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Structural Racism, Lifestyle Behaviors, and Obesity-Related Cancers among Black and Hispanic/Latino Adults in the United States: A Narrative Review

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Abstract

One in three adults in the United States has obesity; a chronic disease that is implicated in the etiology of at least 14 cancers. Cancer is the leading cause of death among U.S. Hispanic/Latino adults and the second most common cause of death, after cardiovascular disease, for Black adults. Our country's legacy in overt discrimination (e.g., slavery, segregation) generated inequities across all spheres in which people function as defined by the socio-ecological model – biological, individual, community, structural– and two of the many areas in which it manifests today are the disproportionate burden of obesity and obesity-related cancers in populations of color. Inequities due to environmental, social, and economic factors may predispose individuals to poor lifestyle behaviors by hindering an individual's opportunity to make healthy lifestyles choices. In this review, we examined the evidence on obesity and the lifestyle guidelines for cancer prevention in relation to cancer risk and outcomes for Black and Hispanic/Latino adults. We also discussed the role of structural and societal inequities on the ability of these two communities to adopt and maintain healthful lifestyle behaviors in accordance with the lifestyle guidelines for cancer prevention and control.

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Keywords

Structural racism; Lifestyle guidelines; Obesity related cancers; Cancer health disparities; Black/African American; Hispanic/Latino; Neighborhood deprivation

Introduction

Obesity has been established in the etiology of at least 14 cancers (1–3) and is eclipsing other preventable causes like tobacco as the leading cause of cancer. (4) These obesity-related cancers include meningioma, multiple myeloma, esophagus (adenocarcinoma), thyroid, postmenopausal breast, gallbladder, stomach cardia, liver, pancreas, kidney (renal cell carcinoma), ovaries, uterus, colon and rectum (colorectal) (2), with mixed evidence for advanced/fatal prostate cancer. (5,6) There are important variations in the incidence rates of obesity-related cancers across racial and ethnic groups. (7–9) For cancers of the colon, rectum, kidney, liver, prostate, stomach, and uterus, Black and/or Hispanic/Latino adults have higher incidence rates relative to White adults. (10)

Cancer is the leading cause of death among U.S. Hispanic/Latino adults (11) and the second most common cause of death, following cardiovascular disease, for Black adults. (10,12) As of 2022, Black men had a 19% higher cancer mortality and Black women had a 12% higher risk of death from cancer, relative to White adults. (7) Similarly, Black and/or Hispanic/Latino communities also experienced a greater mortality rate for some obesity related cancers (e.g., breast, colon, rectum, kidney, liver, prostate, stomach, uterine, thyroid, pancreas, multiple myeloma) compared to White adults. (8) Furthermore, the increasing incidence and death rates of certain less common obesity-related cancers, such as multiple myeloma and cancers of the liver, stomach, thyroid, pancreas, and uterus among Black and Hispanic/Latino communities is noteworthy. (7–9)

Based on the 2017–2018 National Health and Nutrition Examination Survey (NHANES) estimates (13), the overall age-adjusted prevalence of obesity was 42% among all U.S. adults. When stratified by race, ethnicity, and gender, Black (56.9%) and Hispanic/Latino (43.7%) women experienced the greatest prevalence relative to White (39.8%) and Asian (17.2%) women. Among men, similar obesity prevalence (defined as BMI ≥ 30 kg/m^2) were observed for Black (41.1%), Hispanics/Latino (45.7%), and White (44.7%) adults, but not Asian (17.5%) men. (13) However, there are differences in more extreme categories of obesity. For example, NHANES estimates from 2005–2014 showed differences in the age-adjusted prevalence of severe obesity (BMI ≥ 40 kg/m^2) for racial and ethnic groups by gender: Black (All: 12.4%; Men: 7.2%; Women: 16.8%), Hispanics/Latino (All: 7.1; Men: 5.4%; Women: 8.7%), White (All: 7.6%; Men: 5.6%; Women: 9.7%), and Asian (All: 2.0%; gender breakdown not reported). (14) Recent estimates for trends in severe obesity have not been reported separately by gender. (13)

Studies of obesity among populations with and without a history of cancer paint a stark picture. Approximately 36% and 33% of all cancer survivors in the United States (U.S.) in 2019 were overweight (body mass index (BMI) ≥ 25 kg/m^2) or had obesity (BMI ≥ 30 kg/m^2), respectively. (15) The prevalence of obesity varies across race, ethnicity, and

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gender as well as by cancer history. (12,16) As obesity continues to rise among U.S. adults, the disproportionate burden in communities of color has been magnified. Between 1997 and 2014, trend analyses using data from the US National Health Interview Survey (NHIS) documented rapidly increasing obesity rates among individuals in the US with a history of cancer relative to those with no history of cancer, with the largest annual increases observed among Black adults, women, and breast and colorectal cancer survivors. (16) According to 2014 NHIS data, there was a significantly higher burden of obesity among Black and Hispanic/Latino cancer survivors compared to their counterparts with no history of cancer and even White adults with a history of cancer. (16) While the data are older, another analysis of the 2009 Behavioral Risk Factor Surveillance System (BRFSS) found a large difference in obesity prevalence among cancer survivors of Hispanic/Latino (47%) and Black (47%) ancestry compared to those of White (30%) ancestry. (17) Of note, a limitation of the cited obesity studies conducted among cancer survivors is that those survivors completing cross-sectional surveys are healthier overall, which may correlate with better energy balance (i.e., less obesity through better diet and more physical activity) such that in a more general sample of cancer survivors these behaviors may be worse. Nonetheless, a prospective analysis from the Framingham Heart Study among 6,197 adults followed for 24 years, showed that obesity and severe obesity were associated with up to a two-fold increase in all-cause mortality (BMI of 20 to <35: Hazard Ratio 1.2, 95% Confidence Interval (CI): 1.14–1.41; BMI of 35 to <40: HR 1.93, 95% CI: 1.68–2.20). A pooled analysis of 20 prospective cohorts, showed that adults with BMI of 40–60 have an estimated 6.5–13.7 years of life lost compared to adults of normal BMI (BMI of 40–44.9: 6.5 (95% CI: 5.7–7.3), BMI of 45–49.9: 8.9 (95% CI: 7.4–10.4), BMI of 50–54.9: 9.8 (95% CI: 7.4–12.2), and BMI of 55–59.9: 13.7 (95% CI: 10.5–16.9)). (18) Among cancer survivors, similar findings have been noted (19). Obesity has been linked to higher overall mortality (HR 1.14, 95% CI: 1.09–1.19), cancer specific mortality (HR: 1.17, 95% CI: 1.12–1.23), and cancer recurrence (HR 1.13, 95% CI 1.07–1.19) (19). Studies of cancer-free adults stratified by race and ethnicity document mixed findings for the link between BMI and mortality including null and inverse associations among Hispanic/Latino adults (20), and positive associations among Black and White adults. (21)

Materials and Methods

This narrative review aims to place the literature on energy balance (via adherence to the obesity, diet, and physical activity recommendations) and obesity related cancer risk and outcomes within the context of structural racism at the neighborhood level. While most research included in this review focuses on Black and Hispanic/Latino adults given the vast underrepresentation of racially minoritized groups in cancer research, literature in predominantly White cohorts was also discussed when relevant. We chose a narrative review format because of its inherit nature that enables us to “link together many studies on different topics, either for purposes of reinterpretation or interconnection…[as] a valuable theory building technique [that] may also serve hypothesis generating functions,” as described by Baumeister and Leary. (22,23) Therefore, formal guidelines for systematic reviews were not followed. (24)

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In alignment with this goal, we identified studies via PubMed and Google Scholar searches using various combinations of the following terms: “Black/African American”, “Hispanic/Latino”, “cancer risk”, “cancer mortality”, “cancer outcomes”, “structural racism”, “neighborhood deprivation”, “neighborhood segregation”, “lifestyle behaviors”, “lifestyle interventions”, “cancer prevention guidelines,” and “cancer care” in January 2020. The search was repeated in November 2021 and in October 2022, with newly published studies added. Reference lists for all included studies were also cross checked for additional relevant studies.

Data Availability Statement

Data sharing is not applicable to this article as no data were created or analyzed in this study.

Results

The Role of Structural Racism

Our country’s legacy in overt discrimination (e.g. slavery, segregation) has generated inequities across all spheres of the socio-ecological model (25) in which people function – biological (i.e. biological /genetic pathways, biological responses), individual (i.e., individual risk behaviors, individual demographics), community (i.e., social relationships, social context), structural (i.e., neighborhood, built environment), and societal (i.e., institutional context, social conditions, policies). Two of the many areas in which it manifests today are the disproportionate burden of obesity and obesity-related cancers in communities of color. (26–29) Beyond individual level factors, factors at the community (30,31) and structural (31–38) levels may predispose individuals to poor lifestyle behaviors (39), often by hindering an individual’s opportunity to make healthy lifestyles choices. (40)

Another manifestation of structural racism regards access to medical care, utilization of healthcare, and the quality of that care, which may explain many of the poor health outcomes observed in populations of color. Limited access to quality medical care among communities of color has its roots in both segregation and medical apartheid. (41,42) Segregation redistributed medical resources and access to hospitals and physicians to predominantly White neighborhoods. Medical apartheid then exacerbated access by restricting care for Blacks to certain hospitals on the basis of race. (42) Today, medical apartheid manifests itself through payer-based systems that decrease access to high quality medical care at elite institutions based on insurance status and type of insurance. (41) The downstream consequences of intersecting marginalized identities—including, but not limited to, racial and ethnic identity and often lower socio-economic position—can serve as mechanisms by which structural discrimination results in increased disease risk and contributes to poor outcomes observed throughout the cancer continuum—diagnosis, treatment, and survivorship. Black and Hispanic/Latino adults are more likely to be under-insured, covered by Medicaid, or lack insurance. (43–46) A study of Medicaid patients found that patients were less likely to establish a new appointment at randomly selected cancer centers. (47) Data also suggest Black and Hispanic/Latino adults have less access to cancer screening (48,49), may be less likely to obtain timely referrals for cancer specialists (50,51) and cancer treatment (52), less likely to receive care at high quality cancer care

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facilities (e.g., accreditation, high hospital/provider volume) (47,53,54), and are more likely to experience fragmented care (55) given limited services at lower-quality facilities. In turn, these factors are associated with poorer cancer prognosis (43,46) at diagnosis and treatment delays. (56–59) The COVID pandemic further exacerbated access to timely diagnosis and cancer treatment among Black and Hispanic/Latino communities. (26,60) In addition to structural racism, individuals of Hispanic/Latino ancestry and immigrant populations face discrimination. Factors such as lack of policies on immigration, stigma, policing and fear due to documentation status, as well as language barriers overlay the larger structural discrimination, creating substantial barriers for Hispanic/Latino communities to access care and resources that enable healthful lifestyles (34,35), including access to cancer care at high quality cancer centers. (47)

Structural racism has led to a health aversive context concerning where people live and has been influenced by historic and more recent mechanisms of discrimination, such as legal and non-legal redlining across housing, education, retail, and public services. (61–65) These conditions have concentrated poverty in neighborhoods with a high density of Black and Hispanic/Latino individuals. In 2018, Black and Hispanic/Latino adults were more than twice as likely to live in poverty compared to their White counterparts (20.8%, 17.6%, and 8.1%, respectively). (66) Neighborhoods with high poverty are more likely to have low-quality built environments which in turn, is a major determinant of engagement in cancer preventive behaviors and cancer risk and outcomes. Structural racism at the neighborhood-level (e.g., historical redlining, neighborhood segregation, neighborhood deprivation) has been directly linked to adverse cancer risk and outcomes in Black and Hispanic/Latino communities across several obesity-related cancers. (67,68) A systematic review of 24 studies on neighborhood socioeconomic status (SES) and various outcomes along the cancer continuum suggest inconsistent relationships for Black and Hispanic/Latino adults compared to White adults. (69) Across studies, higher neighborhood SES was linked to lower overall cancer incidence in White adults, but not in Black or Hispanic/Latino adults. For cancer specific incidence, the authors reported that high neighborhood SES was linked to increased breast and colorectal cancer incidence, although a clear pattern of association between neighborhood SES and cancer survival was not seen primarily due to limited evidence. In a 2017 study incorporating data from three sources (the National Mortality Database, the 1979–2011 National Longitudinal Mortality Study (NLMS), and the Surveillance, Epidemiology, and End Results (SEER) cancer registry database), Singh and Jemal examined the link between temporal individual/neighborhood SES disparities between 1950 and 2013 and U.S. mortality, incidence and survival rate from overall cancers and major cancers. (70) For Black and White adults, residence in more affluent neighborhoods was associated with a 36% higher incidence rate of prostate cancer for men and a 47% higher incidence of female breast cancer. (70) Residence in neighborhoods with greater deprivation was linked to higher incidence of stomach, liver, and esophageal cancers. (70) The 5-year survival rates for adults in the most deprived vs. least deprived neighborhoods by race and ethnicity were: Black (46% vs. 61%), Hispanic (56% vs. 66%), and White (51% vs. 66%). (70) When examined by site, adults residing in the most vs. least deprived areas experienced worse survival for colorectal cancer (60% vs. 48.4%), prostate cancer (81% vs. 66%), and female breast cancer (81% vs. 62%). (70) In adjusted analysis, residence in

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neighborhoods with low SES ($1^{st}-5^{th}$ decile) was associated with a 15% to 29% increased risk of death from colorectal cancer for both men and women combined, a 26% to 57% higher risk of death from prostate cancer, and 35% to 68% higher risk of death from female breast cancer, relative to residence in the most affluent neighborhoods (10^{th} decile). (70)

The link between high neighborhood SES and higher incidence of common obesity-related cancers like breast, prostate, and colorectal cancer provides some evidence of the protective role of increased neighborhood resources to engage in lifestyle and cancer screening recommendations. However, it is important to note that Black and Hispanic/Latino communities do not benefit from increased neighborhood SES to the same extent as White adults. For example, in their systematic review, Sorice et al. noted that their cancer incidence findings for minoritized groups were attenuated compared to that in White adults likely because of other factors related to structural racism and discrimination within the healthcare system (i.e., patient provider relationships, decision making and access to treatments, healthcare utilization), regardless of patient's individual SES or area of residence. (69)

Structural racism may directly modulate biological and physiological pathways through continuous exposure to racism and discrimination, independent of factors at the neighborhood or individual level. The theories of weathering (71,72) and allostatic load (73–75) help us understand how the context in which Black and Hispanic/Latino people live, function, and receive their medical care impacts biological and physiological processes. For example, exposure to racism and discrimination has been shown to influence numerous biological processes (67,76,77) (e.g., systemic inflammation, metabolic and endocrine dysregulation, immune suppression, DNA methylation, oxidative stress, the microbiome) (Figure 1). In turn, these biological responses may contribute to a greater burden of chronic illnesses like hypertension, diabetes, and metabolic syndrome among people of color that increase risk of cancer development and prognosis or influence cancer development directly. (78,79) For example, studies have shown that the link between neighborhood deprivation and aggressive/ lethal breast (80) or prostate cancer (67) may be through modulation of immune and inflammatory pathways that enhance a tumor's ability for local and distant metastasis.

Role of Structural Racism on Adherence to the Lifestyle Guidelines for Cancer Prevention and Control

The American Cancer Society (ACS) has been publishing lifestyle guidelines for cancer prevention since 1984. (81) The most recent iteration of the guidelines was published in 2020 (82) and recommended that individuals maintain a healthy weight throughout life, engage in at least 150–300 minutes of moderate to vigorous physical activity per week, limit sedentary behaviors (i.e. sitting, lying down, watching TV or screen based entertainments), increase intake of fruits, vegetables, and whole grains while limiting intake of red and processed meats, sugar-sweetened beverages, highly processed foods, refined grain products, and alcohol (Box 1). The World Cancer Research Fund/American Institute of Cancer Research's (WCRF/AICR) Third Expert Report on *Diet, Nutrition, Physical Activity and Cancer: A Global Perspective* (83) highlighted independent associations between obesity, some diet components, physical activity and risk of certain cancers (Box

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1). WCRF/AICR also developed ten cancer prevention recommendations, of which, three currently do not overlap with ACS's guidelines, which include guidelines against use of supplements, breastfeeding among mothers, and recommendations for cancer survivors (https://www.aicr.org/cancer-prevention/). Wang et al. estimated that suboptimal diets were responsible for 3.04 million new cancer cases and 1.74 million cancer deaths, with racially minoritized and low-income groups having higher diet-attributable cancer burden than their counterparts. (84) Despite ample evidence that quality nutrition and physical activity may be important for cancer risk and outcomes, data suggest that Black and Hispanic/Latino adults may not be adherent to these recommendations, in part because quof structural racism at the neighborhood level.

Adverse built and obesogenic environments are more common in neighborhoods with a high proportion of racial/ethnic minoritized groups and low-income areas (85–87), thereby limiting opportunities to choose and engage in healthy behaviors concordant with the lifestyle guidelines for cancer prevention and control. Disadvantaged neighborhoods have high rates of fast-food chains and stores (88), limited access to supermarkets/grocery stores with healthy food (89), and when available, fresh produce and higher quality foods are often unaffordable. (90,91) Low SES neighborhoods are more likely to lack safe, walkable, bikeable infrastructure for physical activity, resulting in built environments that deter residents from recreational physical activity and exercise. (92) These structural inequities in access at the neighborhood level likely exacerbate cancer disparities in Black and Hispanic/Latino communities. (93) Our group is the first to examine how social neighborhood environment was related to ACS guideline adherence (94–96); although two of these studies were limited by power to detect interactions. So far, we have found that neighborhood socioeconomic status was not an effect modifier of the relationship between ACS guideline adherence and obesity-related cancer outcomes among Black and Hispanic/Latino adults and that neighborhood segregation may not be directly related to overall adherence to the ACS scores (94,95), but may influence components of the guidelines independently and in opposing directions. (96)

In a large study of cancer-free Hispanic/Latino adults, researchers observed a direct association between residence in areas with greater racialized economic segregation (higher privilege (e.g., more White and more affluent)) and adherence to overall ACS guideline (Risk Ratio: 1.94, 95% CI: 1.01–3.70) and increased likelihood of meeting BMI recommendations moderately (RR: 1.75, 95% CI: 1.14–2.71) or highly (RR: 2.08; 95% CI: 1.18–3.67). (96) Hispanic/Latino residents of neighborhoods with greater racial/ethnic isolation (exposure segregation) had a lower likelihood of meeting the alcohol recommendations (moderate adherence RR: 0.86, 95% CI: 0.75–0.98; high adherence RR: 0.90, 95% CI: 0.78–1.04) and physical activity recommendations (high adherence RR: 0.73, 95% CI: 0.57–0.94), but a higher likelihood of meeting the dietary recommendations (moderate adherence RR: 1.07, 95% CI: 1.01–1.14)). (96) Other studies have reported that residence in segregated neighborhood environments was associated with lower odds of exercise and higher odds of obesity among Black (97,98) and/or Hispanic/Latino cancer-free adults. (97,99)

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As a result, there is a documented low rate of guideline adherence in Black and Hispanic/Latino communities without a cancer history. Among Black and Hispanic/Latino cancer-free adults, studies estimate that only between 5.4% and 14% of individuals adhere to all the lifestyle cancer prevention guidelines and about 25% adherence to three and 40% adhere to four of the six recommendations (100–103), with several studies reporting low adherence to individual diet, physical activity and BMI recommendations (studies in Hispanic/Latino (104–106) and Black (103,107) adults). Our recent work in two large prospective cohorts has helped to further illuminate adherence to the ACS cancer prevention guidelines among cancer-free Black and Latino adults. Among 9,204 Hispanic/Latino older adults in the NIH-AARP Diet and Health Study, we documented that at start of the cohort just 12% of cancer-free adults had behaviors that were considered highly adherent with the ACS guidelines and when examined by components, few adults were meeting the individual recommendations (percent meeting recommendations for diet: 13%, alcohol: 31%, BMI: 31%, physical activity: 17%). (95) The proportion of cancer-free Black and Hispanic/Latino women at the start of Women's Health Initiative who were considered highly adherent to the ACS guidelines was even lower, 8.7% out of 9,297 Black women and 8.3% out of 4,215 Hispanic/Latino women. McCullough et al conducted a cross-sectional analysis of diet quality measured by concordance with the 2020 ACS recommendations for cancer prevention score among 155,331 adults participating in the ACS's Cancer Prevention Study-3 cohort, and found that Black adults had an increased risk of poor diet quality (HR: 1.16, 95% CI: 1.08–1.25) while Hispanic/Latino adults had a lower risk (HR: 0.0.84, 95% CI: 1.12–1.21), although only the relationship for Hispanic/Latinos remained significant after inclusion of additional covariates. (108) Adults with residence in rural areas (HR: 1.61, 95% CI: 1.48–1.75) and in food desert (HR: 1.17, 95% CI: 1.12–1.22) reported a higher risk of poor diet quality. (108) In analysis of 16,462 diverse adults, ages 18–74, enrolled in the Hispanic Health Community Study/Study of Latinos (HCHS/SOL), Pichardo et al. found that approximately 28% had overall lifestyle behaviors considered highly concordant with the ACS guidelines. (96) The higher reported proportion of adults adherent to the ACS guidelines in the HCHS/SOL cohort may be explained by the cohort's younger age distribution, diversity in Hispanic/Latino background, the use of highly reliable and validated dietary scales that account for cultural and traditional foods found across Hispanic/Latino communities, as well as the use of objectively measured physical activity (for example, it is known that Hispanic/Latino adults are more likely to engage in non-recreatation moderate-vigorous physical activity stemming from higher rates of blue collar work- and commute/transportation- related physical activity than leisure time physical activity. (109)

Recommendations have also been developed for cancer survivors and include nutrition assessment at the time of diagnosis, as well as recommendations for long term survival (110). Recent recommendations also suggest incorporating physical activity at the time of diagnosis (111). Structural determinants of lifestyle guideline adherence among cancer survivors are likely similar to that of cancer-free individuals. Cancer survivors may experience additional barriers related to their chronic disease that prevent engagement in lifestyle behavior change including a lack of time, willpower, enjoyment from exercise, knowledge regarding disease specific side effects or on how to exercise, skills, equipment,

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and good physical health. (112,113) Perceptions, such as the belief of already doing enough exercise, as well as experiencing post treatment side effects (e.g. lymphedema, bone and joint pain, depression, self-motivation), have been reported as barriers. (114) Lack of encouragement from family and friends and lack of counseling from healthcare providers. (115–123) Support from friends, family and health professionals have been identified as facilitators to behavior change. (124–127) In a qualitative study of 26 Black and Hispanic/Latino female breast cancer survivors and 10 oncology health care providers, inconsistent sources of information, cancer information overload, the rapidly changing evidence, and gaps in the current evidence that contributed to non-cancer specific messaging about lifestyle behaviors were identified as major structural level barriers to behavior change after diagnosis. (123)

An analysis of the 2005–2010 NHIS found a high prevalence of non-adherence to the guidelines among Hispanic/Latino and Black adults who self-reported a history of cancer: for fruits (83% and 88%, respectively, were non-adherent), for vegetables (82.7% and 91.4%, respectively), for fiber (94% and 83%, respectively), for added sugars (63% and 69%, respectively), for physical activity (16% and 16%, respectively), and overweight or obesity (75% and 76%, respectively). (128) An analysis of the 2009 BRFSS survey data also found differences by race/ethnicity for adherence to individual components of the cancer prevention guidelines among cancer survivors. (17) Compared to White survivors, Black and Hispanic/Latino survivors had slightly higher adherence to the fruit and vegetable guidelines (26% vs. 27% and 29%, respectively), but significantly lower adherence to the physical activity (49% vs. 34% and 43%, respectively) and obesity (30% vs. 47% and 47%, respectively) guidelines. (17) In studies of smaller cohorts of Black and Hispanic/Latino cancer survivors enrolled in clinical trials or found through retrospective chart reviews, researchers have observed high adherence (78% to 95%) for individual recommendations on red and processed meat or alcohol, but low adherence to diet (32%), physical activity (21%) and BMI recommendations (25% to 70%). (106,107,128–130) In a recent study among U.S. Hispanic/Latino adults, Pichardo et al. reported ACS guideline adherence levels by cancer history status, with a higher proportion of adults without a history of cancer considered to have high (97.5%) vs. low (96.5%) adherence to the guidelines; while for cancer survivors the opposite was true, a greater proportion were classified as low (5.6%) vs. highly (2.5%) adherent to these guidelines ($p<0.001$). (96)

The Link between Adherence to Cancer Prevention Guidelines and Cancer Risk and Mortality

Additional research has evaluated adherence to the lifestyle guidelines in relation to cancer risk, cancer-related mortality, and all-cause mortality. Achieving a healthy BMI through overall healthy lifestyle choices—whether measured according to the ACS or the WCRF scoring systems— has been associated with significantly lower risk of developing cancer, as well as lower cancer-specific mortality and all-cause mortality. A meta-analysis of 12 studies in predominantly White populations found a 10%–61% reduction in overall cancer incidence and reductions in cancer mortality for cohorts of men and women combined (24% to 52%) and separately by gender (20–24% reduction in women and 24 to 30% reduction in men), who maintained an overall healthy lifestyle (i.e., higher guideline adherence) relative

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to those who did not. (131) For specific cancer sites, the authors observed reductions in risk of breast cancer (19% to 60%), endometrial cancer (23% to 60%) in women, and colorectal cancer for both men and women (27% to 52%) who maintained an overall healthy lifestyle (i.e., higher guideline adherence) relative to those who did not. (131) A 2015 study by Kabat et al. in the full NIH-AARP Diet and Health Study cohort (N= 566,401 adults) found that high ACS guideline adherence was associated with a 10% to 19% reduction in overall cancer risk and risk of 14 out of 25 specific cancer sites (esophagus, stomach, small intestine, colon, rectum, liver, gallbladder, pancreas, breast, endometrium, bladder, kidney, lung, and leukemia) compared to low guideline adherence. (132) A 2023 study by Pichardo and colleagues among 9,204 Hispanic/Latino adults enrolled in the NIH-AARP Diet and Health Study, found a 24% lower risk of developing an obesity-related cancer over a 10.5-year period among adults whose lifestyle behaviors were highly adherent with the ACS cancer prevention guidelines versus those with low guideline adherence (subdistribution hazard: 0.76, 95% CI: 0.58–0.996, P = 0.047, P trend = 0.039). (95)

In 2014, Thomson et al. evaluated 65,838 postmenopausal women in the Women's Health Initiative (WHI) and found high ACS guideline adherence was associated with a 17% lower risk of overall cancer (HR: 0.83, 95% CI: 0.75–0.92), with the strongest associations (based on larger coefficient change) observed for Hispanic/Latino (47%) women compared to Black (33%), White (12%), or Asian (19%) women. (100) In another recent analysis among 9,301 Black and 4,221 Hispanic/Latino postmenopausal women in WHI with additional follow-up (up to 24 years), there was a strong association between high adherence to the ACS guidelines and obesity-related cancer risk. (94) Pichardo et al. found that high ACS guideline adherence was associated with a lower risk of obesity related cancers: 28–29% for Black women (HR: 0.72, 95% CI: 0.55–0.94) and 41–42% for Hispanic/Latino women (HR: 0.58, 95% CI: 0.36–0.93), as well as a lower risk of less common obesity-related cancers (cancers linked to obesity excluding breast, endometrial): 31% for Black and 63% for Hispanic/Latino women, P trend = 0.025. (94)

Consistent with these findings, a 2016 study by Warren Andersen et al. using data from the Southern Community Cohort Study (SCCS), of 25,509 majority Black participants without chronic disease at baseline, who were of low socio-economic status, found that participants meeting three or four vs. zero ACS guidelines had 7%−45% lower cancer risk (HR: 0.70, 95% CI: 0.51–0.97, HR: 0.55, 95% CI: 0.31–0.99, respectively). (107) The stronger cancer risk reduction in Black and Hispanic/Latino individuals suggests that lifestyle interventions focused on increasing guideline adherence have the potential to modify cancer risk more robustly in this population. However, randomized lifestyle trials that evaluate intervention efficacy among Black and Hispanic/Latino cancer survivors are limited *(to be discussed later*). (133)

Several studies examining mortality have found mixed results. In a study by Kabat et al. inverse associations between guideline adherence and all-cause mortality (men HR: 0.74, 95% CI: 0.72–0.76); women HR 0.67, 95% CI: 0.65–0.70) and cancer-specific mortality (men HR: 0.75, 95% CI: 0.70–0.80); women HR 0.76, 95% CI: 0.70–0.83) in non-racially stratified analyses were reported. (132) Similarly, in the WHI study by Thomson et al, pre-diagnosis high guideline adherence was associated with a reduced risk of all-cause

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mortality (Black: −44%; Hispanic/Latino: −39%; White: −27% [referent]; women), with a non-significant reduction in cancer-specific mortality (Black: −23%; Latina: −40%; White: −19% [referent] women). (100) On the contrary, in a recent analysis by Pichardo et al., no associations were observed between pre-diagnosis guideline adherence and all-cause mortality for Black women (moderate adherence HR: 1.17, 95% CI: 0.91–1.52; high adherence HR: 0.86, 95% CI: 0.53–1.39, P trend = 0.801) or Latina women (moderate adherence HR: 1.04, 95% CI: 0.64–1.70; high adherence HR: 0.81, 95% CI: 0.32–2.06, P trend = 0.833). (94) These two analyses in WHI are difficult to compare directly as they used different statistical methods and mortality outcomes (cause-specific versus all-cause) and the most recent paper had considerably longer follow-up time. Additionally, studies examining longitudinal behavior change as well as post-diagnosis behavior may be important to fully understand associations between lifestyle factors and mortality outcomes in cancer survivors.

Lifestyle Interventions to Improve Adoption and Maintenance Healthy Behaviors

Many lifestyle interventions to promote weight loss, behavior change, and improvements in obesity related co-morbidities, have been conducted in cancer-free populations of Black and Hispanic/Latino adults. However, there are significant limitations across many of these studies that may prevent success of the intervention itself or long-term adoption of the behavior changes elicited. Reviews of these interventions highlight a range of barriers that may limit the success of the weight loss program, such as focusing on just one level of the socioecological model (134,135), not incorporating a randomized study design (135,136), having small sample sizes or limited to power (135–137), the duration of the intervention not being sufficient to enable behavior change (135,137), questionable role of cultural adaptations (135,138,139), and even in well-designed trials, racially minoritized groups tend to lose less weight than their non-minority counterparts. (135,140) A large gap remains in terms of access to lifestyle interventions among communities of color. In a large systematic review of 124 studies by the U.S. Preventive Services Task Force to identify interventions for weight loss (behavior based (n=80), maintenance (n=9), or medication based (n=35)), just 11 specifically focused on racial minority groups, highlighting the vast under representation and inequities that persist for minority communities to access and engage in weight loss programming. (141) Despite the extensive limitations in the current body of work on lifestyle behavior interventions, the majority of researchers agree on the need to conduct multi-systems and multi-level programming to target obesity in medically at risk minoritized communities. (134,135,142–144)

Among cancer survivors, the oncology community has targeted healthy lifestyle via instituting comprehensive survivorship care, provider-based counseling, and increasing access to lifestyle interventions and programs after diagnosis. There are many diet and physical activity interventions among cancer survivors that have been effective in improving body weight, physical activity, and dietary intake and quality (145,146) as well as cancer outcomes. (147,148) Helping survivors of color adopt and maintain healthy lifestyles requires intervening across the multidimensional forces that influence their lives after a cancer diagnosis and ensuring that interventions address barriers and leverage facilitators for behavior change that have been identified. There is a rapidly growing body of lifestyle

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intervention literature in Black and Hispanic/Latino cancer survivors. (133) However, most of these interventions focused on providing lifestyle counseling and limited resources are often not available to participants beyond the study's duration. Because lifestyle interventions often focus on individual level changes and may not account for various forms of systematic or structural discrimination, it is not surprising that few interventions observe long-term maintenance of behavior changes. Understanding what factors, beyond those at the individual level, contribute to survivors' ability to engage and maintain behavior change goals long-term will be critical to eliminate cancer inequities. (149)

Discussion

There is a need for research and interventions that place energy balance and obesity related cancer risk and outcomes within a socio-ecological model framework—biological, individual, community, structural, and societal (25) and in the context of structural racism. (26) There is mounting evidence on the role of structural racism at the neighborhood level on inequities with regards to obesity (150) and cancer (93) outcomes. As neighborhood environments change due to mobility of racial/ethnic groups from one area to another (also known as gentrification or urban displacement), area level poverty and income inequality also change (151) and may potentially influence cancer risk and outcomes over time. The links between gentrification, energy balance, and cancer remain unexamined, and there are notable limitations in the existing body of literature on segregation and cancer. Studies examining direct, moderating, and mediating effects of social neighborhood context are warranted. There is a need for qualitative studies to understand the role that changing neighborhood dynamics and gentrification may have on access to affordable and healthy diet and food security. This information can help identify critical areas for intervention and develop multi-level based programming, that incorporates multiple social determinants of health (152) at various levels of the socioecological model (25) to enable allocation of resources to those who are most at risk of not meeting the lifestyle guidelines, to design interventions focused on mitigating the negative consequences of rapidly changing neighborhood dynamics, and inform local policies targeting neighborhood development and revitalization projects.

Racial/ethnic disparities are evident at every stage of the cancer continuum—etiology, prevention, detection, diagnosis, treatment survivorship—which may in part be due to the complex interplay with biological, individual, community, structural and societal consequences of discrimination. To eliminate cancer disparities deeply rooted in long-standing structural inequities, there is an imperative need for high quality care and research that considers the historical, social, cultural, and economic context that racially minoritized groups experience daily.

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Abbreviations

CDC	Centers for Disease Control and Prevention
BMI	Body Mass Index
ICD-O	The International Classification of Diseases for Oncology
NHANES	National Health and Nutrition Examination Survey
NHIS	National Health Interview Survey
BRFSS	Behavioral Risk Factor Surveillance System
WCRF/AICR	World Cancer Research Fund/American Institute of Cancer Research
WHI	Women's Health Initiative
SCCS	Southern Community Cohort Study

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Box 1.

Lifestyle Recommendations for Cancer Prevention

The 2020 ACS Guidelines on Diet and Physical Activity For Cancer Prevention[83]

1. Achieve and maintain a healthy weight throughout life. Keep your weight within a healthy range and avoid weight gain in adult life.

2. Be physically active.

a. Get at least 150–300 minutes of moderate intensity or 75 minutes of vigorous intensity activity each week (or a combination of these). Getting to or exceeding the upper limit of 300 minutes is ideal.

b. Limit sedentary behavior such as sitting, lying down, watching TV, or other forms of screen-based entertainment.

3. Follow a healthy eating pattern at all ages.

*A healthy eating pattern i*ncludes:

a. Foods that are high in nutrients in amounts that help you get to and stay at a healthy body weight.

b. A variety of vegetables—dark green, red and orange, fiber-rich legumes (beans and peas) and others.

c. Fruits, especially whole fruits in a variety of colors.

d. Whole grains.

A healthy eating pattern ***limits or does not include:***

e. Red and processed meats

f. Sugar-sweetened beverages

g. Highly processed foods and refined grain products.

h. It is best not to drink alcohol. People who do choose to drink alcohol should have no more than 1 drink per day for women and 2 drinks per day for men.

The 2018 WCRF/AICR Cancer Prevention Recommendation[84]

1. **Be a healthy weight.** Keep your diet within the healthy range and avoid weight gain in adult life.

2. **Be physically active**. We recommend being physically active as part everyday life—walk more and sit less.

3. **Eat a better diet.** Make wholegrains, vegetables, fruits, and beans as part of your usual diet."

4. **Limit fast foods.** Limit consumption of 'fast foods' and other processed foods high in fat, starches, or sugars.

5. **Limit red and processed meat**. Eat no more than moderate amounts of red meat, such as beef, pork, and lamb.

6. **Cut down on sugary drinks.** Limit sugar-sweetened drinks, drink mostly water and unsweetened drinks.

7. **Limit alcohol consumption.** For cancer prevention, it's best not to drink alcohol.

8. **Do not use supplements for cancer prevention.** Aim to meet nutritional needs through diet alone

9. **Breastfeed your baby, if you can.** Breastfeeding is good for mother and baby.

10. **After a cancer diagnosis,** follow our recommendations, if you are able to."

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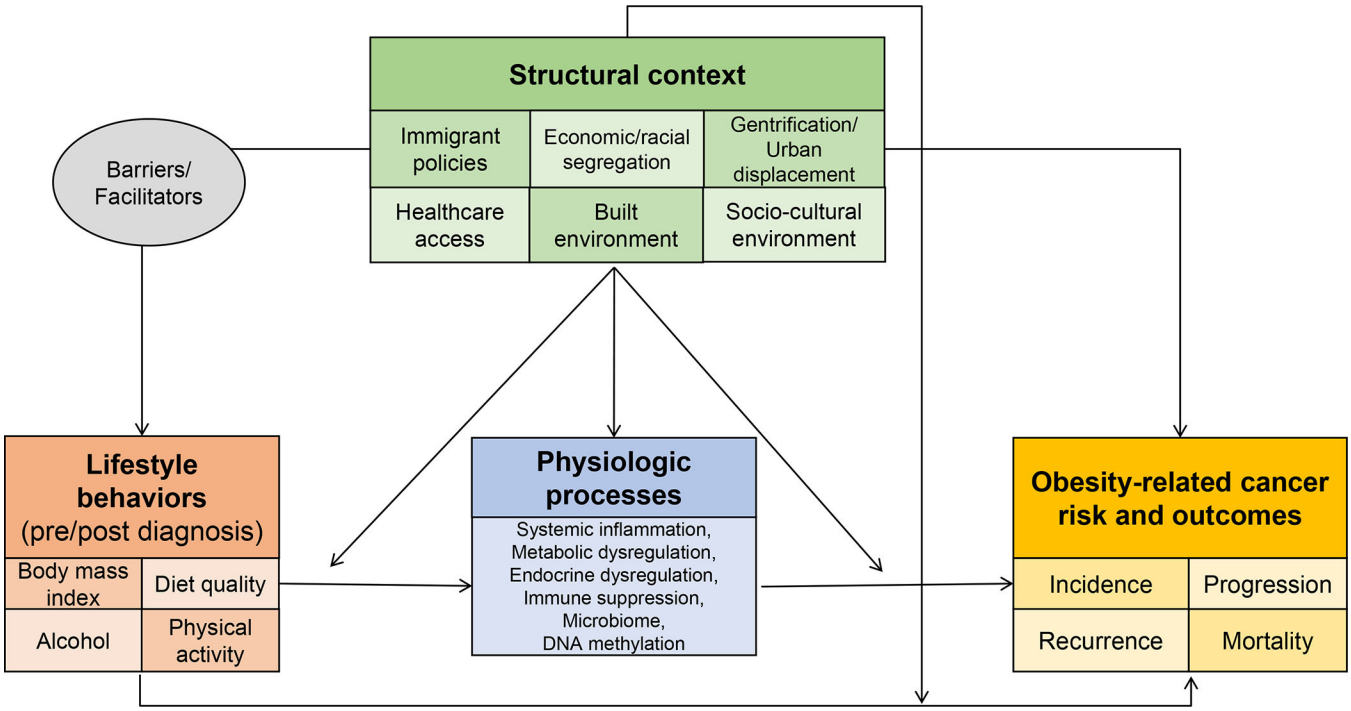

Figure 1.

Conceptual framework to understand cancer health inequities in populations of color: the relationship between context, lifestyle behaviors, physiological processes and obesity-related cancer risk and outcomes.