

Available online at www.sciencedirect.com

Public Health

journal homepage: www.elsevier.com/puhe

Themed Paper – Original Research

Unraveling common threads in obesity risk among racial/ethnic minority and migrant populations



S.K. Kumanyika

Department of Community Health and Prevention, Drexel University Dornsife School of Public Health, Philadelphia, PA, USA

ARTICLE INFO

Article history:

Received 23 September 2018

Received in revised form

22 April 2019

Accepted 28 April 2019

Available online 19 June 2019

Keywords:

Race

Ethnicity

Migrant

Obesity

High-income countries

ABSTRACT

Background: Epidemic obesity poses a major threat to global health. This phenomenon reflects the inability of the average person to cope, biologically and behaviorally, with environmental contexts that promote caloric overconsumption and inadequate caloric expenditure. There is still much to be learned about how to improve these contexts nationally and within-countries for sociodemographic groups with above-average obesity risks.

Methods: Higher obesity risks relative to respective white majority populations were identified among diverse indigenous, other native-born, or migrant ‘racial’ or ethnic minority (hereafter, ethnic minority) populations in the United States, Canada, Australia, New Zealand, and the Netherlands, using publicly available national survey data or other sources. Cross-national comparisons were of interest for identifying common risk pathways associated with social and economic inequities. Potential explanations were explored through a narrative review of peer-reviewed literature, informed by the World Health Organization’s Conceptual Framework for Action on The Social Determinants of Health.

Main findings: Identifying viable solutions to the high risk of obesity in ethnic minority populations in these high-income countries requires examination of national-level social, economic, and health system contexts, food systems, and built environments for physical activity, as well as patterns of social stratification and cultural biases related to ethnicity, migration, and other determinants of social disadvantage. These factors can be linked to mediators of exposure or vulnerability to obesity-related risks, such as poverty, being an ‘outsider’, stress and trauma resulting from historical and current oppression, exposure to bias and discrimination, related biological or behavioral consequences, and inadequate health and social care.

Conclusions: Focusing on ethnic minority populations in high-income countries is critical for public health efforts to address epidemic obesity. Mitigating intersecting risk pathways arising from stratification and bias based on ethnicity and migrant status should be prominent in these efforts.

© 2019 The Royal Society for Public Health. Published by Elsevier Ltd. All rights reserved.

E-mail address: kumanyika@drexel.edu.

<https://doi.org/10.1016/j.puhe.2019.04.010>

0033-3506/© 2019 The Royal Society for Public Health. Published by Elsevier Ltd. All rights reserved.

Introduction

The obesity epidemic is a major threat to population health globally, increasing risks of type 2 diabetes, cardiovascular diseases, and certain cancers.^{1–3} Upward population trends are observed in the global North and South, including urban areas in African countries.^{1,4} According to the World Health Organization, prevalence has nearly tripled since the 1970s.⁵ Estimates for 2016 indicate that more than 650 million adults have obesity; 41 million children aged below 5 years and 340 million children aged 5–19 years are overweight or have obesity. Causes of population-level obesity (as opposed to individual cases) are, undeniably, forces across and within many societal sectors that result in intake of excess calories, i.e. overconsumption of energy relative to need.^{6–8} These forces exceed the ability of human biological and behavioral regulatory systems to cope and result in excess weight gain. Drivers include aspects of physical, economic, sociocultural and information environments, and the policies and institutionalized practices that govern and shape them (termed ‘structural factors’).

This review relates to subgroup differences in obesity within high-income countries—higher obesity prevalence associated with racial/ethnic minority or migrant status in the United States, Canada, Australia, New Zealand, or Northern Europe.⁹ The minority groups of interest here are indigenous to these countries or people of African, Hispanic, North or South Asian, and Pacific origin variously classified as ‘races’, ‘ethnic groups’, or ‘migrants.’ They are recognizable based on skin color in combination with other visible physical or ethnic characteristics such as language or religious practices that set them apart from the respective, politically dominant, majority white populations. Hereafter, these groups will be referred to as ethnic minority populations or migrants, depending on the points discussed.

Above-average obesity-related risks in ethnic minorities who are socially disadvantaged or marginal relative to reference populations are viewed as health inequities, i.e. avoidable and unfair.¹⁰ This review considers whether and how these inequities might arise from common pathways despite differing national contexts and differences in ancestry, sociopolitical history within the country of residence, and nativity or duration of residence. The objective is to facilitate understanding of potential pathways for mitigating the high-obesity risks.

Background

This article elaborates on a plenary presentation at the 1st World Congress on Migration, Ethnicity, Race, and Health (MERH) in Edinburgh in 2018.¹¹ It builds on prior, detailed consideration of potential reasons for above-average obesity prevalence among ethnic minority populations in high-income, plural societies, published in 2012.⁹ That 2012 review was conducted by US-based black American health disparities scholars working with a black African anthropologist experienced in migrant studies and a Dutch expert in non-Western sociology. The authors selected data (preferably national-level and measured rather than self-reported)

permitting direct comparisons of obesity prevalence in ethnic minority vs reference populations. Inequities in obesity prevalence were identified with sufficient consistency to warrant further inquiry into reasons for these patterns.

The 2012 review was premised on evidence that ‘racial’ classifications, although socially and politically meaningful, do not reflect biological races.¹² The authors researched influences on food intake and physical activity at individual, family, and community levels. Social disadvantage, defined as low socio-economic position (SEP) associated with income, education, or other social class indices, was considered in addition to ethnicity. The authors called for tailored or targeted public health solutions to address obesity risks of ethnic minorities in high-income countries with awareness of obesity-promoting factors in physical, economic, sociocultural, and policy environments. This updated review complements the 2012 paper, with more explicit consideration of national contexts and social determinants of health.

Only adult body mass index (BMI) data are considered here. Waist circumference data, as measures of abdominal obesity, add another dimension to the picture provided by BMI^{13,14} but are not routinely reported in national data. Understanding patterns in children can build on ideas discussed here but would require additional consideration of child-specific variables.^{15–18}

Prevalence data

Table 1 illustrates obesity prevalence in minority and reference populations within six high-income countries.^{19–25} These data are not adjusted for socio-economic indicators. Consistent with prior findings,^{9,26,27} obesity prevalence is higher among some or all minority populations in one or both genders in each country. Where differences are observed, their extent among ethnic subgroups and by gender varies. There are also subethnic differences (not shown). For example, a cohort study of US Hispanic/Latino adults reported higher obesity prevalence among Puerto Ricans than people from South America.²⁸ Canadian data indicate higher obesity prevalence in First Nations people living on vs off reserves.²⁰ The Netherlands data for African vs South Asian Surinamese and the data for South Asian subgroups in England illustrate the importance of attending to subethnic differences within the broad category ‘country or region of origin’, although such data are often unavailable.

The US, New Zealand, and English data showing lower risk in Asian-descent compared with white populations is less of a departure from the pattern of higher risk than it would seem. The standard BMI ≥ 30 kg/m² cutoff is misleading for Asian populations from a risk identification perspective. A lower cutoff, such as BMI ≥ 25 kg/m², has been recommended to account for the relatively higher diabetes and cardiovascular risks in Asian populations at lower BMI levels.^{13,14}

Higher obesity prevalence among adults in indigenous or established ethnic minority populations is not typically a new finding and has tracked upward within the overall epidemic.⁶ In migrant populations, the impression is that obesity risk increases from a lower baseline risk with time since migration, i.e. high prevalence reflects excess weight gain with increasing

Table 1 – Obesity prevalence in racial/ethnic minority populations vs reference populations in the United States, Europe, Australia, and New Zealand.

Population and data source ^a and year	Ethnic group	Males	Females
USA (reference 21)			
Data source: National Health and Nutrition Examination Survey, 2013–2016	Non-Hispanic white	36.2 (33.1–39.5)	38.1 (35.6–40.6)
% (95% CI) of adults ages 20 and older with BMI \geq 30 kg/m ² , age-adjusted	Non-Hispanic black	37.4 (33.8–41.2)	55.9 (53.0–58.9)
	Hispanic	40.6 (36.5–44.7)	48.9 (45.3–52.4)
	Non-Hispanic Asian	11.2 (8.8–13.9)	13.6 (11.1–16.5)
USA (reference 25)			
Data source: National Health Interview Survey, 2016	Non-Hispanic white	Combined males and females	
% (SE) of adults ages 18 years and older with BMI \geq 30 kg/m ² , age-adjusted, based on self-reported weight and height	Non-Hispanic black	28.7 (0.42)	
	Mexican American	39.4 (1.18)	
	American Indian or Alaska Native	34.1 (1.26)	
	Asian	39.1 (3.72)	
	Native Hawaiian/Pacific Islander	9.54 (0.94)	
	Canada	51.7 (6.97)	
Canada (reference 20)			
Data source: Canadian Community Health Survey, 2007–2008	Aboriginal (off-reserve)	16.9	25.7 ^b
% of adults ages 18 years and older with BMI \geq 30 kg/m ² , based on self-reported weight and height			
Amsterdam, The Netherlands (reference 24)			
Data source: HELIUS Study Cohort, 2011–2015	Dutch	10 ^c	
% of adults 18 to 70 years with BMI \geq 30 kg/m ²	Turkish	35	
	Moroccan	29	
	South Asian Surinamese	19	
	African Surinamese	30	
	Ghanaian	34	
			Males
England (reference 23)			
Data source: Health Survey for England, 2006–2010 (average)	White	18.8	18.7
% of adults ages 16+ years with BMI > 30 kg/m ² , age-standardized	Black Caribbean ^e	20.9	25.5
	Black African ^{d,e}	16.0	31.6
	Indian	13.2	13.1
	Pakistani ^{d,e}	12.2	26.2
	Bangladeshi	11.5	15.1
	European	28.6 (26.5–30.9)	32.2 (30.6–33.8)
New Zealand (reference 22)			
Data source: New Zealand Health Survey, 2016–2017	Maori	48.8 (44.6–53.0)	51.5 (48.5–54.5)
% (95% CI) of adults ages 15 years and older with BMI \geq 30 kg/m ² , age adjusted	Pacific	63.6 (55.5–70.9)	73.4 (67.1–78.9)
	Asian	15.8 (12.4–20.0)	13.6 (10.8–17.1)
Australia (reference 19)^f			
Data sources: Australian Aboriginal and Torres Strait Islander Health Survey, 2012–2013 and 2011–2012, Australian Health Survey		Males	Females
% of adults with BMI \geq 30 kg/m ² by age groups		Ages 35–44 years	
	Aboriginal and Torres Strait islander	43	50
	Non-Indigenous	30	25
		Ages 45–54 years	
	Aboriginal and Torres Strait islander ^g	35	49
	Non-Indigenous	32	30
		Ages 55 and over	
	Aboriginal and Torres Strait islander	44	50
	Non-Indigenous	35	32

BMI = body mass index; CI = confidence interval; SE = standard error.

^a Based on measured weight and height unless otherwise noted.

^b Statistically different from non-Aboriginal ($P < 0.05$).

^c Source states that prevalence compared to Dutch is higher in the other ethnic groups.

^d Prevalence is higher among women than men.

^e Prevalence of obesity among women is higher than in other ethnic groups.

^f Overall age-adjusted obesity prevalence for Aboriginal and Torres Strait Islander people ages 15 to 55 + was 1.5 times higher than in non-Indigenous people—male ratio 1.4 and female ratio 1.7; age-specific rates shown were estimated from bar graphs in the source.

^g Difference between Aboriginal and Torres Strait Islander rate and non-Indigenous rate is not significant in this group; male female difference is significant in this age group.

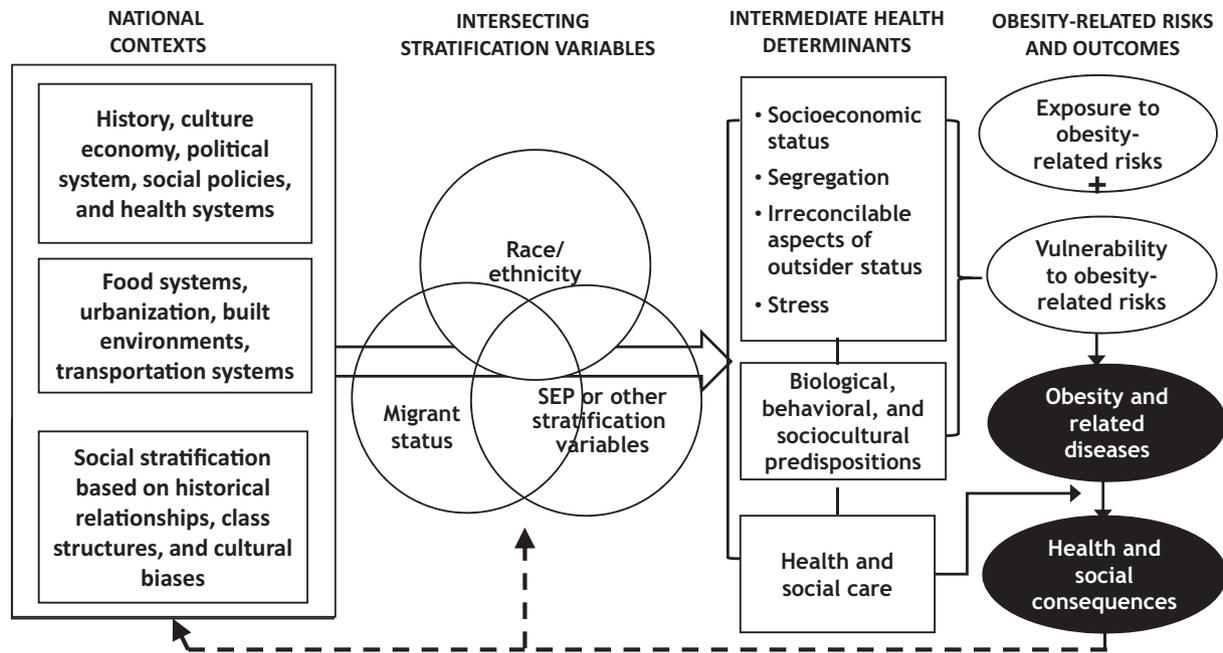


Fig. 1 – Pathways for production of racial/ethnic and migrant inequities in obesity and potential points to intervene. SEP = socio-economic position. Source: Adapted from Reference 33.

duration of residence or in 2nd and 3rd generations due to prolonged exposure to obesity-promoting environmental influences.²⁹ However, this pattern varies.^{30–32} Variations might provide insights about how high-obesity risk prior to migration carries over or about factors that protect certain migrant groups from obesity after migration.

Explanatory frameworks

The intent here is to identify ‘ethnic minority factors’ that augment obesity predisposition. The answers lie in the intersection between pathways that produce obesity and pathways that produce health inequities. Fig. 1 is a new framework that addresses this intersection. It was developed in conjunction with the MERH congress, since revised,³³ and further adapted here.

- At left, Fig. 1 calls attention to the general and obesity-related national contexts that influence obesity prevalence. From a health equity perspective, it refers to the universal phenomenon of social stratification and its manifestations, associated with race/ethnicity, migrant status, and low SEP. Countries have different histories of interactions with ethnic minority populations, which are codified in social, economic, and health policies and national culture and identity, including ‘color-blind’ vs ‘color-conscious’ population data collection, and residential segregation vs integration.^{34–36} National differences include variations in immigration policies, treaties that apply to indigenous peoples, or other legal protections.^{26,37–39} These factors influence the nature and intensity of social stratification.
- The Venn diagram emphasizes that race/ethnicity, migrant status, and SEP have separate and, for those

multiply affected, combined effects. For example, health inequities of indigenous peoples (American Indians, Alaska Natives, and Native Hawaiians) and US-born black people are conditioned by intersections of race (i.e. skin color) and SEP. Health inequities affecting Hispanic/Latino or Asian Americans, even when US-born, may reflect all three types of stratification. They may be viewed as foreign if they prefer or speak Spanish or Chinese, for example, or because of presumed ‘non-American’ cultural influences. Variations specific to migration add a third layer.⁴⁰

- Intermediate determinants, categories related to excess weight and obesity, reflect social stratification as well as food systems and built environment variables. They reflect the effects of systematic social disadvantage resulting from intentional or inadvertent discriminatory or exclusionary policies and practices in institutions, discrimination, or other manifestations of cultural bias or prejudice encountered in interpersonal interactions and internalization of low self-esteem or as a reaction to discriminatory experiences of either type—institutionalized, interpersonal, or internalized racism.⁴¹
- The two boxes at the top of the far right column reflect Braveman’s adaptation of a prior framework by Finn Diderichsen: both disproportionate exposure and greater vulnerability to that exposure combine to foster obesity and related health and social consequences.⁴²

National contexts

Causes of population-wide obesity

Fig. 2 is a schematic map of macroenvironmental and micro-environmental factors that have a bearing on food intake and energy expenditure. Driven by forces of globalization, these

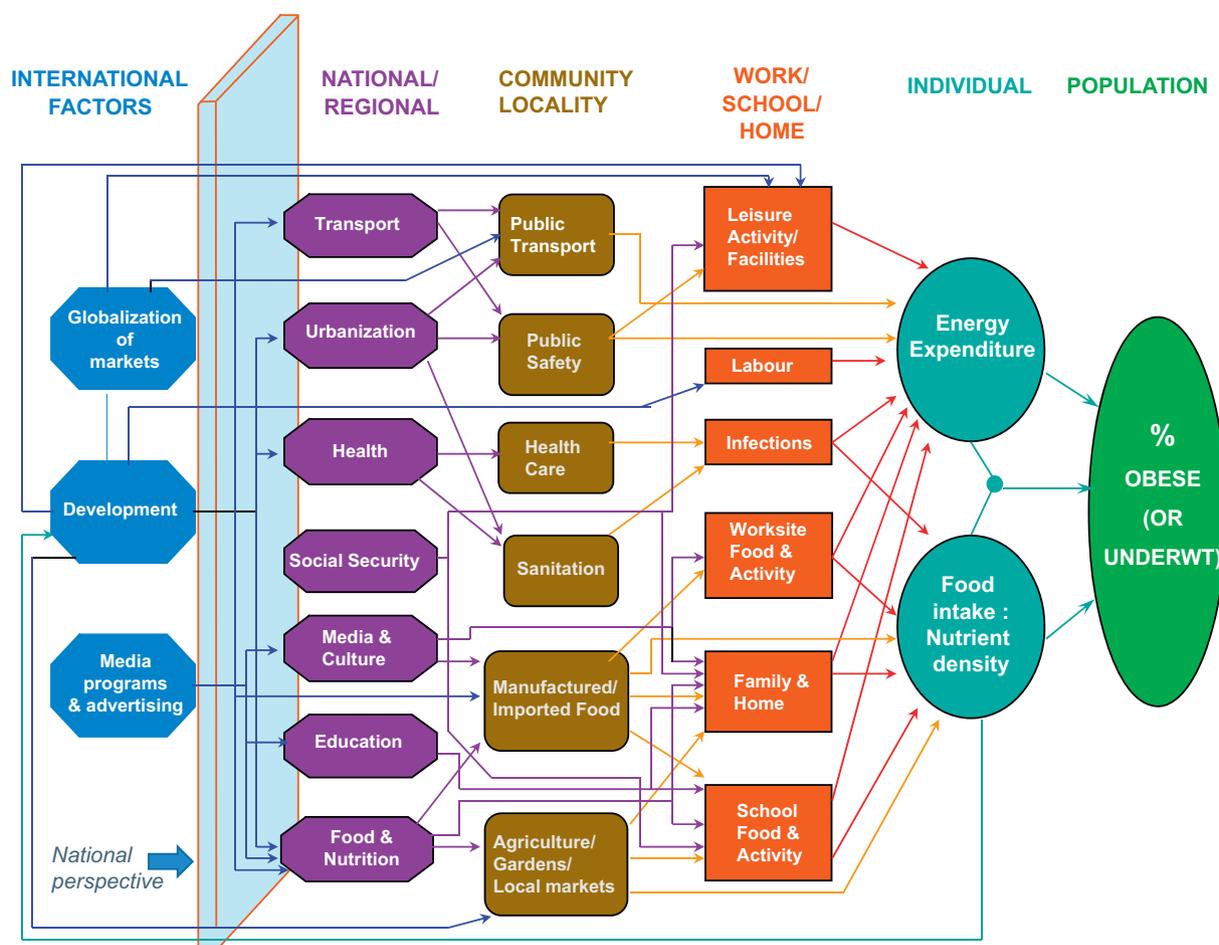


Fig. 2 – Societal policies and processes with direct and indirect influences on the prevalence of obesity and undernutrition. Vertical and horizontal links will vary between different societies and populations. Source: Kumanyika S et al. *Int J Obesity* 2002; 26:425–436 (reference 43).

factors arise from multiple sectors and operate at national, regional, and community levels and in workplaces, schools, and homes to shape the contexts for population-level energy-balance behaviors.⁴³ The ‘national perspective’ element acknowledges country-level differences in how these forces operate. For example, for the countries listed in [Table 1](#), the OECD reports obesity as lowest in The Netherlands (12.8%), highest in the United States (38.2%), and relatively high in the other countries: 30.7% in New Zealand; 25.6% in Canada; 26.9% in the UK; and 27.9% in Australia.⁴⁴ Variations are influenced by geography, type of economy, governance and regulatory structures, and sociocultural variations.⁴⁵ Individualistic world views, conservatism, orientation to leisure and pleasure, and awareness of and intolerance for inequalities—characteristics of national cultures identified by Hofstede—are correlated with cross-national differences in obesity prevalence.⁴⁶

Causes of health inequities

National-level determinants of health inequities include aspects of socio-economic and political contexts such as governance, macroeconomic policies, social policies, public policies, and culture and societal values that are the basis for social stratification, including biases related to language or religion.⁴⁵

These determinants, in turn, condition health through adverse effects on intermediary health determinants: material circumstances, behaviors, biological, and psychosocial factors.

Social stratification

Adverse effects of social stratification lead to social disadvantage from discriminatory practices or policies, residential segregation in underserved communities, limited employment or educational opportunities, and limited political power and agency to change these circumstances.⁴⁵ Some effects directly impact options for healthy eating or physical activity patterns, e.g. constrain access to healthy food at affordable prices or access to safe, outdoor recreation.⁴⁷ For black Americans or indigenous people, such effects may be more consistent and engrained; for migrants, color biases are less explicit and less grounded in policy: social disadvantage may be incidental and relate to skin color, cultural practices, reason for immigration (labor; asylum; other), and the (historical) social-political relationships with migrants' countries of origin. Nevertheless, where country of origin equates to darker (i.e. not ‘white’) skin color, some element of ‘race’ related stratification can be assumed, especially if there is

already resident a large group with similar ethnic origins (e.g. African or South Asian immigrants).

Intermediate health determinants

Socio-economic status and residential segregation

In high-income countries, obesity is typically associated with lower education or income, particularly in women, although patterns may be reversed in countries or populations undergoing economic transitions. Ethnic minority populations in these countries are disproportionately represented in lower socio-economic strata, but associations of SEP with obesity in these populations vary (see US data in Fig. 3). Given the mixed associations, high obesity risk is apparently not always a direct function of purchasing power or years of schooling. Effects may be mediated through segregation in neighborhoods with limited options for healthy eating and physical activity or other consequences of low SEP.

Outsider status

'Irreconcilable aspects of outsider status' refers to the reality that race, ethnicity, and migration confer an 'other' status that will influence the completeness of social integration in 'white' countries where people of European descent dominate politically and control 'national identity'. Whether implicit in definitions of ethnicity or explicit in the use of racial terminology, social stratification systems in these countries assign superior status and higher value (privilege) to people classified

as 'European descent or white' and lower status and value to people with darker skin. When 'race' is the named basis for social stratification (e.g. applicable to US black people and to indigenous people worldwide), the difference is ascribed and thus irreconcilable; there is some level of permanent or persistent social disadvantage that remains at all levels of SEP, even when high SEP is obtained by merit. Ethnic classifications that take their meaning from countries of origin, languages, or religion also enable identification of minorities through distinctive 'ascribed' characteristics.

Stress

'Stress', as used here, refers to a psychological process elicited by an individual's perception of a threat, that is, a situation the individual experiences or perceives as posing demands that exceed his or her ability to meet them. These demands and responses to them may be physical or psychological, and effects of stress may be compounded by adverse effects on the person's coping resources. Chronic stress resulting from exposure to economic and social disadvantage and various manifestations of racism and other discriminatory ideologies and practices contributes to both behavioral and biological risks. Economic or social disadvantage is associated with greater stress, i.e. exposure to and perceptions of threat. Stress exposures and responses have been directly associated with obesity-related risks through effects on body fat distribution and associated metabolic disturbances, sleep disturbances, the effects of stress in

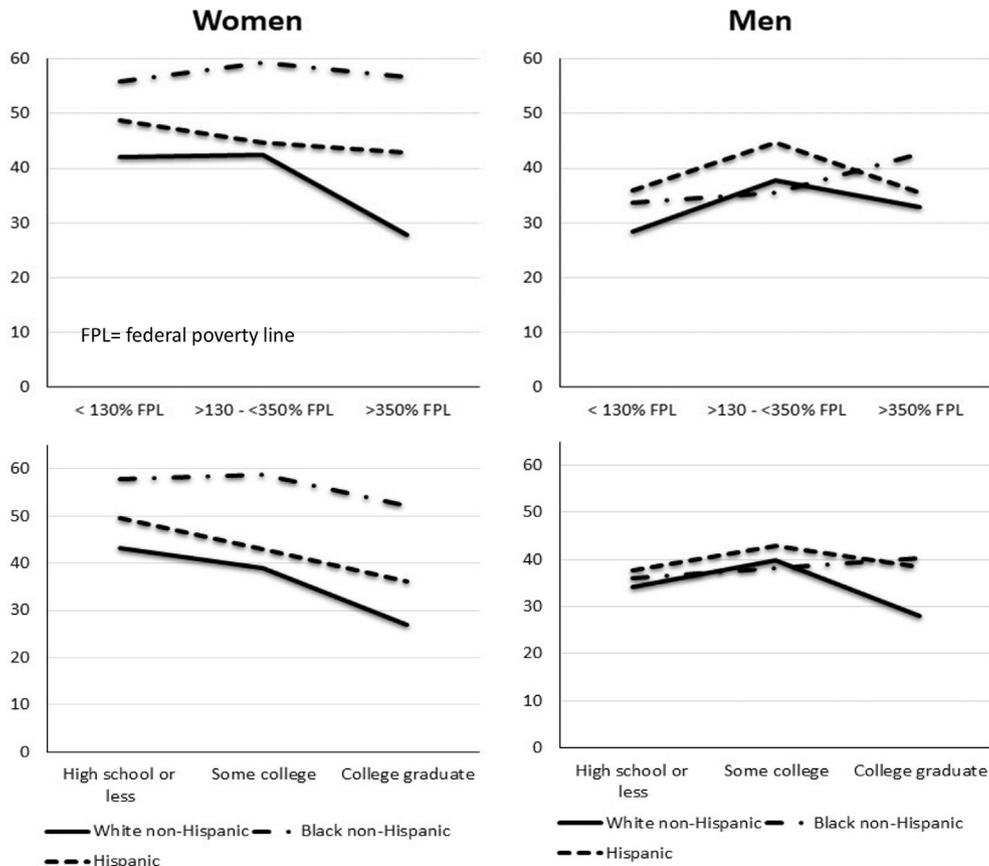


Fig. 3 – Obesity prevalence in US adults by race/Hispanic origin, household income, and education, 2011–2014. Source: Ogden et al. Morbidity and Mortality Weekly Report, 2017 (reference 51).

increasing the desire to eat, and consumption of high-fat or high-sugar foods to cope with stress.^{52–55}

Relevant here, legacies of colonization or enslavement and irreparable cultural and economic disruption constitute chronic exposure to stress and trauma and are perpetuated through repeated exposure to racist and discriminatory policies and practices. For migrants, the stress of uprooting and displacement may be exacerbated by experiences leading up to migration, difficult journeys and border crossings, harsh conditions upon arrival, and political circumstances, such as those that apply to refugees and asylum seekers. In some cases, lack of work permits or permanent resident status or novel exposure to racism and ethnic biases apply. The futility of attempts to assimilate may increase the stress experienced by those who are trying the hardest.

Biological, behavioral, and sociocultural predispositions

A landmark study emphasized the importance of environmental influences on obesity by contrasting high prevalence in US Pima Indians with the absence of obesity among counterparts in Mexico living a traditional lifestyle.⁵⁶ Such environmental variation has since been demonstrated in comparisons of obesity prevalence within other ethnic groups across countries or regions.^{57–59} Nevertheless, genetic and other differences in biological predispositions to obesity are of continuing interest. Many genetic variants associated with obesity are apparently common across ethnicities rather than ethnicity-specific; for those that may appear to be ethnicity specific, further studies are needed before confirming this.⁶⁰ James et al. suggest that a genetic basis for observed ethnic differences in physiological responses to dietary constituents, e.g. lactose, folate, and vitamin D, can probably be explained by evolutionary genetic adaptations of populations exposed to different geographic environments.⁶¹ However, they note that, although the heritability of obesity is well established (e.g. through twin studies), a genetic basis for ethnic differences in obesity risk has not yet been identified.

For migrants from countries with low-obesity risk, behavioral explanations may reflect effects of exposure to highly obesity-promoting environments resulting in an abrupt ‘nutrition transition’ effect of accelerated weight gain.⁴⁷ This may be mitigated by retention of protective cultural practices; in other cases, predispositions may contribute to obesity development. Body image, culturally constructed, should be considered in the latter context.^{62,63} Heavier weights may be viewed as a sign of upward mobility or protection against wasting diseases or not perceived negatively. Solely culturally or behaviorally based explanations are challenged as deflecting attention from institutionalized racism or discriminatory practices; that is, blaming economically or socially disadvantaged people for behaviors that are strongly influenced by environmental circumstances beyond their control.^{39,64} When environmental contexts of ethnic minority populations are found to be systematically less health promoting, a greater emphasis is placed on social injustices, and solutions focus on environmental, policy, and systems change.^{47,48,65}

Obesity-related risks and outcomes

As noted, ethnic minority populations may have relatively greater access to high-calorie low-nutrition foods associated

with neighborhood food access or exposure to widespread availability and promotion of inexpensive manufactured foods as well as greater likelihood of consuming too many calories from such foods because of a combination of their palatability, cultural salience, and food-related coping.^{53,55} Also, access or adherence to obesity prevention and control interventions may be lower (e.g. fewer acceptable or convenient programs available or difficulty adhering to lifestyle recommendations because of social contexts).⁴² Thus, even where obesity prevalence is not higher relative to the reference population, specially targeted interventions are needed to account for response differences.^{66,67} Moreover, access or lack of access to health and social care among ethnic minority populations will impact on health status and have social consequences.

Finally, the arrows linking consequences of obesity back to national contexts and social stratification are a characteristic of health inequities generally⁴⁵ and are clearly applicable to obesity.⁶⁸ As a socially stigmatized condition with multiple, adverse health effects, obesity threatens national health and economies when widespread and becomes itself an additional stratification variable.

Conclusion

Disproportionately high-obesity prevalence among native-born, indigenous, and migrant ethnic minority populations in majority white societies is hidden within national-level data—but is a critical dimension of the global obesity picture. The issue has gained prominence with increases in data collection on ethnic origins and through studies documenting the environmental rather than intrinsically biological nature of ethnic differences in obesity. Public health approaches should include a health equity focus, and health equity approaches should include a focus on obesity given the high and increasing levels of obesity worldwide, and the contribution of obesity to social disadvantage. Cross-national comparisons reveal common threads in pathways to obesity risk—each pathway worthy of in-depth study to be undertaken intersectionally, using a transdisciplinary perspective. The main drivers of inequities are social stratification processes, including racism, whether explicit in labeling or implicit in the visibility of not being white. Skin color and ethnic stratification are still rooted in social hierarchies as a basis for power relationships, notwithstanding conscious human rights or antiracism policies and practices designed to promote equity. Low SEP leads to adverse physical, economic, sociocultural, psychosocial, and biological contexts for those at the bottom of the ladder and is exacerbated by historical and ongoing exposure to racism, colonization, and discrimination. From a research and moral perspective, studies of effects of racism and other ethnic biases on health and obesity, and how to address them, are sorely needed.⁶⁹

Author statements

Acknowledgments

The author expresses appreciation to Dr. Christiaan B. Morsink and Professor Philip James for their feedback on prior versions of this manuscript.

Ethical approval

Not required. This is based on a review of the literature and does not include any data from human subjects.

Funding

This work was made possible with support from Washington University in St. Louis, Missouri, USA CDTR (Grant Number P30DK092950 from the NIDDK, National Institutes of Health, USA). The content is solely the responsibility of the authors and does not necessarily represent the official views of the CDTR or NIDDK.

Competing interests

None declared.

REFERENCES

- NCD Risk Factor Collaboration (NCD-RisC) – Africa Working Group. Trends in obesity and diabetes across Africa from 1980 to 2014: an analysis of pooled population-based studies. *Int J Epidemiol* 2017;46:1421–32.
- NCD Risk Factor Collaboration (NCD-RisC). Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19.2 million participants. *Lancet (London, England)* 2016;387:1377–96.
- NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies in 128.9 million children, adolescents, and adults. *Lancet (London, England)* 2017;390:2627–42.
- Amugsi DA, Dimbuene ZT, Mberu B, Muthuri S, Ezech AC. Prevalence and time trends in overweight and obesity among urban women: an analysis of demographic and health surveys data from 24 African countries, 1991-2014. *BMJ Open* 2017;7:e017344.
- World Health Organization. *Obesity and overweight*. Available at: <http://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>. [Accessed 16 February 2018].
- Rodgers A, Woodward A, Swinburn B, Dietz WH. Prevalence trends tell us what did not precipitate the US obesity epidemic. *Lancet Publ Health* 2018;3:e162–3.
- Roberto CA, Swinburn B, Hawkes C, Huang TT, Costa SA, Ashe M, et al. Patchy progress on obesity prevention: emerging examples, entrenched barriers, and new thinking. *Lancet (London, England)* 2015;385:2400–9.
- Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, Moodie ML, et al. The global obesity pandemic: shaped by global drivers and local environments. *Lancet (London, England)* 2011;378:804–14.
- Kumanyika S, Taylor WC, Grier SA, Lassiter V, Lancaster KJ, Morssink CB, et al. Community energy balance: a framework for contextualizing cultural influences on high risk of obesity in ethnic minority populations. *Prev Med* 2012;55:371–81.
- Whitehead M. The concepts and principles of equity and health. *Health Promot Int* 1991;6:217–28.
- Krasnik A, Bhopal RS, Gruer L, Kumanyika SK. Advancing a unified, global effort to address health disadvantages associated with migration, ethnicity and race. *Eur J Public Health* 2018;28.
- Race, Ethnicity, and Genetics Working Group. The use of racial, ethnic, and ancestral categories in human genetics research. *Am J Hum Genet* 2005;77:519–32.
- Lear SA, James PT, Ko GT, Kumanyika S. Appropriateness of waist circumference and waist-to-hip ratio cutoffs for different ethnic groups. *Eur J Clin Nutr* 2010;64:42–61.
- World Health Organization. *Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies*. *Lancet (London, England)* 2004;363:157–63.
- Labree LJ, van de Mheen H, Rutten FF, Foets M. Differences in overweight and obesity among children from migrant and native origin: a systematic review of the European literature. *Obes Rev* 2011;12:e535–47.
- Reeske A, Spallek J, Bammann K, Eiben G, De Henauw S, Kourides Y, et al. Migrant background and weight gain in early infancy: results from the German study sample of the IDEFICS study. *PLoS One* 2013;8:e60648.
- Willows ND, Hanley AJ, Delormier T. A socioecological framework to understand weight-related issues in Aboriginal children in Canada. *Applied physiology, nutrition, and metabolism = Physiologie appliquee. nutrition et metabolisme* 2012;37:1–13.
- World Health Organization. *Report of the commission on ending childhood obesity*. Geneva, Switzerland. 2016.
- Australian Bureau of Statistics. *Aboriginal and Torres Strait islander health survey: First results 2012-2013. Overweight and obesity*. November 2013. Available at: <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/A07BD8674C37D838CA257C2F001459FA?opendocument>.
- Canadian Institute for Health Information and Public Health and Public Health Agency of Canada. *Obesity in Canada*. Available at: https://secure.cihi.ca/free_products/Obesity_in_canada_2011_en.pdf; 2011.
- Hales CM, Fryar CD, Carroll MD, Freedman DS, Aoki Y, Ogden CL. Differences in obesity prevalence by demographic characteristics and urbanization level among adults in the United States, 2013-2016. *J Am Med Assoc* 2018;319:2419–29.
- New Zealand Ministry of Health. *Tier 1 statistics 2016/2017. New Zealand health survey. Annual data explorer*. 2018. Available at: https://minhealthnz.shinyapps.io/nz-health-survey-2016-17-annual-data-explorer/_w_e5196d0b/_w_6cb88ed7/#!/explore-indicators.
- Public Health England. *Adult obesity slide set*. August 2016. Available at: http://webarchive.nationalarchives.gov.uk/20170110165555/https://www.noo.org.uk/slide_sets.
- Schmengler H, Ikram UZ, Snijder MB, Kunst AE, Agyemang C. Association of perceived ethnic discrimination with general and abdominal obesity in ethnic minority groups: the HELIUS study. *J Epidemiol Community Health* 2017;71:453–60.
- U.S. Department of Health and Human Services. Centers for Disease Control and Prevention. *National Center for Health Statistics. Age-adjusted percent distribution (with standard errors) of body mass index among adults aged 18 years and over, by selected characteristics, United States, 2016. Summary health Statistics. National Health Interview Survey, 2016; 2016*. Available at: <https://www.cdc.gov/nchs/nhis/shs/tables.htm>.
- Anderson I, Robson B, Connolly M, Al-Yaman F, Bjertness E, King A, et al. Indigenous and tribal peoples' health (The Lancet-Lowitja Institute Global Collaboration): a population study. *Lancet (London, England)* 2016;388:131–57.
- Kumar BN, Meyer HE, Wandel M, Dalen I, Holmboe-Ottesen G. Ethnic differences in obesity among immigrants from developing countries, in Oslo, Norway. *Int J Obes* 2005;30(2006):684–90.
- Daviglus ML, Talavera GA, Aviles-Santa ML, Allison M, Cai J, Criqui MH, et al. Prevalence of major cardiovascular risk factors and cardiovascular diseases among Hispanic/Latino

- individuals of diverse backgrounds in the United States. *J Am Med Assoc* 2012;**308**:1775–84.
29. Delavari M, Sønderlund AL, Swinburn B, Mellor D, Renzaho A. Acculturation and obesity among migrant populations in high income countries – a systematic review. *BMC Public Health* 2013;**13**:458.
 30. Albrecht SS, Diez Roux AV, Kandula NR, Osypuk TL, Ni H, Shrager S. Immigrant assimilation and BMI and waist size: a longitudinal examination among Hispanic and Chinese participants in the multi-ethnic study of atherosclerosis. *Obesity (Silver Spring)* 2013;**21**:1695–703.
 31. Alidu L, Grunfeld EA. A systematic review of acculturation, obesity and health behaviours among migrants to high-income countries. *Psychol Health* 2018;**33**:724–45.
 32. Singh GK, Siahpush M, Hiatt RA, Timsina LR. Dramatic increases in obesity and overweight prevalence and body mass index among ethnic-immigrant and social class groups in the United States, 1976–2008. *J Community Health* 2011;**36**:94–110.
 33. Kumanyika S. Common threads in obesity risk among racial/ethnic and migrant minority populations. In: *National Academies of Sciences, Engineering, and Medicine. current status and response to the global obesity pandemic: proceedings of a workshop*. Washington, DC: The National Academies Press; 2019 (in press).
 34. Simon P. Collecting ethnic statistics in Europe: a review. *Ethn Racial Stud* 2012;**35**:1366–91.
 35. Simon P. The failure of the importation of ethno-racial statistics in Europe: debates and controversies. *Ethn Racial Stud* 2017;**40**:2326–32.
 36. Simon P, Beaujeu M. Mainstreaming and redefining the immigrant integration debate in old migration countries: a case study of France, the UK and The Netherlands. In: Scholten PWA, van Breuge I, editors. *Mainstreaming integration governance new trends in migrant integration policies in Europe*. New York, NY: Springer International Publishing; 2018. p. 25–46.
 37. Martinez O, Wu E, Sandfort T, Dodge B, Carballo-Dieguez A, Pinto R, et al. Evaluating the impact of immigration policies on health status among undocumented immigrants: a systematic review. *J Immigr Minority Health* 2015;**17**:947–70.
 38. Martinez O, Wu E, Sandfort T, Dodge B, Carballo-Dieguez A, Pinto R, et al. Erratum to: evaluating the impact of immigration policies on health status among undocumented immigrants: a systematic review. *J Immigr Minority Health* 2016;**18**:288.
 39. Viruell-Fuentes EA, Miranda PY, Abdulrahim S. More than culture: structural racism, intersectionality theory, and immigrant health. *Soc Sci Med* 2012;**75**:2099–106.
 40. Abubakar I, Aldridge RW, Devakumar D, Orcutt M, Burns R, Barreto ML, et al. The UCL-Lancet Commission on Migration and Health: the health of a world on the move. *Lancet (London, England)* 2018;**392**:2606–54.
 41. Jones CP. Levels of racism: a theoretic framework and a gardener's tale. *Am J Publ Health* 2000;**90**:1212–5.
 42. Braveman P. A health disparities perspective on obesity research. *Prev Chronic Dis* 2009;**6**:A91.
 43. Kumanyika S, Jeffery RW, Morabia A, Ritenbaugh C, Antipatis VJ. Obesity prevention: the case for action. *Int J Obes Relat Metab Disord* : J Int Assoc Study Obes 2002;**26**:425–36.
 44. Organization for Economic Development and Cooperation (OECD). *Obesity update*. 2017. 2017. Available at: www.oecd.org/health/obesity-update.htm.
 45. Solar O, Irwin A. *A conceptual framework for action on the social determinants of health. Social determinants of health discussion paper 2 (policy and practice)*. 2010.
 46. Swinburn B, Kraak V, Allender S, et al. The global syndemic of obesity, undernutrition, and climate change: the lancet commission report. *Lancet (London, England)* 2019;**392**:1–57 (in press).
 47. Lovasi GS, Hutson MA, Guerra M, Neckerman KM. Built environments and obesity in disadvantaged populations. *Epidemiol Rev* 2009;**31**:7–20.
 48. Loring B, Robertson A. *Obesity and Inequities in Europe. Guidance for addressing inequities in overweight and obesity*. 2014.
 49. McLaren L. Socioeconomic status and obesity. *Epidemiol Rev* 2007;**29**:29–48.
 50. Molarius A, Seidell JC, Sans S, Tuomilehto J, Kuulasmaa K. Educational level, relative body weight, and changes in their association over 10 years: an international perspective from the WHO MONICA Project. *Am J Publ Health* 2000;**90**:1260–8.
 51. Ogden CL, Fakhouri TH, Carroll MD, Hales CM, Fryar CD, Li X, et al. Prevalence of obesity among adults, by household income and education - United States, 2011–2014. *MMWR Morb Mortal Wkly Rep* 2017;**66**:1369–73.
 52. American Psychological Association. *APA Working Group on Stress and Health Disparities. Stress and health disparities: contexts, mechanisms, and interventions among racial/ethnic minority and low-socioeconomic status populations*. 2017. Retrieved from, <http://www.apa.org/pi/health-disparities/resources/stress-report.aspx>.
 53. Adam TC, Epel ES. Stress, eating and the reward system. *Physiol Behav* 2007;**91**:449–58.
 54. Bjorntorp P. Do stress reactions cause abdominal obesity and comorbidities? *Obes Rev* 2001;**2**:73–86.
 55. Groesz LM, McCoy S, Carl J, Saslow L, Stewart J, Adler N, et al. What is eating you? Stress and the drive to eat. *Appetite* 2012;**58**:717–21.
 56. Ravussin E, Valencia ME, Esparza J, Bennett PH, Schulz LO. Effects of a traditional lifestyle on obesity in Pima Indians. *Diabetes Care* 1994;**17**:1067–74.
 57. Agyemang C, Kunst A, Bhopal R, Zaninotto P, Nazroo J, Nicolaou M, et al. Dutch versus English advantage in the epidemic of central and generalised obesity is not shared by ethnic minority groups: comparative secondary analysis of cross-sectional data. *Int J Obes* 2005;**35**(2011):1334–46.
 58. Agyemang C, Meeke K, Beune E, Owusu-Dabo E, Mockenhaupt FP, Addo J, et al. Obesity and type 2 diabetes in sub-Saharan Africans - is the burden in today's Africa similar to African migrants in Europe? The RODAM study. *BMC Med* 2016;**14**:166.
 59. Luke A, Cooper RS, Prewitt TE, Adeyemo AA, Forrester TE. Nutritional consequences of the African diaspora. *Annu Rev Nutr* 2001;**21**:47–71.
 60. Valera B, Sohani Z, Rana A, Poirier P, Anand SS. The ethnoepidemiology of obesity. *Can J Cardiol* 2015;**31**:131–41.
 61. James WPT, Johnson RJ, Speakman JR, Wallace DC, Frühbeck G, Iverson PO, Stover PJ. Nutrition and its role in human evolution. *J Intern Med* 2019 (in press).
 62. Craig P. Obesity and culture. In: Kopelman PCI, Dietz W, editors. *Clinical obesity in adults and children*. 3rd edn. New Jersey: Wiley-Blackwell Publishing; 2009. p. 41–57.
 63. Murphy M, Robertson W, Oyebo O. Obesity in international migrant populations. *Curr Obes Rep* 2017;**6**:314–23.
 64. Adler NE, Stewart J. Reducing obesity: motivating action while not blaming the victim. *Milbank Q* 2009;**87**:49–70.
 65. Grier SA, Kumanyika S. Targeted marketing and public health. *Annu Rev Public Health* 2010;**31**:349–69.
 66. Egan M, Kearns A, Katikireddi SV, Curl A, Lawson K, Tannahill C. Proportionate universalism in practice? A quasi-experimental study (GoWell) of a UK neighbourhood renewal programme's impact on health inequalities. *Soc Sci Med* 2016;**152**:41–9.
 67. Kumanyika S. *Getting to equity in obesity prevention. A new framework*. NAM Perspectives. Washington, DC: National

- Academy of Medicine; 2017. <https://doi.org/10.31478/201701c>. Discussion Paper.
68. Devaux M, Sassi F. *The labour market impacts of obesity, smoking, alcohol use and related chronic diseases*. Paris: OECD Publishing; 2015. OECD Health Working Papers, No. 86, <https://doi.org/10.1787/5jrqn5fpv0v-en>.
69. Williams DR, Lawrence JA, Davis BA. *Racism and health: evidence and needed research*. *Annu Rev Public Health*; 2019.