Biopsychosocial impact of discrimination on cancer risk and outcome: A conceptual review

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Abstract
Discrimination, a major social factor influencing health, can influence both the risk and course of cancer. The medical and psychological mechanisms through which discrimination can impact the onset and spread of cancer are explored in depth in this conceptual evaluation. In addition to investigating the ethical aspects of discrimination in cancer research, it also studies the effects of bias on cancer detection and therapy. In addition, this review provides suggestions for reducing the effect of discrimination on cancer risk and outcomes. Discrimination, in particular, can trigger the growth and spread of cancer via various pathways, including stress, inflammation, and changes in epigenetic patterns. It can also affect the immune system, making the body more vulnerable to the proliferation of cancerous cells. Discrimination can result in hindrances or delays in the process of cancer screening and treatment, and it can influence the quality of care for individuals suffering from cancer. This can contribute to the presence of disparities in terms of cancer vulnerability, occurrence, mortality, and survival rates among different demographic groups. Various measures can be implemented to mitigate the impact of discrimination on cancer vulnerability and outcomes. These measures address the underlying causes of discrimination, ensure that all individuals have access to exceptional cancer care, promote the acquisition of cultural proficiency and anti-bias training by healthcare providers, and develop and implement interventions to reduce discrimination’s impact on cancer vulnerability, screening, and treatment.

Keywords: discrimination; cancer risk; health disparities; inequality

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Cancer: biological or psychological?

Cancer, a multidimensional and complex disease, manifests at the cellular level and is primarily attributed to alterations in the genes governing cell growth and division. Numerous biological factors are involved in the development of cancer. These factors include genetic predisposition, environmental exposure, and errors inherent to cellular replication [1]. Malignancy is often caused by mutations in critical genes, disrupting the delicate balance that governs cell cycle progression [2]. The role of genetic susceptibility in the development of cancer is undeniable; however, environmental factors, such as exposure to carcinogenic agents, can also have a significant influence on the instigation of genetic aberrations that lead to cancerous transformations [3]. Because of the stochastic nature of errors during cell division, the etiological landscape of cancer is further complicated, amplifying the possibility of genetic abnormalities [4].

Cancer development has been studied not only from a biological perspective but also from a psychological perspective. As a physiological response to perceived threats or challenges, stress profoundly impacts the body's functions [5]. Chronic stress has been implicated in compromising the effectiveness of the immune system, thereby fostering an environment conducive to cancer cell proliferation. This complex web of physiological changes induced by stress extends beyond immune modulation to include an increase in inflammatory responses [6]. This leads to an elevated inflammatory state, where inflammation plays an essential role in the initiation and progression of cancer, with inflammatory mediators contributing to the creation of an environment that favors tumor development [7].

Concurrently, the psychological state of depression arises as a significant element in the complex fabric of cancer causation. Depression, a pervasive affective disorder characterized by symptoms such as enduring melancholy, weariness, and reduced engagement in pursuits, has been linked to increased vulnerability to cancer progression. The underlying mechanisms of this correlation continue to be examined, with potential connections to immune dysregulation and chronic inflammation serving as subjects of ongoing research [8].

Furthermore, a comprehensive understanding of the origin of cancer necessitates a nuanced understanding of the intersection between biological and psychological elements. The interaction between these domains emphasizes the complexity inherent in cancer development. For example, stress-induced immunosuppression can combine with genetic predispositions, creating an environment favorable for the initiation and progression of malignancy [9]. The reciprocal relationship between psychological states and biological processes highlights the significance of an extensive and interdisciplinary approach to cancer research and treatment. Recognizing the intricate interplay of biological and psychological factors reveals a more holistic perspective, facilitating the advancement of targeted interventions that encompass both dimensions in pursuing effective cancer prevention and treatment [10].

How does discrimination influence cancer cells?

The influence of discrimination on cancer development operates on multiple levels, weaving a complex narrative that intertwines sociocultural experiences with intricate biological processes. At the core of this relationship lies the capacity of discrimination to elicit chronic stress, an insidious physiological state characterized by sustained activation of the body's stress response systems. This prolonged stress response, triggered by discriminatory experiences, sets into motion a series of events that reverberate through the body, ultimately contributing to an environment conducive to the initiation and progression of cancer [11].

Chronic stress, an identifiable reaction to discrimination, is inextricably linked to heightened inflammation. The cascade of inflammation triggered by persistent stressors is a complex phenomenon in the context of cancer [12]. Inflammation is an essential immune response component, crucial for combating infections and restoring damaged tissues [13]. However, chronic, low-grade inflammation induced by prolonged stress establishes an environment that allows for the occurrence of cancerous changes. Inflammatory agents contribute to the genome's instability and create a favorable environment for the survival and proliferation of cancer cells [14].

The intricate correlation between discrimination and the immune system further complicates susceptibility to cancer. Discrimination, functioning as a potent immunosuppressive agent, undermines the body's capacity to identify and eliminate abnormal cells, including early-stage cancer cells [15]. The inhibition of immune function induced by stress diminishes the efficacy of immune surveillance, permitting potentially cancerous cells to avoid detection and immune-mediated eradication. This compromised immune response increases the probability of cancer initiation and enhances the likelihood of metastatic dissemination, given that immune surveillance plays a pivotal role in averting the spread of cancer cells [16].

Intriguingly, discrimination's impact extends beyond immediate physiological responses, delving into epigenetics. Epigenetic modifications, which encompass alterations in gene expression without changes to the underlying DNA sequence, represent a molecular interface through which psychosocial stressors, including discrimination, leave an indelible mark on cellular function [17]. Discrimination-induced epigenetic changes may result in aberrant gene expression profiles, potentially favoring the activation of oncogenes or the silencing of tumor suppressor genes. These alterations in gene expression patterns contribute to the molecular landscape conducive to the development and progression of cancer [18].

Discrimination may confer a selective advantage on malignant cells by directly influencing cancer cell biology. The altered physiological state induced by chronic stress, immune suppression, and epigenetic modifications creates a microenvironment favorable for cancer cells' survival, proliferation, and metastasis. Discrimination, therefore, becomes not only a societal stressor but also a biological modulator that shapes the trajectory of cancer development [5].

The effect of discrimination on cancer is multidimensional, involving an intricate interplay of stress, inflammation, immune modulation, epigenetic modifications, and alterations in cancer cell biology. Recognizing and comprehending these complex connections is essential for developing targeted interventions that address both the psychosocial determinants and underlying biological mechanisms of cancer [19]. This integrated approach is essential for advancing our theoretical understanding of cancer etiology and formulation of effective strategies for cancer prevention and treatment that encompass a broader range of human experiences.

Pathway linking discrimination and cancer

Discrimination and cancer can be explained by the combination of sociocultural encounters and complex biological mechanisms, revealing the significant interaction between psychological and social stressors and the molecular processes that regulate cellular behaviors [5]. A comprehensive understanding of this multifaceted association necessitates a thorough investigation into the functions fulfilled by persistent stress, inflammation, alterations in gene expression, and modulation of the immune system within the framework of discriminatory encounters and their impact on the likelihood of developing cancer.

Chronic stress and inflammation

Discrimination is a persistent stressor that triggers physiological responses facilitated by activating the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system. This outcome releases stress hormones, such as cortisol and adrenaline [20]. Extended exposure to stress induced by discrimination contributes to a continuous elevation
of these hormones, resulting in a state of chronic stress. Conversely, chronic strain is closely associated with heightened inflammation, a process regulated by the release of proinflammatory cytokines such as interleukin-6 and tumor necrosis factor-alpha [21]. In the context of chronic stress linked to discrimination, inflammation, traditionally acknowledged as a defensive response to infections and injuries, plays a deleterious role. The persistent release of proinflammatory agents establishes an environment conducive to genomic instability [22]. This stress-induced inflammation contributes to the instigation of cancer by fostering genetic mutations and alterations, thereby facilitating cellular transformations associated with malignancy. Furthermore, the incendiary microenvironment encourages the survival and propagation of malignant cells, thus offering an optimal setting for advancing and spreading tumors [23].

Epigenetic modifications

The physiological responses that occur immediately due to discrimination-induced stress are not only affected but also have an impact on the molecular level through epigenetic modifications. Epigenetic modifications refer to changes in gene expression patterns without any alterations to the underlying DNA sequence, and these modifications play a vital role in regulating cellular functions [24]. Discrimination has been linked to specific epigenomic modifications, such as alterations in DNA methylation patterns, histone modifications, and microRNA expression profiles. These modifications can influence gene expression in essential cellular processes, potentially fostering an environment conducive to cancer development. For example, increased methylation of tumor suppressor gene promoters may inhibit their expression, facilitating uncontrolled cell proliferation [25]. Conversely, decreased methylation of oncogene promoters could result in their overexpression and further advancement of malignant transformation. Consequently, discrimination-induced epigenetic changes contribute to molecular reprogramming that amplifies susceptibility to and progression of cancer.

Immune system modulation

The impact of discrimination on the immune system represents a critical link in the pathway to cancer. Chronic stress, a hallmark response to discriminatory experiences, exerts profound effects on immune function. The release of stress hormones, particularly cortisol, mediates immunosuppression by inhibiting the activity of immune cells such as T cells and natural killer cells [26]. Immunosuppression induced by discrimination compromises the body's potential to mount effective antitumor responses. This dwindled immune surveillance allows incipient cancer cells to avoid detection and immune-mediated destruction. The impaired immune reaction not only increases the chance of cancer initiation but also creates a microenvironment that is permissive for the unbridled growth and metastasis of cancer cells [27]. The complicated interplay among discrimination-induced pressure, immunosuppression, and most cancer development underscores the multifaceted nature of the link between sociocultural experiences and biological outcomes.

Biological aspects of discrimination and cancer

Beyond psychosocial elements, discrimination interfaces with fundamental biological approaches that underpin cancer biology. The inflammatory microenvironment fostered by discrimination-caused stress now not only helps the initiation and development of cancer but also impacts the tumor microenvironment [28]. Chronic inflammation contributes to angiogenesis, forming recent blood vessels essential for presenting tumors with nutrients and oxygen. This technique further helps tumor increase and metastasis [29]. Furthermore, the impacts of bias on a molecular level, which involve changes in the structure of genes, directly impact the biology of cancer cells. Discrimination can give cancer cells a competitive advantage, affecting their ability to spread and propensity to form secondary tumors [30]. Modifications to gene expression profiles due to epigenetic changes may activate pathways that support survival, movement, and resistance to cell death, all of which are essential characteristics of cancer. The interaction between experiences of discrimination and the biology of cancer cells further supports the idea that sociocultural factors have a broader impact beyond just psychological responses, directly shaping the biological traits of cancer cells [31].

Integration of biological and psychosocial aspects

The pathway of discrimination-cancer accentuates the complex interaction between biological and psychosocial factors. Prolonged stress and inflammation are active mediators bridging the divide between sociocultural encounters and biological results. The mutual association between psychosocial stressors and molecular changes, such as epigenetic adjustments, underscores the two-way nature of the discrimination-cancer connection [29].

Understanding this pathway necessitates a comprehensive viewpoint that considers the systemic repercussions of stress induced by discrimination on physiological reactions and the specific alterations occurring at the cellular level [32]. The significance of adopting a comprehensive approach to cancer research, which acknowledges the interconnection between psychological and biological factors, is highlighted by the biological aspects of discrimination and cancer [33]. By implementing sociocultural considerations into the inquiry of cancer biology, an all-embracing framework is established for the development of targeted interventions that address individuals' immediate experiences and the underlying biological processes that contribute to cancer vulnerability and progression [34].

The pathway of discrimination leading to cancer is a convoluted and multifaceted process that encompasses both sociocultural encounters and biological consequences. Prolonged stress, inflammation, alterations in gene expression, and modulation of the immune system collectively contribute to an environment that heightens the risk of cancer initiation and progression in the context of discriminatory incidents [35]. Incorporating biological and psychosocial elements in comprehending this pathway enhances our theoretical comprehension and emphasizes the necessity for comprehensive, interdisciplinary approaches in cancer research.

Discrimination and cancer risk factors

Discrimination intersects with diverse facets of human existence, influencing health outcomes in an intricate and interconnected manner. Within the realm of cancer risk factors, discrimination manifests as a determinant that disproportionately impacts individuals across varying sociodemographic strata, thereby exacerbating disparities in cancer incidence and outcomes [36]. The examination of how bias interacts with critical factors such as socioeconomic status, race/ethnicity, gender, sexual orientation, disability, and other societal factors affecting health is a multi-faceted effort. Moreover, a comprehensive understanding of the mechanisms by which discrimination can contribute to exposure to cancer risk factors necessitates the integration of biological elements and the consideration of environmental toxins, stress, unhealthy behaviors, and limited healthcare accessibility, all of which merit heightened emphasis.

Socioeconomic status (SES)

Socioeconomic status includes economic and social indicators such as income, education, and occupation, which determine access to resources and opportunities. Discrimination associated with SES manifests itself in income disparities, education disparities, and operational constraints. Individuals who experience discrimination based on SES often experience more significant stress due to economic pressures and resource struggles [37]. Chronic stress has far-reaching biological consequences, including immune dysregulation.
inflammation, and altered gene expression through epigenetic modifications. Low SES and increased exposure to environmental toxins are associated, as marginalized communities may live in areas of high pollution or poor waste management, which increases the risk of cancer for those who face discrimination [38].

Race/ethnicity

Discrimination based on race and ethnicity is a profoundly entrenched issue with profound health implications. Individuals from racial and ethnic minorities often face systemic barriers such as limited access to quality education, employment discrimination, and disparities in access to health care [30]. Discrimination against racial and ethnic minorities and chronic stress are associated, as discussed earlier, and can lead to increased immune responses, inflammation, and epigenetic changes that promote cancer progression. Furthermore, racial and ethnic minorities may be exposed to environmental toxicants largely because of residential segregation, environmental racism, and occupational hazards [39]. Genetic factors affecting race also play a role, interacting with experiences of discrimination and contributing to differences in cancer as convenience and consequences [40, 41].

Gender

Gender-based discrimination is an exceedingly rare occurrence that does not result in any disparities in the domains of education, employment, and access to healthcare. Discrimination can enforce societal norms and stereotypes, affecting individuals of both genders [42]. If women, discrimination might intersect with matters related to reproductive health, hormone regulation, and the danger of developing breast cancer. As for men, societal expectations surrounding masculinity may contribute to harmful behaviors such as the use of tobacco and alcohol [43]. The biological responses to gender-based discrimination may involve dysregulation of the endocrine system, which can affect cancer risk through hormonal pathways. To fully comprehend the intricate connection between gender-based discrimination and cancer, it is imperative to possess a comprehensive understanding of both sociocultural and biological factors [44].

Sexual orientation

Discrimination based on sexual orientation is a determinant of health with distinctive implications. Bias is a common problem for LGBTQ+ individuals in education, employment, and healthcare settings [45]. Constant discrimination-related stressors can result in physiological responses, including altered immune function and increased inflammation. Additionally, individuals who identify as sexual minorities might be more inclined to engage in unhealthy behaviors, such as tobacco or substance use, as coping strategies for the stress caused by discrimination [46]. This creates a complex interplay between societal attitudes, biological responses, and cancer risk among sexual minorities.

Disability

Persons with disabilities encounter bias in various areas of life, such as education, employment, and healthcare. Discrimination can impede access to preventive healthcare services and lead to social isolation, exacerbating stress [47]. In addition, disabilities can intersect with environmental factors, resulting in challenges for individuals with mobility limitations in navigating environments with higher exposure to pollutants. The biological implications of discrimination against individuals with disabilities can involve stress-induced worsening of pre-existing health conditions, potentially heightening vulnerability to cancer [48].

Other social determinants of health

Additional social factors contribute to discrimination and affect the risk of cancer beyond the specified determinants. Health outcomes can be influenced by neighborhood conditions, educational opportunities, and community resources [33, 49]. For instance, individuals who live in areas with restricted access to nutritious foods and recreational areas may encounter difficulties adopting healthy behaviors. Health disparities can be compounded by discrimination within these broader social determinants, thereby influencing the risk of cancer through interconnected pathways [50].

Mechanisms through which discrimination leads to exposure to cancer risk factors

Environmental toxins. Discrimination can result in the division and separation of residential areas, thereby compelling marginalized communities to reside in regions that are more susceptible to harmful environmental substances [51]. This form of environmental injustice significantly contributes to disparities in health, as individuals residing within these communities are confronted with heightened risks of developing cancer due to increased exposure to harmful pollutants, hazardous waste materials, and emissions from industrial sources [52]. The biological consequences of this exposure involve direct interaction with cellular processes, which in turn can lead to DNA damage and mutations that serve as catalysts for the onset of cancer [53].

Stress. Chronic stress, a prevalent consequence of discriminatory encounters, affects susceptibility to cancer via numerous biological pathways. Activating the stress response system, encompassing the secretion of cortisol and adrenaline can result in immune suppression and inflammation [54]. Over time, chronic stress may modify gene expression patterns through epigenetic alterations. These physiological responses establish an atmosphere that facilitates the inception and advancement of cancer [55].

Unhealthy behaviors. Discrimination may result in the adoption of unhealthy coping strategies, such as smoking and drinking alcohol, poor eating habits, and physical inactivity. These behaviors are established risk factors for various cancers, and their adoption as a response to discrimination exacerbates cancer risk. The biological results involve the direct impact of these behaviors on cellular processes, such as DNA damage and inflammation, which contribute to cancer development [56].

Lack of access to healthcare. Discrimination within healthcare systems imposes constraints on the availability of preventive care, screenings, and timely treatment. Individuals who encounter discrimination may exhibit a reduced inclination to pursue medical attention because of mistrust or past unfavorable encounters [57]. The limited accessibility to healthcare services intensifies the vulnerability to cancer by postponing the detection and intervention processes. These yield biological ramifications encompass missed opportunities to identify and intervene at earlier stages, thus allowing cancer to advance toward more intricate phases [58].

Discrimination, cancer screening, and treatment

The domain of cancer care is heavily affected by discrimination, which has various influences on screening, treatment, and overall healthcare outcomes. The relationship between discrimination and cancer is not solely characterized by delays and obstacles when it comes to accessing screening and treatment but also by the subtle impact it has on the quality of care received. Furthermore, discrimination plays a significant role in the disparities observed in cancer, further accentuating the existing inequalities in cancer risk, incidence, mortality, and survival across different populations [59].

Individuals who experience discrimination often encounter obstacles in obtaining timely and sufficient cancer screening. This hindrance is rooted in many factors, including, but not limited to, limited access to healthcare services, financial constraints, and the pervasive apprehension of facing discrimination from healthcare providers [60]. The intersectionality of discrimination exacerbates these barriers as marginalized communities, such as racial and ethnic minorities or LGBTQ+ individuals, confront compounded difficulties in navigating the healthcare system. The ramifications of postponed or neglected cancer screening are profound, as early detection is pivotal.
for effective intervention and enhanced outcomes [61].

The impact of discrimination extends beyond the realm of screening and permeates the domain of cancer treatment. Individuals who have been subjected to discrimination may exhibit a decreased likelihood of seeking or receiving high-quality cancer care. Implicit biases among healthcare providers, often unintentional and originating from societal stereotypes, possess the potential to influence treatment decisions [62]. These biases may culminate in implementing less aggressive treatment plans or suboptimal communication with patients, exacerbating care provision disparities. The deterioration of trust between patients and healthcare providers, arising from encounters with discrimination, further compounds these challenges, impeding effective collaboration during the treatment journey [63].

The pernicious character of discrimination is evident in its role in cancer disparities, which illuminate stark disparities in cancer outcomes across different demographic groups. Cancer disparities encompass variations in cancer risk, occurrence, death, and survival, and discrimination plays a significant role in driving these disparities. For example, individuals from racial and ethnic minorities or the LGBTQ+ community are more prone to experiencing discrimination and simultaneously display lower levels of cancer screening and treatment and higher levels of cancer mortality [64].

The relationship between discrimination and disparities in cancer is complex. The ability to obtain cancer screenings is frequently hindered by institutional discrimination in healthcare settings, such as the refusal of services, prejudiced treatment decisions, or a deficiency in culturally sensitive care. As a result, individuals facing discrimination are more likely to present with advanced-stage cancers, which diminishes the effectiveness of treatment interventions [65].

The influence of discrimination on the caliber of cancer care received is significant because individuals who have experienced discrimination may encounter obstacles in receiving timely and appropriate treatment, thereby compromising their likelihood of achieving favorable outcomes [66].

Implicit biases within the healthcare profession represent a crucial nexus where discriminatory practices intersect with the caliber of cancer care. These biases may materialize as presumptions, conventional beliefs, or prejudices based on race, ethnicity, gender, sexual orientation, or other societal aspects [67]. Such biases can impact treatment decisions, consequently engendering discrepancies in the intensity of care provided. For example, research has demonstrated that individuals from racial and ethnic minority groups may be less likely to receive specific cancer therapies, even after accounting for socioeconomic variables. This observation underscores the pivotal role implicit biases play in generating disparities in treatment [68].

Communication discrepancies between healthcare providers and patients encountering discrimination also add to imbalances in the provision of cancer care. Proficient communication is essential for the collective decision-making process and treatment adherence. Nevertheless, mistrust and uneasiness brought about by discrimination may obstruct candid and transparent communication, thereby impeding the establishment of indispensable patient–provider alliances that are vital for optimal cancer care. The outcome is a series of disparities encompassing distinct treatment strategies, delayed interventions, and inferior health outcomes [69].

The evident manifestation of cancer disparities resulting from discrimination is reflected in the disproportionate burden of cancer mortality encountered by marginalized populations. The convergence of discrimination, delayed screening, suboptimal treatment, and impaired communication ultimately led to elevated mortality rates in the groups facing discrimination. Comprehending and tackling the intricate interplay of these variables is imperative in developing focused interventions aimed at dismantling impediments to equitable cancer care [70].

Efforts to alleviate the consequences of prejudice on disparities in cancer patients must embrace a comprehensive strategy. Essential alterations within healthcare systems are necessary, such as establishing policies against discrimination, training healthcare providers in cultural competence, and implementing tactics to confront unconscious biases [71]. It is crucial to enhance the availability of cancer screening through community-centered programs and outreach initiatives and remove economic obstacles to promote early identification and intervention [72].

Moreover, establishing confidence and reliance among individuals seeking medical attention and those providing healthcare services is paramount. Nurturing an atmosphere within the healthcare sector that emphasizes embracing various perspectives, honoring personal encounters, and proactively tackling prejudice is crucial for establishing trust [73]. This encompasses advocating for a diverse healthcare workforce, guaranteeing fair and unbiased representation in clinical trials, and participating in candid discussions concerning discrimination within healthcare environments.

The necessity to confront and tackle discrimination in the healthcare sector is not solely a question of moral principles but is of utmost importance in breaking down obstacles and attaining equality in health. It is only by using focused endeavors to acknowledge, comprehend, and rectify the consequences of discrimination on cancer treatment that we can aspire to establish a healthcare environment that is genuinely encompassing, fair, and effective in fighting against the worldwide weight of cancer.

Ethical implications of discrimination and cancer research

The convergence of discrimination and cancer investigation introduces an intricate ethical terrain that requires thoroughly examining the principles governing participant self-governance, the potential hazards and advantages of investigation, inclusivity in investigation layout, and the essentiality for rigorous ethical supervision [74, 75]. At the core of this ethical discussion is the acknowledgment that cancer investigation, a pivotal endeavor in advancing our comprehension and treatment of a pervasive and life-threatening ailment, must be conducted with the utmost regard for the entitlements and welfare of research participants, notably those from marginalized groups who may be more susceptible to exploitation [76].

Respecting the privacy and autonomy of research participants is a fundamental principle of ethical research. In cancer research, where the stakes are significant and the potential risks substantial, it is crucial to ensure that participants receive comprehensive information about the study. This is of utmost importance, particularly for individuals belonging to marginalized communities who may disproportionately bear the consequences of past and systemic discrimination [77]. Transparent communication regarding study participation’s potential risks and benefits empowers individuals to make informed choices. Furthermore, the principle of voluntary participation underscores that individuals should be free to withdraw from the study at any point without facing adverse consequences. This aspect becomes especially relevant in the context of marginalized groups, where historical injustices may heighten concerns related to exploitation, coercion, or lack of agency [78].

Understanding the potential hazards and advantages of cancer research is essential to ethical decision-making for researchers and participants. Although cancer research offers the potential to advance our understanding and treatment of the disease, it is not devoid of risks. Experimental therapies, invasive procedures, and potential adverse effects introduce uncertainty and potential harm [79]. Ethical considerations necessitate that researchers carefully assess these risks compared to the potential benefits, guaranteeing that the pursuit of knowledge and progress does not compromise the well-being of research participants. This evaluation becomes particularly intricate in the case of marginalized groups, where historical mistreatment and discrimination may generate heightened concerns regarding the ethics of research involvement [80].

An ethical obligation in the domain of cancer investigation lies in the principle that the benefits of exploration should be
all-encompassing, surpassing demographic, social, and economic divisions. The configuration of research studies should be comprehensive to benefit all individuals, regardless of their race, ethnicity, gender, sexual orientation, or socioeconomic standing. This inclusiveness bears immense significance not only from an ethical standpoint but also for the universality and applicability of research discoveries [81]. Nevertheless, enlisting participants from marginalized groups presents inherent difficulties. Historical and contemporary wrongdoings and systemic obstacles to healthcare access and participation may lead to inadequate representation. Ethical considerations necessitate deliberate endeavors to tackle these disparities, guaranteeing that research advances are evenly distributed across varied populations [82].

The ethical aspects of cancer research go beyond the study’s design and the recruitment of participants, including the governance and supervision of research activities. Institutional review boards (IRBs) are crucial in ensuring ethical research conduct [83]. These supervisory bodies are responsible for examining and approving studies to ensure their ethical soundness and the protection of participant rights. In cancer research, IRBs are indispensable for scrutinizing the potential risks and benefits, assessing the informed consent process, and addressing the inclusion of marginalized groups [84]. Thorough ethical supervision is an essential protective measure against potential abuses of power, ethical failures, or inadvertent oversights that could compromise the integrity of the research [84].

Ethical challenges in cancer research are dynamic and ever-evolving, requiring an ongoing commitment to principles prioritizing research participants’ rights, well-being, and inclusivity. The ethical framework outlined here serves as a guidepost for navigating the intricate intersections of discrimination and cancer research. This underscores the necessity of adopting a proactive and intentional approach to address historical and systemic injustices that may perpetuate disparities in research participation. Moreover, it emphasizes the importance of fostering an ethical culture within the research community that prioritizes transparency, accountability, and the equitable distribution of research benefits.

Implications for research and policy

The consequences of bias on the likelihood of developing cancer, the process of screening for cancer, the methods of treatment, and the ultimate outcomes call for a comprehensive research and policy agenda to comprehend, mitigate, and rectify the inequalities that arise from systemic unjust treatment. The intricate relationship between bias and cancer emphasizes the urgency for vigorous research initiatives that delve into the specific mechanisms through which bias influences each stage of the cancer continuum [85]. At the same time, policy interventions are vital in addressing the fundamental causes of bias, removing obstacles to receiving high-quality cancer care, and initiating systemic changes that promote inclusivity and cultural competence within healthcare systems.

Research plays a pivotal role in disentangling the intricate network of elements that connect discrimination to cancer. To tackle the existing gaps in knowledge, there is an urgent need for further research dedicated to comprehending the subtle manners in which discrimination contributes to cancer risk, hinders screening efforts, influences treatment decisions, and ultimately shapes cancer outcomes. Such an investigation should embrace an intersectional viewpoint, recognizing the interconnectedness of different social determinants and how they collectively influence health [86]. Investigations that analyze the encounters of marginalized groups considering variables such as race, ethnicity, gender, sexual orientation, and socioeconomic status are crucial for unraveling the differential impact of discrimination on diverse populations [87].

In addition, the growth and analysis of interventions aimed at reducing the impact of discrimination on cancer outcomes are vital. Interventions could encompass strategies to enhance cultural competency among healthcare providers, reduce implicit biases, and address structural barriers to equitable care. A comprehensive examination of these interventions is vital to ensure their effectiveness and inform evidence-based practices that can be integrated into healthcare systems [88]. The aim is not only to pinpoint effective interventions but also to grasp the contextual aspects that influence their success, thus enabling the development of tailored strategies for diverse populations.

In pursuing this research objective, upholding the fundamental principles of exclusiveness and inequality is of utmost importance. Cancer research must actively and consciously endeavor to be inclusive, ensuring that diverse populations are adequately represented in the samples under study [89]. The inclusion of individuals from different racial, ethnic, gender, and socioeconomic backgrounds is not only essential but also necessary to produce findings that have generalizability and applicability across communities. By prioritizing inclusiveness in research, we can augment the external validity of study outcomes, thereby significantly contributing to a more comprehensive comprehension of the impact of discrimination on cancer within diverse populations [90].

Complementary to the research imperative, policies are indispensable tools for effecting systemic change and dismantling the structural roots of discrimination. Policies should be devised to tackle the underlying reasons behind discrimination, such as racism, sexism, and homophobia. A multifaceted approach is required to encompass legislative measures, education, and public awareness campaigns. Legislation should condemn discriminatory practices and actively dismantle systemic inequities embedded within social, economic, and healthcare systems [91]. Educational measures may increase awareness and understanding of the repercussions of discrimination, fostering a societal ethos that values diversity and inclusivity [92].

Healthcare organizations need to ensure that high-quality cancer care is accessible to every individual, regardless of race, ethnicity, gender, sexual orientation, or socioeconomic status, which is a crucial priority in public policy. This necessitates the removal of impediments to healthcare access, resolving disparities in health insurance coverage, and rectifying systemic prejudices within healthcare systems [93]. Policies should be developed to eradicate structural obstacles that hinder prompt and equitable access to cancer screening, diagnosis, and treatment. The reasonable provision of healthcare services is not just a matter of justice but also a prerequisite for achieving optimal cancer outcomes for the entire population [94].

Moreover, including policies that endorse cultural proficiency and anti-prejudice education among healthcare providers is a crucial aspect of a comprehensive approach to combat discrimination in cancer treatment. These policies require continuous education for healthcare professionals to enhance their comprehension of various cultural perspectives, enhance communication with patients from different backgrounds, and diminish the influence of unintentional biases on treatment decisions [95]. Nurturing a healthcare workforce with cultural proficiency and sensitivity toward the distinct needs of diverse populations is imperative for dismantling systemic barriers to impartial cancer care [96].

Research should delve into the connections between discrimination and the consequences of cancer, thereby providing insight for the creation of targeted interventions. Simultaneously, policies should be developed to eradicate structural barriers, foster inclusivity, and cultivate cultural proficiency within healthcare systems. By aligning research and policy agendas, we can strive toward a future in which the impact of discrimination on cancer is lessened, and every individual, regardless of their background or identity, has equal access to exceptional care.

Recommendations for reducing the impact of discrimination on cancer risk and outcomes

The mitigation of the effects of discrimination on the likelihood of developing cancer and the resulting outcomes necessitates a comprehensive strategy that tackles the fundamental origins of
discrimination, guarantees fair and unbiased availability of exemplary cancer treatment, cultivates cultural proficiency among healthcare practitioners, and enacts specific measures to alleviate the repercussions of discrimination at every stage of the cancer process [97].

Addressing the fundamental causes of discrimination is fundamental to any comprehensive strategy aimed at reducing its impact on cancer outcomes. This requires a coordinated effort to dismantle structural inequalities that perpetuate bias, including racism, sexism, homophobia, and other types of prejudice. Educational initiatives play a pivotal role in this regard, raising awareness about discrimination's pervasive nature and repercussions [98]. By incorporating education about diversity, fairness, and inclusion into curricula at various levels, society can foster a more knowledgeable and compassionate comprehension of the experiences of marginalized groups. Advocacy efforts that challenge discriminatory policies and practices are also indispensable, prompting a systemic transformation beyond individual attitudes to confront institutional and structural impediments to equity [99].

Ensuring fair access to top-notch cancer treatment is a core suggestion for alleviating disparities in cancer outcomes. This requires addressing the broader problem of healthcare accessibility and advocating for policies that ensure affordable healthcare for all individuals, regardless of race, ethnicity, gender, sexual orientation, or socioeconomic status. Implementing public policy initiatives that enhance health insurance coverage, reduce financial burdens, and eliminate obstacles to preventive services and cancer treatments is paramount [100]. Collaborative endeavors with healthcare providers are equally vital to diminish disparities in care delivery. This requires cultivating an inclusive and culturally competent healthcare environment that prioritizes the distinct needs of diverse patient populations [101].

Promoting the development of cultural competence and anti-bias training among healthcare providers represents a fundamental approach to augmenting the quality of cancer care and diminishing the effects of discrimination. Cultural incompetence training gives healthcare professionals the necessary lack of knowledge and skills not to understand and ignore the cultural, social, and linguistic requirements of diverse patient populations [102]. This training is not a singular occurrence but an ongoing process that evolves with the changing landscape of societal attitudes and healthcare demands. Incorporating anti-prejudice training in medical education and professional development programs can aid healthcare providers in identifying and mitigating underlying biases that might affect their interactions with patients [103]. By fostering an environment that prioritizes cultural competence, healthcare providers can facilitate effective communication, establish trust, and deliver truly patient-centered care.

Developing and enacting measures to mitigate the impact of discrimination on the risk, examination, and management of cancer represents a proactive endeavor toward achieving health parity. These measures should address the specific mechanisms of discrimination shaping health outcomes [104]. To illustrate, endeavors to diminish stress and inflammation, which are physiological responses to discrimination, can be implemented through stress reduction programs, mental health support services, and community-based initiatives that foster resilience [105]. Enhancing accessibility to cancer screening and treatment necessitates targeted measures that target structural barriers such as limited transportation, financial constraints, and restricted healthcare infrastructure in marginalized communities [106]. Providing support to cancer patients during and after treatment entails comprehensive care strategies that consider the psychosocial and economic obstacles confronted by individuals who may have been discriminated against [107].

Implementing interconnected strategies such as addressing the underlying causes of discrimination, ensuring equitable access to high-quality healthcare, fostering cultural competency among healthcare providers, and executing targeted interventions are all vital components that can collectively contribute to alleviating the impact of discrimination on cancer. This comprehensive framework acknowledges the intricate interplay of societal, institutional, and individual factors that influence health outcomes and emphasizes the significance of collaborative endeavors by policymakers, healthcare providers, researchers, and advocates to attain health equity for all.

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