosexual women, stratified by receipt of SNAP. Among women who did not receive SNAP, all marginalized groups (Black SMW, Black heterosexual women, and White SMW) reported higher prevalence of food insecurity than heterosexual White women. These differences were most pronounced for Black women; Black SMW who did not receive SNAP reported past-30 day food insecurity (NHIS) and past 12-month food insecurity (NHANES) that were more than twice as high as White heterosexual women (NHIS: PR: 2.16; 95% CI: 1.41, 3.30; NHANES: PR: 2.79; 95% CI: 1.73, 4.51). Among non-SNAP users, White SMW had prevalence of past-30 day food insecurity that was almost twice as high as White heterosexual women (NHIS: PR: 1.87; 95% CI: 1.54, 2.26), a similar finding was observed for past 12-month food insecurity (NHANES: PR: 1.81; 95% CI: 1.17, 2.79).

In both NHIS and NHANES, Black SMW, White SMW, and Black heterosexual SNAP users, compared to White heterosexual women, had generally higher estimates of food insecurity prevalence of past-30 day (NHIS) and past-12 month (NHANES) food insecurity. However, unlike the estimates for non-SNAP users presented above, these were much attenuated effects and the differences did not quite reach statistical significance.

Table 2
Poisson regression models for the adjusted prevalence of food insecurity in adult Black and White heterosexual and sexual minority women by SNAP use: NHIS 2014–2018 and NHANES 2005–2014.

	NHIS 2013–2018		NHANES 2005–2014	
	Did not receive SNAP	Received SNAP	Did not receive SNAP	Received SNAP
	PR (95% CI)			
Sexual orientation				
Black sexual minority	2.16 (1.41–3.30)	1.04 (0.96–1.12)	2.79 (1.73–4.51)	1.22 (0.89–1.69)
Black heterosexual	2.37 (2.14–2.63)	1.24 (0.94–1.63)	2.23 (1.74–2.86)	0.92 (0.74–1.15)
White sexual minority	1.87 (1.54–2.26)	1.21 (0.99–1.47)	1.81 (1.17–2.79)	1.37 (1.00–1.87)
White heterosexual	Ref	Ref	Ref	Ref
Age				
18-25	1.23 (1.07–1.41)	0.69 (0.61–0.78)	1.53 (1.16–2.03)	0.84 (0.65–1.08)
26-35	1.03 (0.92–1.17)	0.65 (0.59–0.72)	1.02 (0.72–1.43)	1.04 (0.87–1.24)
36-45	1.11 (0.99–1.24)	0.79 (0.72–0.88)	1.28 (0.94–1.73)	1.16 (0.92–1.46)
46-59	Ref	Ref	Ref	Ref
Education level				
≤ High school	1.41 (1.27–1.56)	1.00 (0.92–1.09)	1.40 (1.10–1.77)	1.02 (0.84–1.24)
Any college or greater	Ref	Ref	Ref	Ref
Health Insurance				
None	2.90 (2.53–3.31)	1.50 (1.31–1.72)	2.52 (1.92–3.31)	1.28 (0.96–1.70)
Public	2.82 (2.51–3.16)	1.46 (1.29–1.65)	2.98 (2.20–4.04)	1.29 (0.94–1.76)
Private	Ref	Ref	Ref	Ref
Current smoker (Ref = No)	2.39 (2.17–2.64)	1.26 (1.15–1.37)	1.84 (1.45–2.34)	1.20 (0.95–1.51)

PR = Prevalence ratio; 95% CI = 95% Confidence Interval. Simultaneous multivariable Poisson regression analyses also adjusted for survey cycle.

Table 3 presents estimates of experiencing food insecurity due to being multiply marginalized (i.e., the intersection of being Black and sexual minority) on the additive scale. The RERI, AP, SI, and RJE all indicated the presence of a negative interaction. A statistically significant interaction (RERI) was observed for women in NHIS who did not receive SNAP. A negative RERI (or AP) indicates a negative interaction between being Black and a sexual minority, indicating that the combined effect of being Black and sexual minority on food insecurity is less than the sum of the effects of being White and heterosexual. However, we focus on interpreting the SI and RJE as they are easier to understand, especially in the presence of a negative interaction. Unlike RERI and AP, the magnitude of the SI and RJE measures are also interpretable and provide unique insight into the joint disparity and the absolute joint risk, respectively. SI is the ratio of the observed joint disparity of being Black and a sexual minority to what we would expect if this excess intersectional disparity was zero. Again, for women in NHIS who did not receive SNAP, the intersection of being Black and sexual minority halved the joint disparity in food insecurity (SI: 0.52; 95% CI: 0.11, 0.93). A more intuitive measure might be RJE, which estimates how much greater or lesser the observed joint effect is (here, being Black and sexual minority) compared with the joint effect that is expected in the absence of interaction. Among women in the NHIS who did not receive SNAP, the RJE was 0.67 (95% CI: 0.38, 0.95). Here, the intersection of Black race and sexual minority orientation resulted in a 33% lower prevalence of reporting past 30-day food insecurity than what would be if there was no interaction. Taken together these measures indicate that, for past 30-day food insecurity, we observed a statistically significant protective effect for the intersection of being Black and a sexual minority among women who did not receive SNAP.

Discussion

Our study uses an intersectional approach to identify and document disparities in food insecurity and food assistance use in a population-based sample of women with diverse and intersecting races and sexual orientations. Accordingly, our results extend the existing epidemiological literature, which is limited by unitary approaches to understanding food insecurity disparities in minority gender, racial, and sexual orientation groups. Our study was rooted in intersectionality theory, which argues that women who hold multiple minority social positions (i.e., gender, race, and sexual orientation) experience *unique* oppression and discrimination due to their interlocking social positions as Black and sexual minority (Crenshaw, 1989). For Black women and Black SMW, experiencing intersectional oppression is linked with poor mental and physical health (Agénor et al., 2014, 2019; Kim et al., 2017; Lewis et al., 2017; Moody & Lewis, 2019); however, these studies do not investigate how intersectional oppression—approximated by holding multiple,

Table 3
Measures of additive interaction of race and sexual orientation on food insecurity: NHIS 2013–2018 and NHANES 2005–2014.

	NHIS 2013–2018		NHANES 2005–2014	
	Did not receive SNAP	Received SNAP	Did not receive SNAP	Received SNAP
	Estimate (95% CI)			
RERI	-1.08 (-2.05, -0.10)	-0.01 (-0.41, 0.40)	-0.24 (-1.70, 1.21)	-0.07 (-0.60, 0.46)
AP	-0.50 (-1.14, 0.15)	-0.01 (-0.34, 0.33)	-0.09 (-0.64, 0.46)	-0.06 (-0.50, 0.38)
SI	0.52 (0.11, 0.93)	0.97 (-0.68, 2.63)	0.88 (0.19, 1.56)	0.77 (-0.78, 2.32)
RJE	0.67 (0.38, 0.95)	0.99 (0.67, 1.32)	0.92 (0.45, 1.38)	0.95 (0.55, 1.34)

95% CI = 95% Confidence Interval. RERI = Relative Excess Risk due to Interaction. AP = Attributable Proportion. SI = Synergy Index. RJE = Ratio of observed versus expected joint effects.

intersecting, marginalized social positions (i.e., multiple marginalization)—confers excess risk for resource loss, including food insecurity (Link & Phelan, 1995; Phelan et al., 2010; Warnecke et al., 2008).

Population prevalence of food insecurity in Black and White SMW

As hypothesized, population-level prevalence of food insecurity was highest in Black SMW. Over 1 in 4 Black SMW reported experiencing past 30-day food insecurity (NHIS) and over 1 in 3 reported experiencing food insecurity at some point over the past 12-months (NHANES). These estimates are higher than published Census-based population estimates, in which approximately 1 in 4 Black households reported experiencing past 12-month food insecurity (Coleman-Jensen et al., 2019a). Population-level prevalence of food insecurity was also high for White SMW: Approximately 1 in 6 White SMW reported past 30-day food insecurity (NHIS) and 1 in 4 reported past 12-month food insecurity (NHANES). The rates of food insecurity in Black and White SMW are concerning, given that food insecurity is associated with increased risk of cancer, cardiovascular disease, and diabetes (Gregory & Coleman-Jensen, 2017; Gundersen & Ziliak, 2015), which are also higher in the general population of SMW (Caceres et al., 2018; Gonzales & Zinone, 2018; Newlin Lew et al., 2018; Trinh et al., 2017) and Black SMW (Caceres et al., 2019, 2020; Mays et al., 2002; Molina et al., 2014), specifically.

Variations in the population-level distribution of food insecurity reported in NHIS and NHANES underscore the importance of specifying the time period in which food insecurity is assessed. Food insecurity prevalence was higher for all groups in NHANES, which uses a 12-month recall period to measure food insecurity (versus a 30-day recall period used in NHIS). Food security fluctuates across seasons (Maxwell, 1996); likely due to seasonal variations in employment (Quandt et al., 2004) and costs (Nord & Kantor, 2006). Consequently, differing recall periods can result in notable differences in food insecurity estimates. By assessing food insecurity prevalence in NHIS and NHANES we are able to demonstrate that Black SMW experience higher population prevalence in experiences of food insecurity despite variant recall periods.

Intersectionality and food insecurity

Consonant with an intersectionality framework, we hypothesized that, among women who did not receive SNAP, the prevalence of food insecurity would be greater in Black and White SMW (versus White heterosexual women). Our results supported this hypothesis: Black SMW who did not receive SNAP reported food insecurity over the past 30-days (NHIS) and within the past 12-months (NHANES) that were more than twice as high as that of White women. While the effect was reduced for White SMW who did not receive SNAP, the prevalence of food insecurity over the past 30-days (NHIS) and within the past 12-months (NHANES) was almost twice as high as their White heterosexual counterparts.

Intersectionality suggests that SMW experience intersecting oppressions arising from their race/ethnicity and sexual orientation, which confer multiplicative risks for structural discrimination across contexts. For example, Black SMW face racism, sexism, and heterosexism in society-at-large; racism and sexism in sexual minority communities; and sexism and heterosexism in Black communities (Bowleg et al., 2003; Calabrese et al., 2015; Lewis et al., 2017). Structural discrimination experienced by SMW disproportionately depletes their social and economic resources, which may increase their susceptibility to food insecurity as reflected in our study. Evidence supports this hypothesis; SMW face economic challenges arising from employment discrimination, lower insurance rates, and historical lack of access to tax and financial benefits associated with marriage (Badgett et al., 2013). The limited scientific evidence documenting poverty in SMW indicates a greater prevalence of SMW hold socioeconomic positions defined as poor or near poor (Albelda et al., 2009; Badgett et al., 2013). These disparities are further exacerbated for SMW of color (DeFilippis, 2016), which

supports our hypothesis that experiencing intersectional oppression further diminishes Black SMW's access to economic and social resources. For Black and White SMW who do not receive SNAP, decreasing food insecurity requires addressing inequitable social conditions specific to race and sexual orientation.

To further understand how multiple marginalization affects food insecurity, we assessed the absolute risk of food insecurity due to the joint effects of experiencing racism *and* heterosexism/homophobia. We hypothesized that intersectionality (i.e., experiencing multiple marginalization due to holding both minority race and sexual orientation) would result in excess risk of food insecurity for Black SMW beyond that proscribed by their race or sexual orientation alone. Our results, however, did not support our a priori hypothesis: When we assessed joint effects of minority race and sexual orientation on food insecurity, results consistently indicated a negative interaction. While these differences were only statistically significant in NHIS, the patterning of joint effects on food insecurity prevalence were similar for NHANES, increasing confidence in the validity of these results.

We can only hypothesize how holding intersecting marginalized social positions reduces food insecurity among Black SMW. For this study, women's minority race and/or sexual orientation represented social positions that confer risk for food insecurity due to experiencing historical and contemporary racism and/or heterosexism/homophobia. However, race and sexual orientation may also represent other underlying social processes. One such process, cultural resilience, describes how shared cultural factors (e.g., values, customs, norms) facilitate development of social support networks that help minority individuals and communities cope in the face of structural and systemic oppression and discrimination (Brown, 2008; Clauss-Ehlers, 2008; McCubbin et al., 1998). We believe our results may be connected to cultural resiliency and, specifically, Black SMW's social support systems. Historically, Black SMW have created and engaged in supportive social and activist communities of color (Lorde, 1983; Moore, 2006) to which they feel strongly connected. Evidence suggests that SMW rely on friend and "families-of-choice" for everyday social support (e.g., social needs, talking about problems) (Frost et al., 2016; Frost & Meyer, 2012). If support that reduces food insecurity is conceptualized as "everyday social support" (i.e., relieving temporary need for food), it is possible that these Black and sexual minority-specific communities provide Black SMW access to resources that reduce food insecurity. Similar strategies have been described by transgender and gender non-conforming people who report that friendship networks often provide in-kind support, including meals, in times of need (Russomanno et al., 2019).

However, across studies, Black SMW also describe receiving informal support from natal family that is rooted in shared racial identities and cultural connections (Glass, 2014; Glass & Few-Demo, 2013; Swendener & Woodell, 2017). This is contrary to evidence from the general sexual minority population, in which sexual minority youth report having lower levels of closeness with parents (Pearson & Wilkinson, 2013). One explanation is that Black SMW may be less likely to be "out" (i.e., openly discuss their sexual orientation) with natal family/kinship networks (Bowleg et al., 2008; Brooks et al., 2010; Moradi et al., 2010; Parks et al., 2004) than White SMW. In qualitative studies, Black SMW describe de-emphasizing their sexual minority orientations and relationships in kinship networks where their minority sexual orientation is tacitly accepted (Glass, 2014; Glass & Few-Demo, 2013). In de-emphasizing their minority sexual orientation, Black SMW may increase their access to kinship support—for example, more substantial monetary gifts or loans (Frost et al., 2016)—that may reduce Black SMW's risk of experiencing food insecurity. If these hypotheses are true—that Black SMW are able to tap into Black and sexual minority social support networks—then holding minority race and sexual orientation may also represent cultural resiliency and, thus, appear in our findings as a protective factor against food insecurity. Future research is warranted to ascertain how Black and White SMW differently cope with food insecurity, including how social and kinship networks function to produce or attenuate food

insecurity in racially diverse SMW. Such evidence may help researchers and practitioners develop community-based programs designed specifically to reach food insecure, racially diverse SMW.

SNAP as a protective factor

Multiple studies document the use of food assistance programs in low-income families struggling with food insecurity (Bazerghi et al., 2016; Gundersen & Ziliak, 2015). Existing studies indicate that SMW women are 30–70% more likely to receive SNAP benefits than heterosexual women (Brown et al., 2016; Gates, 2014). In contrast, our study suggests that receipt of SNAP varies by race *and* sexual orientation. Population-level prevalence estimates indicated that more Black SMW reported past 12-month receipt of SNAP (NHIS: 46%; NHANES: 51%) than Black heterosexual women (NHIS: 34%; NHANES: 32%) or White SMW (NHIS: 17%; NHANES: 21%). Black SMW's greater receipt of SNAP may reflect income inequities. Despite high labor market participation, Black women have suffered the largest wage declines since 2007 and with a widening wage gap compared to White women (Fisher & Houseworth, 2017; Mishel et al., 2012). Black SMW's higher SNAP utilization may reflect these economic trends. Understanding SNAP use by Black SMW is important because longitudinal evidence indicates that SNAP is associated with a 31% decrease in households reporting food insecurity and 20% decrease in households reporting severe food insecurity over 6 months (Mabli et al., 2013; Ratcliffe et al., 2011). Evidence from multivariable analyses supports the use of SNAP as a protective factor against food insecurity disparities, as we found no differences in prevalence of food insecurity among multiply marginalized women who reported receiving SNAP benefits within the past 12-months. Without SNAP, it is likely that more Black SMW would be at risk for experiencing food insecurity and, thus, food insecurity disparities would widen between Black SMW and both Black and White heterosexual women.

Public health implications

Our study indicates that Black and White SMW who did not receive SNAP benefits reported greater prevalence of food insecurity compared to White heterosexual women. Yet, among women who received SNAP benefits, these disparities were attenuated. SNAP is effective in reducing food insecurity because benefits can be rapidly implemented to reach individuals and families most in-need, therefore, enrolling Black and White SMW in SNAP should be considered a public health priority. To achieve active enrollment from SMW, state and local agencies could partner with LGBT and Black cultural organizations to promote and assist with SNAP enrollment of these populations.

At a policy level, public health efforts are also needed to increase access to SNAP. While food insecurity has been declining over time (Coleman-Jensen, 2020), strained economies place lower income populations at higher-risk for food insecurity. In early studies published in the wake of the 2020 Coronavirus (COVID-19) pandemic, food insecurity prevalence tripled among US adults (Fitzpatrick et al., 2020), threatening to widen existing disparities for Black (Wolfson & Leung, 2020) and sexual minority populations (McKay et al., 2020). At the time of this writing, the US Families First Coronavirus Response Act has provided the USDA additional funding to increase SNAP program participation, temporarily suspended SNAP's three-month time limit on benefits for unemployed adults under age 50 without children in their home, and increased individual benefit amounts through emergency supplements (United States Department of Agriculture and Food and Nutrition Services, 2020). The continuation of these temporary changes to SNAP will be needed as the US rebuilds from a deep economic downturn in the wake of COVID-19. Black (Montenovo et al., 2020) and sexual minority (McKay et al., 2020) workers have experienced disproportionate job loss in the early months of the pandemic. Recovering from job loss may be more difficult for multiply marginalized women, who experience workplace and hiring discrimination due to

racism and White supremacy (Fekedulegn et al., 2019) and/or heterosexism and homophobia (Fidas & Cooper, 2018). Extending SNAP benefits—including increases to minimum and maximum benefit levels and restrictions on minimum work requirements for able-bodied adults without dependents—is critical for mitigating food insecurity and negative sequelae for our most at-risk populations, including multiply marginalized SMW.

Limitations

Our results must be viewed in light of limitations. NHIS and NHANES use different measures of sexual orientation, which limits comparisons between datasets. Also, NHANES' sexual identity measure pairs each identity response (e.g., “lesbian”) with a statement about sexual attraction (e.g., “sexually attracted to females”). Double-barreled questions may conflate responses as individuals must choose a single response that comprises multiple aspects of their sexual orientation. Our study defined sexual orientation by sexual identity only; this is in contrast to prior studies that have defined SMW in terms of identity and sexual behavior (Farmer et al., 2013; Patterson & Jabson, 2018). Sexual orientation is a multidimensional construct and failing to measure sexual behavior and/or attraction excludes SMW who may experience same-sex attraction or engage in same-sex behavior, but identify as heterosexual or another non-heterosexual identity (Badgett, 2009). For example, young adults in the general population demonstrate high prevalence of food insecurity (Bruening et al., 2017; Gooding et al., 2012), and younger generations of sexual minorities are more likely to self-identify their sexual orientation using terms beyond “lesbian” and “bisexual” (e.g., queer, pansexual) (GLAAD, 2017). These younger SMW may be underrepresented in health surveillance that does not include more inclusive and multidimensional measures of sexual orientation. Only female respondents aged 18–59 are asked NHANES' sexual orientation questions, which substantially limited our analytic sample for both NHIS and NHANES. This is problematic because sexual orientation is salient across the life course and older adults are at risk for food insecurity (Goldberg & Mawn, 2015). Consequently, food insecurity disparities may be realized in older women with intersecting minority races and sexual orientations. Finally, even with oversampling for race/ethnicity, our sample sizes were small. Small samples make modeling PRs for Black SMW, and especially among stratified groups by SNAP, challenging. To counterbalance this limitation, we presented population estimates from two national health surveillance programs (NHIS and NHANES), so that we could investigate patterns of food insecurity in data sets with markedly different unweighted sample sizes of SMW. As the proportion of SMW within Black and White racial groups was similar within data sets, the small number of Black SMW in our study appears to be an artifact of the lower overall sample size of Black women in NHIS and NHANES than differences in self-reported sexual orientation between Black and White SMW. We were also unable to investigate differences in other diverse racial/ethnic groups of SMW, including Hispanic, Asian, multiracial and other racial/ethnic minorities. This is a substantial limitation of our study and the field in general (Institute of Medicine Committee on Lesbian Health, 2011). As previously mentioned, food insecurity was measured using the same USDA measures of food insecurity but within different timeframes (NHIS: past 30-days; NHANES: past 12-months). Thus, food insecurity prevalence estimates are not directly comparable between NHIS and NHANES. Our analytic samples from NHIS and NHANES comprised different time periods for survey collection (NHIS: 2013–2018; NHANES 2004–2014). Partly, this is because NHIS did not begin measuring sexual orientation until 2013. Distribution of survey cycles also differ, with NHIS distributing surveys annually and NHANES distributing surveys biannually. Food insecurity in the US has been decreasing since 2011 (Coleman-Jensen, 2020); thus, population-level prevalence estimates for food insecurity may be greater in unadjusted, weighted analyses because this analytic sample included respondents during a time period when food

insecurity increased (prior to 2011). Finally, our intent with this study was to explore prevalence differences in food insecurity and food assistance use; thus, we did not make adjustments for multiple comparisons. Future studies with larger cohorts of Black lesbian and bisexual women are needed to confirm these findings.

Conclusion

This study provides the first population-level evidence of food insecurity disparities in a diverse sample of women with intersecting minority races and sexual orientations. Our results suggest that White and Black SMW experience substantial food insecurity disparities—including disruptions in quality/type of food and reduced food intake. This is concerning as food insecurity is associated with financially costly and quality of life diminishing chronic diseases, which are known disparities in SMW and Black women (Caceres et al., 2019; Mays et al., 2002; Molina et al., 2014). Our results also reveal food insecurity disparities are attenuated among women who received SNAP benefits, which suggests that increasing SNAP use among multiply marginalized women is a key strategy for reducing food insecurity disparities. Identifying strategies to increase participation in food assistance programs is critical for decreasing food insecurity in racially diverse groups of SMW.

Author contribution

Joanne G. Patterson: Conceptualization; Data curation; Formal analysis; Writing - original draft preparation; Writing - review & editing. **Jennifer Russomanno:** Writing - original draft preparation; Writing - review & editing. **Andreas Teferra:** Data curation; Formal analysis; Preparation of figures and tables; Writing - review & editing. **Jennifer M. Jabson Tree:** Conceptualization; Writing - original draft preparation; Writing - review & editing.

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Ethics approval

This study was a secondary analysis of de-identified, publicly available data and did not require a human subjects review.

Declaration of competing interest

Scientists' social identities shape their experiences, perspectives, and subsequent research questions, methodological approaches, and interpretation of results. To promote accountability and responsibility in the study of marginalized groups and their health experiences, it is especially important that scientists acknowledge their social identities. Our four-member research team includes three, White, sexual minority, cis-gender female investigators, and one, Black, heterosexual, cis-gender male investigator. While we have been thoughtful about our accountability and careful to consider interpretations of our findings in the context of an intersectional framework, rooted in Black feminist thinking, our interpretations are shaped by our social identities and lenses.

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