Published in final edited form as:
Med Care Res Rev. 2013 February ; 70(1): 84–97. doi:10.1177/1077558712458158.

Differences in Mortality for Surgical Cancer Patients by Insurance and Hospital Safety Net Status

Lindsay M. Sabik, PhD and
Virginia Commonwealth University, Department of Healthcare Policy and Research, School of Medicine, Virginia Commonwealth University, P.O. Box 980430, Richmond, VA 23298-0430, Phone: 804-628-0491, Fax: 804-628-1233, lsabik@vcu.edu

Cathy J. Bradley, PhD
Virginia Commonwealth University, Department of Healthcare Policy and Research, School of Medicine, Virginia Commonwealth University, P.O. Box 980430, Richmond, VA 23298-0430, Phone: 804-828-5217, Fax: 804-628-1233, cjbradley@vcu.edu

Abstract

Recent research suggests hospitals serving low-income patients have poorer outcomes. However, safety net hospitals (SNHs) offering access to care regardless of insurance coverage may provide better care than low-income patients would otherwise receive. This study considers the association between insurance and mortality among surgical cancer patients and the role of SNHs. We estimate models of 1- and 5-year mortality on insurance, SNH status, patient characteristics, and hospital surgical volume for colorectal and breast cancer patients. Interaction terms between insurance and SNH status estimate how mortality differs by insurance source at SNHs. Medicaid and uninsurance are associated with significantly higher mortality for colorectal cancer patients. There is a statistically significant improvement in mortality for Medicaid colorectal cancer patients treated in SNHs relative to non-safety net hospitals, and a marginally significant improvement for uninsured breast cancer patients treated in SNHs. The results suggest a survival benefit for low-income patients treated in SNHs.

Keywords

Cancer; Mortality; Insurance; Safety Net Hospitals

Uninsured and Medicaid patients fare worse than the privately insured on a range of health and healthcare measures related to access, quality, morbidity and mortality (Institute of Medicine, 2001). Inpatient mortality is often higher for uninsured and Medicaid patients relative to their privately insured counterparts (Abdullah et al., 2009; Hadley, Steinberg, & Feder, 1991; Shen, Wan, & Perlin, 2001). This may be driven by a combination of factors, including case mix within insurance group (i.e., uninsured and Medicaid patients may be more severely ill) or access to high quality medical care (these groups may receive lower quality care). There is evidence to support both explanations; in a review of the literature, Hadley (2003) found that the uninsured receive fewer preventive and diagnostic services, less therapeutic care, and tend to be more severely ill than their insured counterparts. The uninsured are also less likely to receive medical care when they develop symptoms (Ayanian, Weissman, Schneider, Ginsburg, & Zaslavsky, 2000; Baker, Shapiro, & Schur, 2000).

Correspondence to: Lindsay M. Sabik.

Recent literature has suggested that hospitals treating low-income, minority, and Medicaid patients may provide lower quality care on average (Jha, Orav, & Epstein, 2011; Werner, Goldman, & Dudley, 2008; Rhoads, Ackerson, Jha, & Dudley, 2008; Goldman, Vittinghoff, & Dudley, 2007; Hasnain-Wynia et al., 2007), which could contribute to disparities in outcomes. Understanding the roles of different factors driving disparities in outcomes between insurance groups as well as factors that may mitigate these disparities is important for informing policy and practice aimed at improving health outcomes for underserved populations.

Cancer is a prevalent disease with high treatment costs, and there are documented disparities in cancer related treatment and health outcomes by insurance status (Halpern et al., 2008; Ward et al., 2008; Bradley, Given, & Roberts, 2002; Bradley, Gardiner, Given, & Roberts, 2005). In particular, uninsured and Medicaid cancer patients have higher mortality than do privately insured patients (Ward et al., 2008; Bradley, Given, & Roberts, 2001), but many studies face difficulties in identifying whether these disparities are driven by differences in access to indicated treatment, in coordination of care, or in patient characteristics including health status and socioeconomic differences. Comparing insured and uninsured patients who have all received surgery for a given type of cancer can shed light on whether differences in outcomes by insurance status are driven primarily by receipt of surgery by reducing heterogeneity in disease and treatment type.

Where low-income patients receive care may also play an important role in determining health outcomes. While uninsured and Medicaid patients are known to have more difficulty accessing care and to have poorer health outcomes, access to and quality of care for uninsured and Medicaid patients may differ across different settings. The expected effect of treatment in a hospital that serves a large population of Medicaid and uninsured patients is somewhat unclear. On the one hand, low-income cancer patients may be more likely to obtain access to necessary care if they are connected with a safety net hospital (SNH) than if they seek care in non-safety net settings. On the other hand, recent literature suggests that hospitals serving a relatively large proportion of Medicaid patients have lower average quality or smaller gains in quality of care over time on measures related to treatment of myocardial infarction, congestive heart failure, and pneumonia, as well as cancer survival (Werner et al., 2008; Rhoads et al., 2008; Goldman et al., 2007).

One implication of these studies is that low-income patients who are covered by Medicaid or are uninsured might be better off if treated in a hospital that does not treat a large proportion of low-income patients. While existing evidence indicates lower average quality of care for those treated in SNHs, it does not address the counterfactual of how outcomes for uninsured and Medicaid patients would differ if treated in non-safety net hospitals. It could be the case that the while quality is perceived to be lower in SNHs, low-income patients would be even worse off if treated outside these institutions.

Despite findings of lower quality in hospitals serving Medicaid and low-income patients, there is reason to believe that SNHs may offer a benefit to underserved patients, particularly those requiring intensive treatment. SNHs offer access to care regardless of patients' ability to pay (by legal mandate and/or explicit mission) and have experience with these patient groups since they serve a disproportionate share of patients who are uninsured, Medicaid insured, or belong to other vulnerable groups (Lewin & Altman, 2000). Many safety net providers have formed strong community partnerships with the communities they serve (Anderson, Boumbulian, & Pickens, 2004); for example, faculty associated with academic health centers, many of which are core safety net providers, often provide outpatient care to poor and underserved patients (The Commonwealth Fund, 2001). In addition, SNHs receive

financial compensation for providing care to underserved populations (Zwanziger, Khan, & Bamezai, 2010).

The role of SNHs and the resources they provide may also differ by disease. There may be differences in the impact of SNHs even across different cancer sites, due to differences in hospital specialty, patient populations, treatment regimens, or other sources of public support. For example, the Center for Disease Control's National Breast and Cervical Cancer Early Detection Program (NBCCEDP) provides screening for low-income uninsured or underinsured women. Under the federal Breast and Cervical Cancer Prevention and Treatment (BCCPT) Act, states have the option of covering treatment under Medicaid for women screened through the program and found to have cancer. Thus, low-income patients may be more likely to be diagnosed at early stages with these cancers, and indeed recent evidence from one state suggests that the program has led to breast cancer patients enrolling in Medicaid at earlier stages of disease relative to women with other types of cancer, which may expand their treatment options and improve outcomes (Chien, Adams, & Yang, 2011). Thus, the role of SNHs for cancer patients and whether the effects of treatment in SNHs differ across cancer sites are both empirical questions that can inform discussions about the importance of the safety net for various low-income and underserved patient populations.

NEW CONTRIBUTION

This study considers the association between insurance status and mortality among surgical colorectal and female breast cancer patients, as well as the association between treatment at a SNH and mortality by insurance group, to investigate whether these institutions contribute to differences in survival for uninsured and Medicaid patients. In doing so, this study adds to the recent literature on quality in safety net hospitals, but expands on existing studies by considering differential effects across insurance groups. Surgery is the primary course of treatment for almost all patients with colorectal or breast cancer (National Cancer Institute, 2012a, 2012b). While patients may have differed in their receipt of neoadjuvant chemotherapy before surgery or adjuvant care following surgery, all patients in the sample we study have received definitive surgery. Thus, any differences across insurance types in this treated population are likely due to other aspects of care or population characteristics that differ across insurance groups, and capture the added costs or benefits of treatment in a SNH beyond simply the receipt of surgery for each insurance group.

DATA AND METHODS

Data Sources

The data come from linked cancer registry and discharge records for the Commonwealth of Virginia. Using data from a single state allows for linkage of cancer registry and hospital discharge data and controls for factors related to the Medicaid program, which differ substantially across states. The Virginia Cancer Registry (VCR) and the Virginia Health Information (VHI) discharge data were the two sources of patient data. The VCR, which is population-based, and North American Association of Central Cancer Registries accredited, contained data on patient demographic characteristics, cancer site, diagnosis date, stage, planned first course treatment, and primary health insurer. Inpatient treatment information, including patient information, International Classification of Diseases version 9 (ICD-9) diagnosis and procedure codes, payer information, and dates of admission and discharge, was extracted from the VHI discharge database, which contained discharge abstracts on all civilian Virginia hospital admissions that exceeded 23 hours. Use of VHI data allowed us to confirm receipt of surgical resection, examine patient comorbidities, and identify the hospital where each patient was treated. VHI data also supplied information on hospital characteristics.

The VCR and VHI data were linked using deterministic and probabilistic matching techniques. Both datasets contained Social Security Number (SSN), date of birth, gender and ZIP code. The sample consisted of non-elderly colorectal and female breast cancer patients who had resection as the definitive surgery (not including those colorectal cancer patients who required only polypectomy or breast cancer patients who had outpatient lumpectomy or mastectomy) identified in both the VCR and VHI with a resection within one year of diagnosis and a hospital stay of at least 24 hours. Elderly patients were excluded from the sample since they are almost universally covered by Medicare. We excluded individuals insured by government plans other than Medicaid (e.g., Veterans Administration, county plan, jail) and with unknown or missing race information. Non-elderly Medicare patients were excluded because they qualified for Medicare as part of Social Security Disability Insurance and may have had conditions that interfered with cancer treatment. We also excluded individuals with multiple cancers. Finally, we excluded a small number of observations (approximately 3% of the sample) for which we do not have complete hospital data. The final analytic sample of individuals diagnosed between January 1, 1999 and September 30, 2006, and who had a surgical resection as the definitive surgery included 5,658 colorectal cancer and 4,304 female breast cancer patients. The VHI and the American Hospital Association (AHA) survey included industry information on hospitals that was used to determine hospital safety net status.

Variables

The outcomes of interest were 1-year and 5-year mortality. Length of survival was calculated by taking the difference between date of death and date of diagnosis for individuals who were deceased. Our main patient-level variable of interest was health insurance status, categorized as private or military insurance, Medicaid, or uninsured. We controlled for a number of other patient-level factors. We included patient race and age in all models, and added a variable for patient sex in models using the colorectal cancer sample. Race was categorized as White, African American, or other. Age was entered into all models as a categorical variable (less than 45 years, 45–54 years, or 55–64 years of age). To control for patient comorbidity burden at time of surgery, we used the Deyo, Cherkin, and Ciol (1992) adaptation of the Charlson Comorbidity Index (Charlson, Pompei, Ales, & MacKenzie, 1987). Comorbidities were counted and classified into four groups: 0, 1, 2, or ≥3. We included variables for cancer stage using the American Joint Commission on Cancer (AJCC) criteria, which indicated the tumor size, degree of cancer progression, nodal involvement, and metastasis. We used information on clinical stage group whenever available; we categorized individuals who had missing or unknown clinical stage information but had pathological stage group available using the latter. Stage was categorized as early stage (AJCC 0 or I) versus AJCC stage II, III, IV, unknown, or missing.

The main hospital variable of interest was safety net status. Using the proportion of charges for charity care and the proportion of charges for Medicaid and receipt of Disproportionate Share Hospital (DSH) funds, two hospitals out of 79 represented in our sample were designated as SNHs. This classification is described in detail elsewhere (Bradley, Dahman, Shickle, & Lee, 2012). The two safety net institutions were teaching hospitals, publicly owned, and were larger than hospitals in the non-safety net category. Among the non-safety net hospitals only 3% were government owned and teaching hospitals, while approximately 20% were for-profit. In a sensitivity analysis, we ranked all hospitals by the amount of Medicaid and charity care provided as a percentage of total care. We expanded the definition of SNH to include the 10 highest ranked hospitals. In this sample of safety net hospitals 90% were non-profit, with one for-profit hospital categorized as safety net. On average among the 10 safety net hospitals 16% of charges were from Medicaid, while 8% of charges were from

Medicaid on average among the non-safety net hospitals. In addition to safety net status, we included cancer site specific measures of annual surgical volume.

Statistical Methods

We estimated linear probability models for each mortality measure on insurance status, hospital safety-net status, patient characteristics, and hospital surgical volume by cancer site. Robust standard errors were clustered at the hospital level. In a second set of models, interaction terms between insurance status and SNH status were included to investigate how mortality differs for patients of different insurance types between safety net and non-safety net hospitals. The use of linear probability models allowed for direct interpretation of interaction terms and avoided interpretation issues that arise when estimating interaction terms in nonlinear models (Ai & Norton, 2003). We also estimate logit models using methods described in Karaca-Mandic, Norton and Dowd (2012) to estimate interaction effects, although we present linear results for ease of interpretation. The results from all models estimated were qualitatively similar.

RESULTS

Descriptive statistics for the surgical cancer samples by insurance type and cancer site are reported in Table 1. For both colorectal and breast cancer patients, those with private or military insurance are slightly older, more likely to be male and white, and have earlier stage at diagnosis than Medicaid or uninsured patients. Medicaid patients have more comorbidities than the other groups. Among colorectal cancer patients (panel A) 1-year mortality is 9.1% and 5-year mortality is 32.2% across the sample, although mortality is highest among Medicaid enrollees and lowest among those with private or military insurance. Among breast cancer patients (panel B) 1-year mortality is 1.5% and 5-year mortality is 11.7% on average. As in the colorectal cancer sample, both mortality measures are highest among Medicaid patients and lowest among those with private or military insurance.

Table 2 reports regression results for both samples for 1-year and 5-year mortality models including insurance and SNH main effects, as well as patient controls, surgical volume, and year indicators. Among surgically resected patients, having Medicaid coverage or being uninsured are both associated with statistically significantly higher mortality at 1 year and 5 years for colorectal cancer patients, with increases in mortality rates of 15 percentage points and 24 percentage points relative to those with private or military insurance, respectively. Breast cancer patients with Medicaid have statistically significantly higher 5-year mortality, and the coefficient on 5-year mortality for uninsured breast cancer patients is insignificant, but positive ($p = 0.17$).

Table 3 reports regression results for the same samples and outcomes including interaction terms between insurance category and SNH status. Medicaid colorectal cancer patients treated in SNHs have statistically significantly lower 5-year mortality than Medicaid patients treated in non-safety net hospitals. To illustrate the magnitude of the difference in mortality indicated in Table 3, we consider the predicted mortality rate for a median patient (white, male, age 45–54, with no comorbidities, and with stage 3 cancer) treated in a hospital with the mean colorectal cancer surgical volume across our sample of patients in 1999. For this representative patient, the predicted probability of death within 5 years is 62.0% for a Medicaid patient treated in a non-safety net hospital and 40.4% for a Medicaid patient treated in a SNH, which is a 21.6 percentage point difference in mortality across settings. This is slightly higher than the predicted 5-year mortality rates of 34.9% and 35.9% for similar private or military insured patients treated in non-safety net hospitals and SNHs, respectively. While not statistically significant, the signs for coefficients on uninsured

colorectal cancer patients treated in SNHs are the same, and are suggestive of a positive effect of treatment in the safety net for this group as well. There is also a marginally significant improvement in mortality for uninsured breast cancer patients treated in SNHs relative to non-safety net hospitals.

The results are similar in sensitivity analyses that expanded the definition of SNH to include the 10 hospitals providing the most Medicaid and charity care as a percentage of total patient care, with statistically significantly higher mortality among uninsured and Medicaid colorectal cancer patients at 1-year and 5-years and breast cancer patients at 5-years. The interaction between Medicaid coverage and SNH status is negative and statistically significant for colorectal cancer patients, indicating lower mortality for those treated in SNHs at both 1 and 5 years (results not shown). Results are also very similar in logit models.

DISCUSSION

Among a sample of cancer patients who have all received surgical treatment, mortality is generally higher for uninsured and Medicaid patients. Our estimates of differences in mortality by insurance status are in line with previous estimates, though we see a larger disparity between the privately insured and Medicaid patients (Ward et al., 2008), which may be due to restrictive Medicaid eligibility in Virginia, resulting in a lower-income and possibly sicker Medicaid population than in other states. Our results suggest that factors other than simply receipt of surgery play a role in determining differences in outcomes for cancer patients by insurance group. In addition, the results are strongest for colorectal cancer patients among whom 1-year and 5-year mortality is statistically significantly higher for Medicaid and uninsured patients than for those with private insurance.

This may reflect that while surgery is the primary therapy, adjuvant care, including chemotherapy, also contributes to long-term survival benefits. It is possible that uninsured and Medicaid patients who undergo resection have poorer access to adjuvant care and that such access also differs by safety net setting, though future research is necessary to test this hypothesis. While we control for demographic factors, comorbidities and stage at diagnosis, there may also be differences across insurance groups in disease severity, including molecular subtypes, which will affect survival as well.

We find that SNHs provide a mortality benefit for Medicaid patients with colorectal cancer relative to other settings. There is suggestive evidence of a similar benefit for the uninsured with both colorectal and breast cancer. This may be explained in part by access to chemotherapy and radiation available for uninsured and Medicaid patients in safety net settings, where access to outpatient services and coordinated care is provided regardless of ability to pay. While the results are not as strong for the uninsured, there is suggestive evidence of a survival benefit for uninsured patients treated in SNHs relative to non-safety net hospitals.

Both the difference in mortality among the Medicaid and uninsured relative to those with private or military insurance and the positive effect of treatment in a SNH on mortality are most pronounced and statistically significant among the sample of colorectal cancer patients. These patients have higher mortality than the sample of breast cancer patients across all insurance groups and the sample is slightly larger, thus we have more statistical power in the colorectal cancer sample. There may be other reasons for the differences in effects across the samples. In particular, more public resources are available for patients with breast cancer, including screening through the CDC’s NBCCEDP and treatment coverage through Medicaid under the BCCPTA for women who would not be categorically eligible for Medicaid if they did not have breast or cervical cancer. This may lead to better surveillance

and less reliance on the safety net among low-income breast cancer patients than among colorectal cancer patients.

Our study faces four main limitations. First, the ability to generalize the results is limited by the focus on a single state. The Virginia Medicaid program currently covers adults with Medicaid eligible children who are below 31% of the Federal Poverty Level (Kaiser Family Foundation, 2011), making it one of the more restrictive Medicaid programs in the country. However, cross-state comparisons are inherently limited because each state implements its Medicaid program differently and because the linking of state cancer registry data to inpatient discharges can only occur at the state level. Second, we only categorized two hospitals in the sample as SNHs in our main analysis, and they differ from other hospitals in the sample in terms of size, teaching status, and ownership. In a sensitivity analysis, we expand the sample of hospitals categorized as SNHs and our results are very similar, suggesting that these hospitals improve outcomes for Medicaid patients, and possibly for the uninsured, relative to other treatment settings.

Third, while we have data for all patients who are diagnosed and receive surgery in Virginia, we do not observe those who receive treatment out of state. These individuals are likely to be concentrated in Northern Virginia where multiple treatment facilities exist in contiguous states and may represent better insured, higher income individuals who are more likely to travel for care. Fourth, there are limitations to the measures in our data. For example, the cancer may have progressed from diagnosis to surgery (or diminished if the patient received neoadjuvant care) and there are likely differences in outpatient treatment, both of which may differ by insurance. While we know from previous research that wait times are longer in SNHs (Bradley et al., 2012), this would dampen the mortality benefit from SNHs for low-income patients. In spite of the longer wait times we find that uninsured and Medicaid patient treated in SNHs have lower mortality. More importantly, we are unable to examine differences in the types of treatment that patients receive prior to and after leaving the inpatient setting, though understanding the role of other types of treatment and how they differ by SNH status is an important avenue for future research.

We focus on two specific cancer sites and on a subset of patients who received surgical resection in an inpatient setting. While most patients with breast or colorectal cancer receive surgery, we do not consider those who do not. Further, our results may not generalize to other types of cancer that follow substantially different treatment regimens. We chose to focus on this specific sample of patients in one state in order to eliminate variation in many aspects of treatment across other cancer sites and in Medicaid policy across states. While this approach increases the internal validity of our study, it limits the external validity of our findings.

Several recent studies have shown that hospitals that serve low-income patients and racial and ethnic minorities provide lower quality care than other hospitals (Jha et al., 2011; Werner et al., 2008; Goldman et al., 2007; Hasnian-Wynia et al., 2007). In contrast, our results suggest that safety net hospitals relative to other hospitals can provide a survival benefit for uninsured and Medicaid cancer patients. This result is most pronounced among colorectal cancer patients. On average, across all patients treated in SNHs, we do not see clear evidence of improved survival, but we find evidence of a statistically significant effect of treatment in a SNH for uninsured and Medicaid colorectal cancer patients, for whom the access provided by SNHs is likely to matter the most. This suggests that even if SNHs have lower quality on certain measures, low-income or underserved patients may fare better when treated in a safety net setting than they would without access to a SNH and affiliated resources.

While the Affordable Care Act (ACA) will increase insurance coverage rates, it will also reduce DSH funds that currently provide additional support for hospitals serving large populations of uninsured and Medicaid patients. Evidence from Massachusetts suggests that after reform in that state patients continued to seek care at SNHs because they found them convenient and affordable (Ku, Jones, Shin, Byrne, & Long, 2011). Our analysis suggests that SNHs can also provide a survival benefit to uninsured and Medicaid insured cancer patients. This suggests that continued support for SNHs is warranted regardless of policy initiatives to expand insurance coverage. Furthermore, it suggests the importance of cancer care in the safety net environment. SNHs may be of particular importance for low-income patient populations in need of complex and intensive therapies. Studies indicating lower overall quality in hospitals serving low-income, uninsured and publicly insured patients do not address the issue of whether underserved patients may fare better in these settings despite lower overall quality than they would in other types of hospitals. Policies should aim to increase quality at SNHs; to ensure better access to high-quality, coordinated care at non-safety net hospitals for low-income patients; or both, in order to address the disparities in health outcomes between different insurance groups.

Acknowledgments

This research was supported by American Cancer Society grant, RSGI-08-301-01, An examination of uninsured and insured cancer patients in Virginia, Cathy J. Bradley, Principal Investigator. Dr. Sabik was also supported under a fellowship from the National Cancer Institute (2R25CA093423-06A2).

References

Abdullah F, Zhang Y, Lardaro T, Black M, Colombani PM, Chrouser K, et al. Analysis of 23 million US hospitalizations: uninsured children have higher all-cause in-hospital mortality. Journal of Public Health. 2009; 32(2):236–244. [PubMed: 19875420]

Ai C, Norton E. Interaction terms in logit and probit models. Economics Letters. 2003; 80:123–129.

Anderson RJ, Boumbulian PJ, Pickens SS. The role of U.S. public hospitals in urban health. Academic Medicine. 2004; 79(12):1162–1168. [PubMed: 15563650]

Ayanian JZ, Weissman JS, Schneider EC, Ginsburg JA, Zaslavsky AM. Unmet health needs of uninsured adults in the United States. JAMA. 2000; 284(16):2061–2069. [PubMed: 11042754]

Baker DW, Shapiro MF, Schur CL. Health insurance and access to care for symptomatic conditions. Archives of Internal Medicine. 2000; 160(9):1269–1274. [PubMed: 10809029]

Bradley CJ, Given CW, Roberts C. Disparities in cancer diagnosis and survival. Cancer. 2001; 91(1): 178–188. [PubMed: 11148575]

Bradley CJ, Given CW, Roberts C. Race, socioeconomic status, and breast cancer treatment and survival. Journal of the National Cancer Institute. 2002; 94(7):490–496. [PubMed: 11929949]

Bradley CJ, Gardiner J, Given CW, Roberts C. Cancer, Medicaid enrollment, and survival disparities. Cancer. 2005; 103(8):1712–1718. [PubMed: 15768435]

Bradley C, Dahman B, Shickle L, Lee W. Surgery wait times and specialty services for insured and uninsured breast cancer patients: does hospital safety net status matter? Health Services Research. 2012; 47(2):677–697. [PubMed: 22092155]

Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. Journal of Chronic Disease. 1987; 40(5):373–383.

Chien L-N, Adams EK, Yang Z. Medicaid enrollment at early stage of disease: The Breast and Cervical Prevention and Treatment Act in Georgia. Inquiry. 2011; 48(3):197–208. [PubMed: 22235545]

Deyo RA, Cherkin DC, Ciol MA. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. Journal of Clinical Epidemiology. 1992; 45(6):613–619. [PubMed: 1607900]

Goldman LE, Vittinghoff E, Dudley RA. Quality of care in hospitals with a high percent of Medicaid patients. Medical Care Research and Review. 2007; 45(6):579–583.

Hadley J, Steinberg EP, Feder J. Comparison of uninsured and privately insured hospital patients. Journal of the American Medical Association. 1991; 265(3):374–379. [PubMed: 1984537]

Hadley J. Sicker and poorer - the consequences of being uninsured: a review of the research on the relationship between health insurance, medical care use, health, work, and income. Medical Care Research and Review. 2003; 60(2):3S–75S. [PubMed: 12800687]

Halpern MT, Ward EM, Pavluck AL, Schrag NM, Bian J, Chen AY. Association of insurance status and ethnicity with cancer stage at diagnosis for 12 cancer sites: a retrospective analysis. Lancet Oncology. 2008; 9(3):222–231. [PubMed: 18282806]

Hasnain-Wynia R, Baker DW, Nerenz D, Feinglass J, Beal AC, Landrum, et al. Disparities in health care are driven by where minority patients seek care: examination of the hospital quality alliance measures. Archives of Internal Medicine. 2007; 167(12):1233–1239. [PubMed: 17592095]

Institute of Medicine. Coverage matters: insurance and health care. Washington, DC: National Academies Press; 2001.

Jha AK, Orav EJ, Epstein AM. Low-quality, high-cost hospitals, mainly in south, care for sharply higher shares of elderly black, Hispanic, and Medicaid patients. Health Affairs. 2011; 30(10): 1904–1911. [PubMed: 21976334]

Kaiser Family Foundation. [Accessed on: July 12, 2012] Virginia: Medicaid/CHIP eligibility. 2011. Available at: http://www.statehealthfacts.org/profileind.jsp?cat=4&sub=54&rgn=48.

Karaca-Mandic P, Norton EC, Dowd B. Interaction terms in nonlinear models. Health Services Research. 2012; 47(1 pt. 1):255–274. [PubMed: 22091735]

Ku L, Jones E, Shin P, Byrne FR, Long SK. Safety-net providers after health care reform: lessons from Massachusetts. Archives of Internal Medicine. 2011; 171(15):1379–1384. [PubMed: 21824954]

Lewin, ME.; Altman, S. America's Health Care Safety Net: Intact but Endangered. Committee on the Changing Market, Managed Care, and the Future Viability of Safety Net Providers, Institute of Medicine. , editor. Washington DC: National Academies Press; 2000.

National Cancer Institute. [Accessed on: July 12, 2012] Breast cancer treatment: treatment options by stage. 2012. Available at: http://www.cancer.gov/cancertopics/pdq/treatment/breast/Patient/page6

National Cancer Institute. [Accessed on: July 12, 2012] Colon cancer treatment: treatment options for colon cancer. 2012. Available at: http://www.cancer.gov/cancertopics/pdq/treatment/colon/Patient/page5

Rhoads KF, Ackerson LK, Jha AK, Dudley RA. Quality of colon cancer outcomes in hospitals with a high percentage of Medicaid patients. Journal of the American College of Surgeons. 2008; 207(2): 197–204. [PubMed: 18656047]

Shen JJ, Wan TT, Perlin JB. An exploration of the complex relationships of socioecologic factors in the treatment and outcomes of acute myocardial infarction in disadvantaged populations. Health Services Research. 2001; 36(4):711–732. [PubMed: 11508636]

The Commonwealth Fund. [Accessed on: July 12, 2012] Improving the quality of health care services. 2001. Available at: http://www.commonwealthfund.org/annual-reports/~/media/files/annualreport/2001/05_qualheal.pdf.

Ward E, Halpern M, Schrag N, Cokkinides V, DeSantis C, Bandi P, et al. Association of insurance with cancer care utilization and outcomes. CA - A Cancer Journal for Clinicians. 2008; 58(1):9–31. [PubMed: 18096863]

Werner RM, Goldman LE, Dudley RA. Comparison of change in quality of care between safety-net and non safety-net hospitals. Journal of the American Medical Association. 2008; 299(18):2180–2187. [PubMed: 18477785]

Zwanziger J, Khan N, Bamezai A. The relationship between safety net activities and hospital financial performance. BMC Health Services Research. 2010; 10:15. [PubMed: 20074367]

Med Care Res Rev. Author manuscript; available in PMC 2014 February 01.

Table 1

Descriptive statistics for surgical sample by insurance status and cancer

A. COLORECTAL CANCER SAMPLE						
Insurance Type:	**Private or Military**		**Medicaid**		**Uninsured**	
	n	**%**	**n**	**%**	**n**	**%**
n	4,901		237		520	
Mortality						
1 year	378	7.7	56	23.6	79	15.2
5 year	1,451	29.6	138	58.2	234	45.0
Hospital SN status						
Non-SNH	4,668	95.3	204	86.1	400	76.9
SNH	233	4.8	33	13.9	120	23.1
Age						
<45	600	12.2	49	20.7	107	20.6
45–54	1,713	35.0	79	33.3	180	34.6
55–64	2,588	52.8	109	46.0	233	44.8
Gender						
Female	2,270	46.3	140	59.1	255	49.0
Male	2,631	53.7	97	40.9	265	51.0
Race						
White	3,776	77.1	129	54.4	292	56.2
African American	945	19.3	97	40.9	191	36.7
Other	180	3.7	11	4.6	37	7.1
Comorbidity score						
0	3,801	77.6	153	64.6	392	75.4
1	824	16.8	62	26.2	103	19.8
2	113	2.3	13	5.5	10	1.9
>/=3	163	3.3	9	3.8	15	2.9

A. COLORECTAL CANCER SAMPLE

Insurance Type:	Private or Military		Medicaid		Uninsured	
	n	%	n	%	n	%
Stage						
0–1	1,228	25.1	32	13.5	67	12.9
2	1,080	22.0	47	19.8	144	27.7
3	1,193	24.3	55	23.2	138	26.5
4	769	15.7	47	19.8	103	19.8
Unknown	578	11.8	51	21.5	65	12.5
Missing	53	1.1	5	2.1	3	0.6

B. BREAST CANCER SAMPLE

Insurance Type:	Private or Military		Medicaid		Uninsured	
	n	%	n	%	n	%
n		3,831		245		228
Mortality						
1 year	53	1.4	8	3.3	5	2.2
5 year	398	10.4	59	24.1	45	19.7
Hospital SN status						
Non-SNH	3,482	90.9	190	77.6	151	66.2
SNH	349	9.1	55	22.5	77	33.8
Age						
<45	977	25.5	71	29.0	67	29.4
45–54	1,484	38.7	96	39.2	79	34.7
55–64	1,370	35.8	78	31.8	82	36.0
Race						
White	3,013	78.7	123	50.2	126	55.3
African American	655	17.1	108	44.1	79	34.7
Other	163	4.3	14	5.7	23	10.1

B. BREAST CANCER SAMPLE

Insurance Type:	Private or Military		Medicaid		Uninsured	
	n	%	n	%	n	%
Comorbidity score						
0	3,293	86.0	174	71.0	167	73.3
1	384	10.0	53	21.6	50	21.9
2	36	0.9	7	2.9	4	1.8
>/=3	118	3.1	11	4.5	7	3.1
Stage						
0–1	1,509	39.4	60	24.5	53	23.3
2	1,340	35.0	88	35.9	80	35.1
3	530	13.8	43	17.6	47	20.6
4	67	1.8	13	5.3	12	5.3
Unknown	380	9.9	41	16.7	36	15.8
Missing	5	0.1				

Table 2

Multivariate regressions of mortality on insurance and hospital safety net status

	Colorectal Cancer		Breast Cancer	
	1-year	5-year	1-year	5-year
Medicaid	0.149***	0.242***	0.005	0.084***
	(0.026)	(0.038)	(0.011)	(0.022)
Uninsured	0.068***	0.119***	−0.005	0.044
	(0.014)	(0.022)	(0.009)	(0.032)
Safety Net Hospital	−0.009	−0.017	0.008***	−0.021***
	(0.032)	(0.024)	(0.003)	(0.007)
Age 45–54	0.033***	0.056***	0.007	0.004
	(0.010)	(0.018)	(0.005)	(0.013)
Age 55–64	0.046***	0.066***	0.006	0.016
	(0.010)	(0.018)	(0.005)	(0.013)
Male	0.031***	0.045***		
	(0.009)	(0.011)		
African American	−0.008	0.014	0.014**	0.050***
	(0.009)	(0.013)	(0.006)	(0.016)
Other	0.017	−0.005	−0.002	−0.003
	(0.017)	(0.027)	(0.007)	(0.024)
Charlson = 1	−0.009	0.005	0.001	0.042**
	(0.010)	(0.014)	(0.007)	(0.017)
Charlson = 2	0.046	0.078**	0.069*	0.191***
	(0.029)	(0.031)	(0.036)	(0.058)
Charlson>/=3	0.034	0.022	0.006	−0.041
	(0.028)	(0.033)	(0.011)	(0.088)
Stage II	0.009**	0.076***	0.000	0.070***
	(0.004)	(0.012)	(0.003)	(0.009)
Stage III	0.044***	0.254***	0.030***	0.220***
	(0.009)	(0.016)	(0.007)	(0.020)
Stage IV	0.314***	0.749***	0.113***	0.540***
	(0.017)	(0.015)	(0.027)	(0.049)
Stage Unknown	0.106***	0.249***	0.029***	0.089***
	(0.014)	(0.022)	(0.009)	(0.017)
Stage Missing	0.093**	0.198***	−0.002	0.173
	(0.035)	(0.050)	(0.006)	(0.177)
Observations	5,658	5,658	4,304	4,304

*** p<0.01

** p<0.05

* p<0.1

Notes: Cluster robust standard errors in parentheses; SNH = Safety net hospital; All regressions also include cancer specific hospital surgical volume measures and year dummies. Omitted insurance category is “private or military”; omitted age category, “<45”; omitted race category, “white”; omitted Charlson score, “0”; and omitted stage, “0–1.”

Table 3

Multivariate regressions of mortality on insurance and hospital safety net status including interactions between insurance and safety net hospital status

	Colorectal Cancer		Breast Cancer	
	1-year	5-year	1-year	5-year
Medicaid	0.159***	0.271***	0.010	0.081***
	(0.028)	(0.037)	(0.013)	(0.027)
Uninsured	0.067***	0.121***	−0.006	0.073***
	(0.017)	(0.026)	(0.012)	(0.026)
Safety Net Hospital	−0.002	0.010	0.010***	−0.011
	(0.023)	(0.025)	(0.002)	(0.011)
Medicaid*Safety Net	−0.077*	−0.225***	−0.022	0.008
	(0.044)	(0.050)	(0.018)	(0.030)
Uninsured*Safety Net	−0.001	−0.031	0.003	−0.095*
	(0.029)	(0.028)	(0.014)	(0.055)
Age 45–54	0.034***	0.057***	0.007	0.003
	(0.010)	(0.018)	(0.005)	(0.013)
Age 55–64	0.046***	0.067***	0.006	0.016
	(0.010)	(0.018)	(0.005)	(0.013)
Male	0.031***	0.045***		
	(0.009)	(0.011)		
African American	−0.008	0.015	0.014**	0.052***
	(0.009)	(0.013)	(0.006)	(0.016)
Other	0.017	−0.006	−0.002	−0.003
	(0.017)	(0.027)	(0.007)	(0.023)
Charlson = 1	−0.009	0.006	0.001	0.043**
	(0.010)	(0.014)	(0.007)	(0.017)
Charlson = 2	0.046	0.078**	0.068*	0.194***
	(0.029)	(0.031)	(0.036)	(0.059)
Charlson>/=3	0.033	0.019	0.006	−0.042
	(0.028)	(0.034)	(0.012)	(0.089)
Stage II	0.008*	0.076***	0.000	0.070***
	(0.004)	(0.011)	(0.003)	(0.010)
Stage III	0.044***	0.254***	0.031***	0.220***
	(0.008)	(0.016)	(0.007)	(0.020)
Stage IV	0.314***	0.749***	0.114***	0.539***
	(0.017)	(0.015)	(0.028)	(0.049)
Stage Unknown	0.106***	0.246***	0.029***	0.089***
	(0.014)	(0.022)	(0.009)	(0.017)
Stage Missing	0.093***	0.199***	−0.002	0.174

	Colorectal Cancer		Breast Cancer	
	1-year	5-year	1-year	5-year
	(0.035)	(0.049)	(0.006)	(0.177)
Observations	5,658	5,658	4,304	4,304

*** p<0.01

** p<0.05

* p<0.1

Notes: Cluster robust standard errors in parentheses; SNH = Safety net hospital; All regressions also include cancer specific hospital surgical volume measures and year dummies. Omitted insurance category is “private or military”; omitted age category, “<45”; omitted race category, “white”; omitted Charlson score, “0”; and omitted stage, “0–1.”