

Understanding Racial Disparities in Cancer Treatment and Outcomes

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A recent report from the Institute of Medicine documents widespread racial disparities in medical treatment and health outcomes.¹ Such disparities are particularly apparent among patients with cancer. For many types of cancer, black Americans have markedly higher cancer-specific mortality rates than members of other racial and ethnic groups—more than 2-fold higher in some instances.² Excess cancer mortality in this group is partly attributable to higher cancer incidence rates.² However, increased cancer mortality among black patients is also due in large part to worse prognoses among those already diagnosed.

Reasons for higher mortality among minorities encompass both patient factors and provider and health care system effects. Patient factors include characteristics associated with decreased longevity, such as socioeconomic status (SES), health behaviors, and comorbid conditions. At the provider level, higher cancer mortality may reflect underuse of screening, resulting in later stage at diagnosis, and underuse of cancer-directed surgery and adjuvant therapy. Finally, racial disparities may be associated with differences in the quality of care delivered by providers and by the selected settings where black patients cluster for care. Some of these settings have been associated with higher cancer mortality rates^{3,4} and may be less likely to provide high quality comprehensive, transitional, and follow-up care after surgery.

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In this review, we will explore racial disparities in the context of cancer surgery. First, we describe the magnitude of racial disparities in this area. Next, we consider the underlying mechanisms with regard to patient factors, under-treatment, and disparities in quality of care within certain health systems. Finally, we propose a research and policy agenda for ameliorating disparities going forward.

Racial disparities in cancer outcomes

With few exceptions, studies of outcomes after cancer surgery published in the last 15 years have identified increased perioperative mortality and decreased late survival rates among blacks relative to whites.¹ Our review of recent data from the National Cancer Institute's Surveillance Epidemiology End Results (SEER) program showed systematically decreased survival among black Americans, relative to whites, for nearly every common solid tumor type (Table 1). In absolute terms, disparities in survival tend to be smallest for cancers in which treatment has the smallest impact on survival, either because the prognosis is uniformly good or uniformly poor. For example, prostate cancer has an excellent prognosis for most patients. Five-year survival rates for black and white patients were 97.5% and 99.9%, respectively⁵; so the absolute disparity in survival rate was only 2.4%. Likewise, long-term survival of pancreas cancer is extremely rare, regardless of race. The 5-year survival rates were only 4.6% for black patients and 4.7% for whites; therefore, minority patients experienced minimal survival disadvantage.

By contrast, the largest disparities in survival tend to occur among patients with solid tumors for which appropriate and high quality treatment is an important factor in prognosis. Among patients with a treatable cancer, the difference in 5-year survival rates ranged from 10% for colorectal cancer (55.5% for blacks vs 65.6% for whites) to 24.6% for uterine cancer (61.8% for blacks vs 86.4% for whites). These types of tumors may be cured with surgical intervention and adjuvant therapies that have been shown to improve survival, but they are likely to be fatal without treatment. So, eliminating health system factors that contribute to differential delivery of effective treatment will be key in reducing disparities in cancer outcomes.

Table 1. Survival among African Americans and Whites after Diagnosis with 9 Common Solid Tumors, SEER 1995 to 2003*

Tumor type	5-y survival rate, %		Absolute difference, %
	White	Black	
Pancreas	4.70	4.60	0.10
Liver	9.10	6.50	2.60
Lung	15.20	12.20	3.00
Esophagus	16.80	10.50	6.30
Head and neck	62.10	40.50	21.60
Colorectal	65.60	55.50	10.10
Bladder	83.20	64.80	18.40
Uterine	86.40	61.80	24.60
Breast	89.80	76.60	13.20
Prostate	99.90	97.50	2.40

*<http://seer.cancer.gov/canques/survival.html>. Accessed February 1, 2008. SEER, Surveillance, Epidemiology and End Results.

Mechanisms underlying disparities in cancer outcomes

To better understand patient, provider, and health system influences on disparities in cancer outcomes, we propose 3 underlying mechanistic domains: patient factors, use of care, and quality of care (Fig. 1). As illustrated in Figure 1, outcomes are dependent on effective cancer care, including screening, surgical resection, and appropriate use of adjuvant therapy. Patient factors include social determinants of health (race or ethnicity, SES, geography), clinical characteristics (cancer stage, tumor biology, comorbid disease), and beliefs or preferences. Provider factors include knowledge, skill, and access to resources within the hospital or health system. Each of these variables may contribute to underuse of care. Quality of care refers to the processes and structural elements of care in each health system based on hospital characteristics. Together, these domains provide a conceptual framework described in the remainder of this article.

Patient factors

Studies examining the impact of patient characteristics on disparities in cancer mortality have focused primarily on cancer stage at the time of diagnosis, differences in tumor biology, comorbid disease, and SES.

Cancer stage. Cancer stage is the single most important prognostic indicator. Relative to whites, black patients consistently are diagnosed with more advanced stages of cancer.^{6,7} Tumor stage at the time of diagnosis depends partly on access to adequate screening for breast, colon, and prostate cancers, partly on timely access to care for cancers without a screening option, and partly on tumor biology. Cancer screening rates among minority groups tend to be

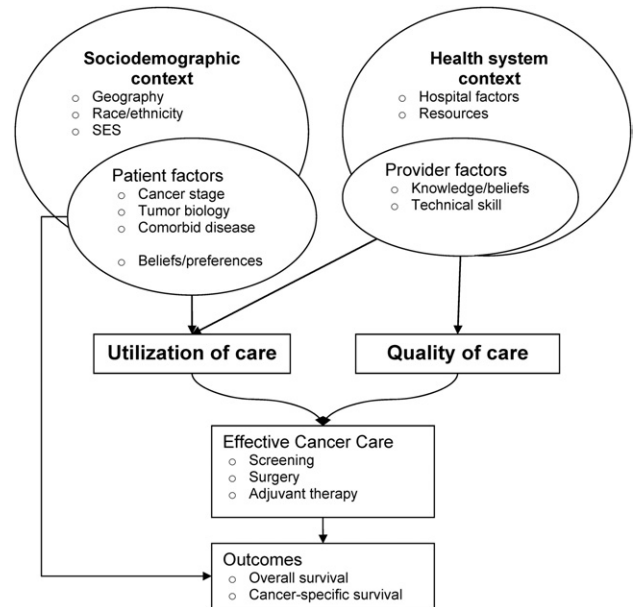


Figure 1. A conceptual model of mechanisms underlying disparities in cancer care and outcomes. SES, socioeconomic status.

lower than those among whites,⁸⁻¹⁰ which, in turn, contributes to later stage disease and subsequent poorer survival among minority patients.^{11,12}

Tumor biology. When population-based data are adjusted for cancer stage, however, the overwhelming data indicate that black patients do not experience more aggressive tumor biology than whites.^{7,13} If more aggressive tumor biology among blacks explained the black/white difference in cancer stage and survival, receipt of comparable treatment should not substantially reduce disparities in survival. However, several studies in which black and white patients received identical cancer treatment showed no significant racial difference in cancer-specific deaths.¹⁴⁻¹⁶ These data imply that, for the most part, racial differences with respect to tumor biology are negligible, and that non-clinical predictors of treatment and the quality of treatment deserve further attention.

Comorbid disease. Comorbid disease, especially heart disease, hypertension, and diabetes, is independently associated with race¹⁷ and socioeconomic status.¹⁸ It is plausible that the increased burden of comorbid disease is an unrecognized contributor to disparities in survival after cancer surgery.

In a recent study, Tammemagi and colleagues¹⁹ examined 10-year survival among 906 black and white breast cancer patients. The authors used chart review to develop a rigorous comorbidity measure and to ascertain all-cause, cancer-specific, and competing-cause mortality (Table 2). The authors found a stepwise increase in all-cause mortality with increasing comorbidity counts. Relative to white pa-

Table 2. Explaining Racial Disparities in Long-Term Survival after Breast Cancer Treatment

Mortality	Black:white hazard ratio of mortality, unadjusted, (95% CI)	Black:white hazard ratio of mortality, adjusted for comorbid conditions, (95% CI)	Excess mortality explained by comorbid disease, %
All cause mortality	1.34 (1.11–1.62)	1.17 (0.96–1.43)	49
Cancer-specific mortality	1.47 (1.08–2.00)	1.47 (1.06–2.03)	0
Competing cause mortality	1.27 (1.00–1.63)	1.06 (0.83–1.36)	76.7

(Adapted from: Tammemagi CM, Nerenz D, Neslund-Dudas C, et al. Comorbidity and survival disparities among black and white patients with breast cancer. JAMA 2005;294:1765–1772, with permission.)

tients, black patients had substantially higher mortality rates in the unadjusted analyses. However, comorbid disease did not qualitatively affect black patients more adversely than whites. Rather, comorbidities were more frequent among black patients and therefore had a quantitative effect. Adjusting for comorbid conditions accounted for nearly half of the all-cause mortality difference between black and white breast cancer patients.

Comorbid diseases are less likely to account for all-cause mortality among patients with cancers that have a shorter prognosis. For example, colorectal cancer patients are less likely to die from comorbid causes than are breast cancer patients.²⁰ However, the additional burden of comorbid disease experienced by minority patients with shorter prognosis cancers may affect survival indirectly in other ways, such as mitigating cancer treatments that are offered.

Socioeconomic status. SES is a measure of social class composed of income, wealth, education, and occupation. Most investigators who use aggregate income data to adjust for SES report an attenuation of racial disparities in cancer outcomes. Some contend that disparities in outcomes widely deemed attributable to race are simply a matter of SES^{7,21}; that is, race is just a proxy for low SES. Clearly, low SES is a robust mediator of race effects on outcomes.²² However, numerous studies have also shown a race effect on cancer survival independent of SES.¹ Although at first glance these data may appear to conflict, a closer look reveals persistent racial disadvantages in outcomes within socioeconomic strata and persistent socioeconomic effects on outcomes within racial categories.²³ It may not be possible to determine precisely the extent to which race is a proxy for patients' SES. Therefore, examining their separate and combined effects will continue to be important to understanding racial disparities.

It is important to note that the negative influence of low SES is not limited to the patient level. Similar poor outcomes are seen for both high and low SES patients who attend hospitals that disproportionately care for low SES patients, that is "low SES hospitals."^{3,24} Below, we further review the aggregate effects of SES on hospital level quality of care.

Provider factors and underuse of cancer care

Underuse of care plays a key role in poorer cancer outcomes among minority and low income patients. Although reasons for underuse are incompletely understood, it has been demonstrated consistently among minority patients along the continuum of care from screening and diagnosis, through surgery, adjuvant therapy, and surveillance.

Underuse of cancer screening is partly due to limited access to care at the patient level. However, provider behavior also appears to play a role.¹⁰ Minority and low income patients are responsive to screening recommendations^{25, 26} but are less likely to be counseled by primary providers to receive screening.²⁷ Poor communication and absence of relationship building have been demonstrated among race-discordant patient-physician dyads.^{28,29} Although it is unlikely that clinicians engage in explicit discrimination, the data support identifying opportunities to improve communication between race discordant physician-patient dyads.

Use of surgery. Black patients are considerably less likely than whites to undergo surgical resection of colon cancer,^{30,31} prostate cancer,³² nonsmall cell lung cancer,³³ and other cancers (Table 3). Whether these data represent differences in patient preference, provider decisions, or poor patient-provider communication has not been studied in the context of cancer surgery.^{34,35} However, for other surgical diseases, evidence of patterns in provider decisions based on patient race has been demonstrated in experimental and clinical settings.^{36,37}

Use of adjuvant therapy. Black patients are also less likely than whites to receive appropriate adjuvant therapy for several potentially curable tumors.³⁸⁻⁴⁰ In a national study of rectal cancer, we found that black patients had 18% higher cancer-specific mortality than whites and that the most influential care-related variable was underuse of adjuvant therapy.⁴⁰ Similar disparities have been observed in use of adjuvant therapy for colon cancer⁴¹ and breast cancer.⁴²

Reasons for racial disparities in use of adjuvant therapy are not well understood. Among rectal cancer patients, we found that black Americans with Medicare coverage were equally likely to see a medical oncologist postoperatively as

Table 3. Underuse of Surgery among Black and White Cancer Patients

First author, y	Cancer type	Frequency of surgical resection			Comment
		Black, %	White, %	p Value	
Esnaola, 2008 ⁶⁷	Stage I–II non-small cell lung cancer	44.7	63.4	<0.0001	
Bach, 1999 ³³	Stage I–II non-small cell lung cancer	64	77	<0.001	Overall 5-year survival rates for black and white patients were 26% and 34%, respectively (p < 0.001). Among patients undergoing surgery, no survival difference.
Tewari, 2005 ⁶⁸	Localized prostate cancer	17	28	<0.001	Adjusting for use of surgery decreased the racial difference in survival by 34%.
Randall, 2003 ⁶⁹	Stage II endometrial cancer	79	94	<0.001	Adjusting for use of surgery decreased racial difference in survival by 30%.
Sloane, 2006 ⁷⁰	Stage I–II hepatocellular cancer	20	30	<0.001	
Paulsen, 2008 ⁷¹	Stage I esophageal cancer	39	61	<0.001	After risk adjustment, use of surgery conferred a 30% increase in 5-year survival rate (p < 0.001).
Steyerberg, 2005 ⁷²	Stage I–II esophageal cancer	25	46	<0.001	Among patients undergoing surgery, no survival difference.

whites, but were 23% less likely to use chemotherapy after the oncologist visit.⁴³ After adjusting for clinical covariates, we were able to account for only 10% of the discrepancy in chemotherapy use. A similar study recently evaluated the use of chemotherapy among stage III colon cancer patients.⁴¹ Although both groups were equally likely to be referred to an oncologist, the youngest, healthiest black patients in the cohort were about 20% less likely to undergo chemotherapy than their white counterparts. Adjusting for measurable patient, physician, and hospital variables within the SEER-Medicare dataset accounted for less than 50% of the racial disparity in receipt of chemotherapy.

It is plausible that provider-patient interaction or other nonclinical factors are playing a role in underuse of adjuvant therapy. Black patients may be more likely than white patients to decline adjuvant therapy for societal or cultural reasons, such as lack of trust in the medical system or individual providers, poor communication with providers, or perceived insensitivity or discrimination in the patient-provider relationship. Alternatively, surgeons' and medical oncologists' recommendations about adjuvant treatment of colorectal cancer may be influenced by patient race in ways that have not been well defined. For example, in spite of randomized trial evidence,^{14,16} some physicians may believe that the efficacy of adjuvant therapy differs by race on the basis of retrospective cohort data.⁴⁴ Alternatively, physicians may hold conflicting or erroneous beliefs about chemotherapy benefits in general, as documented among pulmonary oncologists and thoracic surgeons.⁴⁵ In addition, providers may underestimate patient priorities and needs

with regard to chemotherapy. A large survey of lung cancer patients and their physicians found that in more than 50% of cases, physicians underestimated patients' preference for extended survival over symptom relief.⁴⁶ Provider underestimation of patient preferences for aggressive care may be more pronounced among black patients who are more likely to favor life-prolonging treatment.⁴⁷⁻⁴⁹

Quality of care

Black and white patients tend to be treated in different settings by different physicians. Even when black and white patients receive the same nominal treatment, black patients may have poorer outcomes to the extent that they are treated in poorer quality settings. Systematically inferior settings of care may lead to lack of advanced technology or available specialist providers. A large study of Medicare recipients reported that 80% of black patients were seen by only 22% of providers.⁵⁰ These primary providers reported a reduced ability to deliver high quality care due to setting or resource constraints.

Influence of hospital quality. Analogous to primary care, in which most black patients cluster within a disproportionately small number of providers, surgical care for black and low income patients is delivered in different hospitals than for white patients—hospitals with a reduced ability to deliver high quality care.^{3,4,24,51} In previous work, we identified hospital characteristics associated with post-operative mortality among black and white Medicare patients.⁵² After nearly every procedure type, black patients

had higher 30-day mortality rates. Adjustment for individual hospitals attenuated the effect of race on mortality substantially more than adjusting for patient characteristics or hospital volume. Moreover, hospital racial composition predicted 30-day mortality for each procedure regardless of individual patient race. These data indicate that postprocedural mortality differences by race are explained by clustering within specific hospital types. With the exception of surgical volume,⁵³⁻⁵⁵ attributes of hospitals that provide poorer quality of care are not clearly defined and are an active area of investigation.

Influence of hospital patient mix. In an analysis of California Cancer Registry data, Rhoads and colleagues³ showed a correlation between use of hospitals with a poor financial payor mix and overall increased mortality rates after surgery for colon cancer. Hospitals with a high Medicaid use rate served a disproportionately high percentage of minority patients and showed significantly higher 30-day and 1-year mortality compared with all other hospitals. These so-called high Medicaid hospitals had worse outcomes than hospitals with a more favorable payor mix, even after controlling for individual clinical characteristics and insurance status. The authors hypothesized that resource constraints in high Medicaid hospital settings translates into lower quality of care and worse outcomes for all who use these settings. Taken together, these data suggest that the racial and ethnic differences in outcomes between hospitals may be as important as differences in outcomes within hospitals, supporting an association between hospital characteristics and individual patient outcomes.

We further tested the hypothesis that racial disparities in cancer outcomes are associated with differences between hospitals rather than within hospitals by examining long-term survival among black and white patients with breast and colon cancer.⁴ After risk adjustment, 5-year survival rates among black patients with breast cancer was 25% lower than in their white counterparts. Adjusting for hospital characteristics explained 36% of the excess risk of mortality among black patients. Similarly, black patients' 5-year survival rate for colon cancer was 13% lower than that of their white counterparts; hospital characteristics accounted for 54% of the excess mortality risk. Notably, within groups of hospitals of similar racial composition, there were essentially no racial differences in cancer-specific mortality. That is, the racial composition of each hospital had a significant effect on survival but the race of individual patients within hospitals did not. So, although patient and provider factors are important, racial disparities in cancer outcomes appear to be as much about the hospital systems in which black patients receive their care.

Conclusion and recommendations

In this article, we have summarized the current evidence surrounding racial disparities in cancer treatment and outcomes. We have developed a conceptual framework to describe the mechanisms underlying disparities in outcomes, including patient factors, provider influences on use of care, and hospital influences on quality of care. This conceptual framework suggests important directions for research and policy interventions most likely to leverage ongoing disparities in cancer treatment and outcomes.

Research recommendations

Improve data quality. Rigorous examination of race and ethnicity disparities relies on accurate and reliable data. At the patient level, reliable race assignment is available for patients over the age of 65 from Medicare claims,⁵⁶ but race and ethnicity data are less reliable for many patients under age 65. To better assess whether findings among the elderly are applicable or perhaps even amplified among younger patients with reduced opportunities for health care coverage, race and ethnicity data must be collected as part of the standard medical record.

At the hospital level, there is a growing recognition that minority patients cluster within hospitals and health care systems. Without available hospital-level data, undertreatment and differential outcomes at the population level may be incorrectly attributed to the patient and provider factors. Efforts to reduce disparities may be misdirected and fall short. Therefore, we contend that hospital level data should be made publicly available for the primary purpose of improving quality of care.

SES is a key mediator of race effects and a separate marker of underserved populations. SES data tend to be available only in aggregate at the ZIP code or census tract level. Although using ecologic income data at the hospital or regional level is appropriate,^{3,4,24} it can present a methodologic challenge at the individual patient level. We recommend using a compound measure of SES or individualized data whenever possible for accurate attribution of SES influences.²⁴

On occasion, models adjusting for aggregate SES have eradicated the independent effects of race on mortality. However, there are several important reasons not to abandon race in favor of SES as the main predictor of an underserved population. First, racial designation has a powerful influence on SES that is not reciprocal. Second, minority racial status is consistently and systematically associated with a survival disadvantage. Given the legacy of discrimination in the United States, the confounding effects of race and SES are unlikely to diminish. Therefore, efforts to better understand their relative weight will continue to be important in developing targeted solutions.^{23,57-59}

Expand research methodologies. Conventional regression techniques may be inadequate for cancer outcomes that are influenced at multiple levels. Hierarchical modeling offers a means to distinguish the weighted association of each independent variable with the outcome of interest. Originally designed to evaluate the combined effects of individual hierarchical elements in educational settings (student, teacher, classroom, school) on educational outcomes, hierarchical or multilevel modeling can help to distinguish the effects of patient, provider, hospital, and even regional characteristics.

Newer research methodologies, such as qualitative research, can be used to better understand causality and previously unexplained patient and provider influences on disparities in cancer outcomes. For example, semistructured interviews and focus groups may disentangle the relative effects of race and ethnicity, education, income, and social networks on patient-provider interactions in the treatment process. New knowledge generated through qualitative techniques will help investigators design population and community-specific research and interventions. Equally important, insights gained through qualitative methodologies can help researchers and policy makers anticipate the unintended consequences that have sometimes thwarted these efforts.³⁷

Policy recommendations

Policy recommendations for ameliorating disparities in cancer care and outcomes must be grounded in the results of high quality research. Coordinated policy efforts should address each of the domains in our conceptual framework. To this end, we suggest expanding indications for access to public insurance systems; creating appropriate treatment algorithms for the delivery of cancer care; expanding patient-centered tools for navigating hospitals and health systems; and aligning the development of quality improvement incentives with the elimination of disparities.

Expand access to cancer care. Patients with cancer face high health care costs related to disability and time away from work, copayments for expensive chemotherapeutic drugs, and long-term evaluation and treatment by various specialists. As cancer care continues to improve clinically, those who can afford it have found that some cancers are transitioning to chronic rather than terminal illnesses. However, patients who are disproportionately uninsured or underinsured, such as racial or ethnic minorities and low SES patients, are not enjoying the same improved outcomes. Access to expanded public insurance programs for cancer patients is likely to substantially increase receipt of appropriate care, as has been demonstrated among patients with end-stage renal disease.⁶⁰

Expand and coordinate patient-centered tools for navigating hospitals and health systems. From timely diagnosis to receipt of appropriate treatment, many cancer patients face barriers in navigating the health care system—barriers that are amplified among minority and low SES patients. Poor access to mammographic screening, delayed follow-up of positive results, and difficulty initiating care among Harlem residents led to high breast cancer mortality rates. In response, Dr Harold Freeman partnered with the American Cancer Society in 1990 to expand local access to mammography and develop the first patient navigator program to individually assist patients with positive screening.⁶¹ Navigators acted as patient advocates in coordinating care, communicating with providers, addressing cultural issues, and overcoming logistical barriers such as transportation and child care. By early 2003, patient navigator programs were adopted in several settings and, in some cases, began to receive substantial private and federal support.

The navigator programs are designed for flexible responsiveness to local needs. However, their flexibility and local orientation has also led to inconsistent definitions of goals and measures of success.⁶² Efforts to measure their effectiveness and cost-effectiveness are underway⁶³ but are hindered by lack of uniformity among programs and by limited analytic tools for assessing such diverse subjects. The Patient Navigation Research Program is a 5-year, 9-site clinical trial that shares common definitions, provides training support to navigators, and collects committee-defined outcomes measures including timelines of care, patient satisfaction, and cost-effectiveness.⁶⁴ Thus far, rigorous studies of whether navigator programs have reduced cancer mortality have not been feasible.

Create, endorse, and revise appropriate treatment algorithms. Given minority patient clustering observed within providers, dissemination and promotion of basic standards for quality of cancer care among all providers should effectively reduce disparities. Such a program is currently underway with Centers for Medicare and Medicaid Services adoption of National Quality Forum–endorsed quality measures for use and timeliness of breast and colon cancer chemotherapy.⁶⁵ Under this plan, physicians and hospitals eventually will be required to demonstrate adherence to best practices guidelines developed by cancer-focused organizations, such as the National Comprehensive Cancer Network (NCCN), the American Society of Clinical Oncology (ASCO), and the Society for Surgical Oncology (SSO). The program's stated goal is provider accountability rather than quality improvement. Whether the anticipated uptake of timely chemotherapy use will improve equity of care is not yet clear.

Align incentives to hospitals with the elimination of disparities. Pay-for-performance programs are designed to financially reward health care systems and hospitals that meet benchmarked performance measures and penalize those that fall short. However, these plans may result in the unintended consequence of withholding funds from resource-constrained hospitals.^{37,66} In addition, buying into pay-for-performance or quality improvement programs may entail a significant financial burden. For example, the National Surgical Quality Improvement Program (NSQIP) requires an annual capital outlay of approximately \$30,000 and full-time data collection costs (personal communication). Hidden costs associated with quality improvement may place hospitals that disproportionately serve minorities and the poor at a significant disadvantage in the competition to improve quality and may, in fact, worsen disparities. To mitigate the risk of inadvertent penalties to poorer hospitals, performance-based reimbursement programs could directly reward success in decreasing disparities as an additional quality improvement measure. In this way, provider reimbursement would incentivize equitable and guideline-concordant cancer care.

In conclusion, improving cancer outcomes for all patients calls for improving coordination of care from the time of diagnosis, through treatment, and surveillance. Several federal programs have been introduced to address the issue primarily at the level of screening. However, the successful elimination of disparities will require change at multiple levels. Development of rational solutions to improve care and outcomes will require race- and ethnicity-based research and data collection as well as complex analytic methods. Policies based on a more comprehensive, culturally aware knowledge base will be better equipped to address differences in seeking, accepting, and receiving care. Aligning financial incentives with the delivery of equitable, high quality care will most certainly move us closer to the elimination of disparities in this field.

Author Contributions

Study conception and design: Morris, Rhoads, Stain, Birkmeyer

Acquisition of data: Morris, Rhoads

Analysis and interpretation of data: Morris, Rhoads, Stain, Birkmeyer

Drafting of manuscript: Morris, Rhoads

Critical revision: Morris, Rhoads, Stain, Birkmeyer

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