The Relationship Between Insurance Coverage and Cancer Care: A Literature Synthesis

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The Relationship Between Insurance Coverage and Cancer Care: A Literature Synthesis

Nicole M. Marlow, Alexandre L. Pavluck, John Bian, Elizabeth M. Ward, and Michael T. Halpern

Abstract

This paper summarizes key literature on the relationship between health care insurance status and screening, diagnosis, and medical care patterns and outcomes for individuals with cancer. All studies included for this literature synthesis were identified using the National Library of Medicine's Medline database; only English language articles published in the past 10 years were considered. Based on article titles and abstracts, we selected the most relevant studies for full review and inclusion in this manuscript. Although the summarized literature is mixed, individuals who are uninsured or have insurance coverage through programs for low-income persons (e.g., Medicaid coverage) are significantly less likely to use cancer screening services and significantly more likely to present with advanced stage cancer at diagnosis and to have significantly worse survival. The relationship between insurance status and cancer treatment patterns is less clear, as fewer studies have examined this relationship, but the available evidence suggests that uninsured patients are less likely to receive optimal cancer care. The research reviewed here suggests that the benefits of extending appropriate insurance coverage to uninsured and underinsured individuals could be substantial. These benefits are likely to include reduced morbidity, improved quality of life, and increased survival for cancer patients as well as a positive impact on overall health care and societal costs.

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Introduction

Many studies have indicated that lack of health insurance is associated with adverse patient outcomes.[1-3] Although lack of insurance is a barrier for medical care access overall, uninsured adults face even greater barriers for preventive services and treatment for chronic illnesses, such as cancer, than for acute care.[4] Thorpe and Howard reported that approximately 11 percent of cancer patients were uninsured.[5] An additional 15 percent had coverage through Medicaid or other public programs (not including Medicare). Rates of being uninsured or insured through public programs are greater among racial/ethnic minority populations: 14 percent of black cancer patients were uninsured and 33 percent received insurance through public programs, while the rates for Hispanic cancer patients were 20 percent uninsured and 24 percent receiving public program insurance.

Not surprisingly, individuals who are either uninsured or enrolled in Medicaid have decreased rates of cancer screening, less optimal cancer treatment patterns, and worse cancer-related outcomes compared with those with Medicare coverage or private insurance. These differences are likely attributable to multiple factors, including the following:

- out-of-pocket expenditures for uninsured patients that deter use of preventive care services and physician encounters for suspicious symptoms

- decreased appreciation of the importance of appropriate and timely followup after abnormal screening results

- difficulty in identifying both primary care and specialist physicians willing to see uninsured and Medicaid patients, and greater delays for appointments among physicians willing to see these patient groups

- greater likelihood of receiving care at safety-net hospitals, which may be less likely to have the most recent medical care technology or physicians informed about current practices and guidelines

- decreased access to newer, more expensive therapies, which are generally more effective and/or have fewer side effects

- greater difficulties in navigating health care systems, including the complex set of health care providers involved in cancer care.

Beyond the potential impacts of being uninsured or having Medicaid coverage, other forms of insurance may also be associated with decreased access to care for individuals with cancer. Private health insurance includes a tremendous range of products, some of which have substantial out-of-pocket expenses (deductibles, co-payments, and co-insurance). These costs may deter the use of preventive care services (e.g., cancer screenings) and visits with physicians to evaluate suspicious symptoms that may represent early-stage cancers. Privately insured patients with more limited benefits may also be less likely to purchase expensive new medications because of substantial patient-borne costs.

In addition, patients in traditional fee-for-service plans may differ from those in managed care plans. Managed care plans (for privately insured or Medicare- or Medicaid-covered individuals), owing to their capitated payment structures, have increased financial incentives to keep enrollees healthy and diagnose diseases early. Thus, individuals in these plans may have more incentives or support for participating in screening programs and other preventive care activities.

A substantial body of literature has investigated the relationship between health care insurance status and medical care patterns and outcomes for individuals with cancer. This research report summarizes key literature regarding the relationship between health insurance coverage and cancer care. Our main objective is to provide a summary of published results to evaluate whether providing adequate insurance coverage for uninsured and underinsured individuals (i.e., those experiencing problems in accessing care despite having health insurance) could improve outcomes for cancer patients (e.g., earlier stage at diagnosis, increased access to treatments, improved quality of life outcomes during and after treatments, increased survival). Our synthesis is not a comprehensive review of all literature on this topic; our focus is on providing an overview and highlighting the main findings in this area. The summary (presented in the Results section)

is divided into three sections: the association of insurance status with cancer screening services, with cancer stage at diagnosis, and with cancer treatment patterns and outcomes.

Methods

We identified all studies included for this literature synthesis using the National Library of Medicine's MEDLINE database. We used the Medical Subject Heading (MeSH) term *Neoplasms* in conjunction with the MeSH terms *Insurance*, *Health*, *Medically Uninsured*, or *Health Services Accessibility*. We included only English language articles, studies based on US populations, and studies published in the past 10 years. In addition, we also evaluated reference sections of reviewed articles to identify other studies for inclusion in this report. Study selection for inclusion in this literature synthesis was based on a comprehensive review of article titles and abstracts.

To provide an overview and highlight findings in this area, we selected only articles that clearly presented information on both patient insurance status and the specific type of cancer screening, diagnosis, treatment, or outcomes being assessed. Papers that did not clearly define different insurance status groups or did not provide information on cancer treatment patterns or outcomes separately for each insurance status group were excluded. Further, when multiple papers examined the link between insurance status and cancer treatment patterns or outcomes in the same (or very similar) populations, we included only the most recent studies. We selected the most relevant studies for full review and inclusion in this manuscript. Additionally, all articles selected for review for this report had to include multivariate statistical analyses as part of their study methodology, to control for other relevant factors while examining the potential impact of insurance status.

Results

Identified Articles

Based on the MEDLINE search parameters and review process described previously in the Methods section, we identified 25 publications providing information on the association between health insurance and cancer screening; 17 publications on insurance and cancer diagnosis; and 26 publications on insurance and cancer treatment and outcome. The literature summary presented in this section includes 15 of the articles on insurance and screening, 11 on insurance and diagnosis, and 18 on insurance and cancer treatment and outcome.

Association Between Health Insurance and Cancer Screening Services

A variety of studies have explored the relationship between insurance status and use of cancer screening services, mainly mammography, colon cancer screening, and cervical cancer screening. Studies included in this literature synthesis are summarized in Table 1 (following page). Most published studies have used data from national surveys, either the Behavioral Risk Factor Surveillance System (BRFSS) or the National Health Information Survey (NHIS). Studies in this literature synthesis are grouped below based on their source of data.

Studies Using Data from the Behavioral Risk Factor Surveillance System

The BRFSS, an annual health survey developed by the Centers for Disease Control and Prevention (CDC), is the world's largest ongoing telephone-based health survey system (http://www.cdc.gov/brfss). Analyses of the BRFSS have consistently shown that lack of health insurance is associated with decreased rates of cancer screening. Qureshi et al.[6] assessed the effects of insurance status on the likelihood of screening mammography utilization within the preceding 2 years among women ages 40 to 49 using data from the 1992–1993 BRFSS. Separate evaluations of the impact of health insurance on screening mammography utilization were performed for four racial/ethnic groups: non-Hispanic white, non-Hispanic black, Hispanic, and other. Adjusting for potential confounders (including other access-to-care variables, demographics, and behavioral characteristics), having health insurance significantly increased the likelihood of using screening mammography among all ethnic groups except the "other" group.

Table 1. Summary of literature relating to associations of insurance coverage with cancer prevention and screening

Author and Citation Number	Data	Sample	Insurance Category	Dependent Variable	Statistical Analysis	Results
A. Studies Using the BRFSS						
Ayanian et al.[7]	1997-1998 national Behavioral Risk Factor Surveillance System (BRFSS) data	Adults ages 18-64 (N=163,538)	Long-term uninsured (1+ yr), short-term uninsured (<1 yr), insured (any public or private source)	SM & CBE w/in 2 yrs, Pap smear w/in 3 yrs, FOBT w/in 2 yrs, & sigmoidoscopy w/in 5 yrs	Multivariate logistic regression to compute and report adjusted proportions of each insurance group that had not received screening	In adjusted analyses, compared with the insured, the long-term uninsured were significantly (p<.001) more likely not to have each of the studied cancer screening services and the short-term uninsured were significantly more likely (p<.001) to not have mammography and Pap smears but were equivalently likely to have FOBT and sigmoidoscopy.
Ioannou et al.[8]	1999 BRFSS	Adults ages 50+ (N=61,068)	Uninsured, private, Medicaid, Medicare, Military/ CHAMPUS/ VA, or other	CRC screening: FOBT w/in 1 yr and/or S/C w/in 5 yrs	Multivariate logistic regression analysis of predictors of screening using STATA to account for the sampling and weighting processes	After adjusting for other predictors, the presence of health care coverage remained a significant predictor (OR=1.7, p<0.001) of receipt of current CRC screening (FOBT and/or S/C) within timeframes specified by clinical guidelines.
Pollack et al.[9]	2002 BRFSS data	Adults ages 50+ (N=110,413)	Insured and uninsured	CRC screening: FOBT w/in 1 yr and/or S/C w/in 10 yrs	Multivariate logistic regression	The adjusted odds of receiving CRC screening were significantly lower for respondents who reported having no health insurance (FOBT: OR=0.63 [95% CI=0.56-0.72], S/C: OR=0.63 [95% CI=0.56-0.70]).
Qureshi et al.[6]	1992-1993 BRFSS	Women ages 40-49 (N=18,245)	Reported availability of any form of healthcare coverage	Use of SM w/in 2 yrs (excluded women w/ diagnostic mammography)	Multivariate logistic regression	Having health insurance coverage significantly increased the likelihood of SM among all ethnic groups (All: OR=2.16 [95% CI=1.8-2.6], non-Hispanic whites: OR=2.4 [95% CI=2.0-3.0], non-Hispanic blacks: OR=1.5 [95% CI=1.0-2.3], Hispanics: OR=2.5 [95% CI=1.5-4.2]) excluding the "other" ethnic group (OR=1.1, 95% CI=0.5-2.3).
Ross et al.[10]	2002 BRFSS	Adults ages 18-64 (N=194,943)	Insured and uninsured	Pap smears w/in 3 yrs, SM w/in 2 yrs, and CRC screening (FOBT w/in 2 yrs or S/C w/in 5 yrs)	χ^2 tests and multivariate logistic regression	Unadjusted analyses showed that those with health insurance had proportionately greater use of all cancer prevention services (p<.01). Multivariate analyses further showed that increased income did not attenuate the significant associations between being uninsured and using fewer services.
B. Studies Using the NHIS						
Coughlin et al.[11]	2000 NHIS cancer control topical module	Women ages 40+ (N=10,403)	Insured and uninsured	Mammography use & CBE w/in 2 yrs	Multivariate logistic regression	Adjusted analyses showed a significant and positive association for health insurance coverage with mammography (OR=2.31, 95% CI 1.88-2.84) and CBE (OR=1.99, 95% CI 1.59-2.49).
Echeverria & Carrasquillo[13]	2000 NHIS data	Women ages 18-70 (N=18,342)	Insured and uninsured	Pap smears w/in 3 yrs for women 18-65; SM w/in 2 yrs for women 50-70	Multivariate logistic regression to report adjusted and unadjusted screening proportions	Adjusting for covariates, including health insurance and usual source of care, Pap smears remained significantly less likely (p<0.01) among noncitizens than among US-born women (<0.01), yet there were no significant disparities in SM between these groups.

Table 1. Summary of literature relating to associations of insurance coverage with cancer prevention and screening *(continued)*

Author and Citation Number	Data	Sample	Insurance Category	Dependent Variable	Statistical Analysis	Results
B. Studies Using the NHIS (continued)						
Potosky et al.[14]	1992 NHIS	Women ages 18+ for Pap smear (N=6,841); men and women ages 40+ for all other tests (N=2,614 & 3,803, respectively)	≤Age 64: HMO/PPO, private fee-for-service (FFS), Medicaid not managed care, & uninsured; ages 65+: Medicare w/ private FFS, Medicare w/ Medicaid, HMO/PPO Medicare, Medicare only	PRSIG w/in 3 yrs, Pap smear w/in 3 yrs, SM w/in 2 yrs, CBE w/in 2 yrs, DRE w/in 2 yrs, and FOBT w/in 2 yrs (excluded respondents with receipt of testing for a health problem)	Multivariate logistic regression models to estimate proportions of screening w/in each insurance group	≤64: all except PRSIG were more likely ($p<0.05$) for Medicaid than for uninsured; Pap smear was more likely ($p<0.001$) for FFS than for Medicaid; FOBT & DRE were more likely ($p≤0.01$) for HMO/PPO than for FFS. 65+: SM & FOBT were more likely ($p=0.02$) for Medicare-HMO/PPO than for Medicare w/ FFS; all except PRSIG were more likely ($p≤0.05$) for Medicare w/ FFS than for duals.
Sambamoorthi & McAlpine[12]	1996 Medical Expenditure Panel Survey (MEPS), which collected more detailed information form a subset of NHIS respondents	Women ages 21-64 (N=6,218)	Private, public, and uninsured	Pap smear w/in 3 yrs and SM w/in 2 yrs	Multivariate logistic regression	Health insurance was associated with a significantly increased use of services for all groups except public FFS compared with uninsured.
Ward et al.[15]	2005-2006 NHIS	Women ages 40-64 for SM, & 18+ for Pap smear; men & women ages 50+ for CRC screening; men ages 50+ for PSA	All, private, Medicaid, uninsured (at time of interview), uninsured for >12 months	Proportion of the population sub-group that received appropriate screening (SM w/in 2 yrs, Pap smear w/in 3 yrs, FOBT w/in past yr or endoscopy w/in 10 yrs, PSA w/in past yr)	Stratified descriptive analyses	The likelihood of receiving recommended screening varies markedly by insurance status.
C. Studies Using Other Data Sources						
Almeida et al.[17]	1997 National Survey of America's Families (NSAF)	Low-income women ages <65 (N=11,172)	Medicaid or other public plan, private, or uninsured	Pap smear w/in the past yr, CBE w/in the past yr	Multivariate ordinary least squares regression analyses	Adjusting for other predictors, those uninsured were significantly less likely ($p<0.05$) than those with Medicaid and other public insurance to receive Pap smears ($β=-0.13$) and CBE ($β=-0.11$).
Carrasquillo & Pati[16]	April-November 2001 Commonwealth Fund's (CMWF) Health Care Quality Survey (HCQS)	Women ages 18-65 for Pap smear, women 40-70 for mammogram (N=3,596)	Private, government, or uninsured	Pap smear & SM w/in 2 yrs	Multivariate logistic regression models to estimate the adjusted percentages of women in each group who received a Pap-smear and SM	In the final models, health insurance remained the strongest independent predictor of screening (Pap smear: OR=0.49, 95% CI=0.32-0.75; SM: OR=0.23, 95% CI=0.12-0.43; uninsured vs. privately insured).

Table 1. Summary of literature relating to associations of insurance coverage with cancer prevention and screening *(continued)*

Author and Citation Number	Data	Sample	Insurance Category	Dependent Variable	Statistical Analysis	Results
C. Studies Using Other Data Sources (continued)						
Chen et al.[18]	2001 California Health Interview Survey	Adults ages 65+ (N=11,161)	Medicare w/ Medicaid, Medicare w/ private-insurance, Medicare only, other insurance, uninsured	SM w/in 2 yrs for women and CRC screening (FOBT w/in the 2 yrs and/or receipt of lower GI endoscopy w/in 5 yrs)	Multivariate logistic regression was used to test the effect of type of health insurance receipt of screening services	Patients in each insurance category, with the exception of the "other insurance" group, were significantly less likely (p<0.01) than patients with Medicare plus private insurance to receive screening services (OR [95% CI] for CRC screening: 0.7 [0.7–0.9] for duals, 0.7 [0.5–0.9] for Medicare only, and 0.3 [0.1–0.6] for uninsured; OR [95% CI] for SM: 0.7 [0.6–0.9]) for Medicare w/Medicaid, 0.5 [0.4–0.6] for Medicare only, and 0.2 [0.1–0.5] for uninsured).
Koroukian et al.[19]	1999 Medicare Denominator File, the Medicare Outpatient Standard Analytic Files, and Physician Supplier Part B files; 1998 Area Resource File	Adults ages 65+ (N=22.7 million)	Dual enrollees and non-duals (Medicare enrollees not also enrolled in Medicaid)	CRC screening (FOBT, FLEX, and COL) at least once during the study period	Hierarchical logistic regression analysis	Adjusted results showed a significant (p<0.001) decrease in CRC screening (FOBT: OR=0.48, FLEX: OR=0.55. FLEX and COL: 0.60, COL only: 0.85) among duals compared with non-duals.
Parker et al. [20]	1993-1994 Health Care Financing Administration data and 1990 US Census data	Female California residents ages 65+ with Medicare coverage (N=837,413)	Medicare only and dual enrollees	Receipt of at least one mammogram during the study period	Bivariate comparisons and multivariate logistic regression	Women with dual coverage were significantly less likely (OR=0.59, 95% CI=0.58-0.60) than women with Medicare only to receive a mammogram.

BRFSS = Behavioral Risk Factor Surveillance System, CBE = clinical breast exam, CI = confidence interval, COL = colonoscopy, CRC = colorectal cancer, DRE = digital rectal exam, duals = dual Medicare-Medicaid enrollees, FFS = fee-for-service, FLEX = flexible sigmoidoscopy, FOBT = fecal occult blood test, GI = gastrointestinal, HMO = health maintenance organization, MEPS = Medical Expenditure Panel Survey, NHIS = National Health Interview Survey, PPO = preferred provider organization, PRSIG = proctosigmoidoscopy, PSA = prostate-specific antigen, S/C = sigmoidoscopy/colonoscopy, SM = screening mammography, yr = year(s).

Ayanian et al.[7] examined rates of clinical breast examination, screening mammography, Pap smear, fecal occult blood test (FOBT), and sigmoidoscopy rates using data from the 1997–1998 BRFSS. After adjusting for potential confounders, long-term uninsured individuals were significantly less likely to have each screening service ($p < 0.001$) and short-term uninsured individuals were significantly less likely to have screening mammography and Pap smears ($p < 0.001$). Ioannou et al.[8] presented similar findings using data from the 1999 BRFSS.

These investigators reported that after adjusting for other predictors, the lowest calculated prevalence of cancer screening was found among the uninsured (20.4 percent) and those with Medicaid insurance (29.2 percent). Pollack et al.[9] provided similar results from the 2002 BRFSS, reporting that rates of colorectal cancer screening (FOBT, sigmoidoscopy, colonoscopy) were lowest for respondents who reported having no health insurance (adjusted odds ratio [OR] = 0.63, 95% CI = 0.56–0.72).

Ross et al.[10] also examined the relationship between insurance status and utilization of Pap smears, screening mammography, and FOBT or sigmoidoscopy/colonoscopy, using data from the 2002 BRFSS. After adjusting for income and other potential confounders (including self-reported health status and sociodemographic variables), insurance coverage was significantly associated with increased use of all services. Even among the highest income group, lack of insurance was associated with decreased use of these preventive services. These results suggest that efforts to increase screening utilization should consider expanding insurance coverage/enrollment for both low- and high-income adults.

Studies Using Data from the National Health Interview Survey (NHIS)

The NHIS, administered by the US National Center for Health Statistics, is a major source of information on the health of the civilian noninstitutionalized population of the United States (http://www.cdc.gov/nchs/about/major/nhis/hisdesc.htm). Similar to analyses of the results from the BRFSS, analyses of the NHIS have consistently indicated that being uninsured is associated with decreased rates of participation in cancer screening. Coughlin et al.,[11] using data from the 2000 NHIS, found that having health insurance was one of the strongest predictors for women's having had a mammogram or clinical breast examination over a 2-year period, regardless of race or ethnicity. Sambamoorthi and McAlpine[12] used data from the 1996 Medical Expenditure Panel Survey (MEPS), a more detailed medical care survey involving a subset of NHIS respondents. These investigators reported that compared with uninsured individuals, those with public or private insurance had significant increases in receipt of Pap smear or screening mammography (except for the public fee-for-service group with respect to receipt of screening mammography).

Echeverria and Carrasquillo[13] investigated the effect of citizenship status and health insurance on cancer screening rates, including Pap smear use among women ages 18–65 and mammograms among women ages 50–70, using 2000 NHIS data. They found that noncitizens and naturalized citizens were less likely to report mammography and Pap smears than were US-born women ($p < 0.01$). Yet, for mammography, the effect of citizenship status on health insurance became nonsignificant after controlling for health insurance coverage and usual source of care, suggesting that lack of health insurance coverage and a usual source of care explained the observed citizenship-based disparities.

Not only are insurance coverage and screening utilization associated, but significant differences also exist among specific insurance types regarding use of cancer screening services. Potosky et al.[14] used 1992 NHIS data to estimate the proportions of individuals screened with Pap smears, proctosigmoidoscopy, clinical breast examination, screening mammography, digital rectal examination, and FOBT by insurance type, adjusting for potential confounders (including socioeconomic, demographic, and health status variables).

For those ages 64 and younger, all screenings except proctosigmoidoscopy were significantly more likely for those with Medicaid than for the uninsured; Pap smears were significantly more likely for those with private fee-for-service insurance (FFS) than for those with Medicaid; and FOBT and digital rectal examination were significantly more likely for those with health maintenance organization/preferred provider organization (HMO/PPO) coverage than for those with private FFS.

For those ages 65 and older, Medicare HMO/PPO enrollees were significantly more likely than Medicare enrollees with supplemental private FFS to have had screening mammography and FOBT. Further, individuals with Medicare and supplemental private FFS were more significantly more likely to have had all screening exams except proctosigmoidoscopy than were individuals with dual Medicare/Medicaid coverage. This comparatively lower rate of screening exams among dual enrollees may reflect lower socioeconomic status and associated decreased health literacy for these individuals and/or decreased physician and medical care facility payment for dual enrollees compared with non-dual enrollees in some instances. Those with Medicare only (i.e., without supplemental insurance) and those with dual Medicare/Medicaid coverage did not differ significantly regarding these variables.

Ward et al.[15] analyzed 2005–2006 NHIS data and found that the likelihood of receiving recommended cancer screening tests (mammography in the past 2 years among women ages 40 to 64, Pap test in the past 3 years among women ages 18 and older, colorectal cancer screening test according to recommended guidelines among men and women ages 50 and older, and prostate-specific antigen test among men ages 50 and older) varies markedly by insurance status, with privately insured patients showing greater screening rates than those with Medicaid or the uninsured. Additionally, in separate analyses of the likelihood of receiving mammography and colorectal cancer screening stratified by race and ethnicity (non-Hispanic white, non-Hispanic black, and Hispanic), level of education, and insurance status (insured versus uninsured), health insurance was an important predictor across all racial/ethnic and level of education groups. At all levels of education, individuals with health insurance are approximately twice as likely as those without health insurance to have had mammography or colorectal cancer screening.

Studies Using Other Data Sources

A variety of other survey and data sources have been used to assess the relationship between insurance status and participation in cancer screening. In general, results are similar to those from the BRFSS and NHIS: uninsured individuals are less likely to receive cancer screening.

Carrasquillo and Pati[16] analyzed data from the April–November 2001 Commonwealth Fund's Health Care Quality Survey. These investigators reported that after adjusting for potential confounders (including usual source of care), lack of insurance coverage remained the strongest independent predictor for not receiving a Pap smear (OR = 0.49, 95% CI = 0.32-0.75) or screening mammography (OR = 0.23, 95% CI = 0.12-0.43).

Almeida et al.[17] used 1997 National Survey of America's Families data to compare use of health care services by low-income women with Medicaid or other public insurance coverage (including other state-sponsored insurance programs and CHAMPUS), private insurance, or no insurance. Adjusting for demographic, socioeconomic,

geographic, and health-status indicators, the probability of obtaining a Pap smear or clinical breast examination did not differ significantly between women with public coverage and those with private insurance. However, women with public coverage were significantly more likely than uninsured women to obtain both a Pap smear and a clinical breast examination.

A small number of studies using other data sources have also explored associations between types of insurance coverage and receipt of cancer screening. Chen et al.[18] conducted a state-level analysis of an elderly study population (99.6 percent of whom had Medicare coverage) using data from the 2001 California Health Interview Survey. These investigators found that respondents with Medicare and Medicaid, Medicare only, or no insurance were significantly less likely to receive colorectal cancer screening and mammograms than were those with Medicare plus supplemental private insurance. Although the number of individuals with no insurance (42 of 10,724 individuals, or approximately 0.4percent of the study population) was small, it was sufficient to indicate a highly significant ($p < 0.001$) association with a person's likelihood of having cancer screening tests.

Koroukian et al.[19] used 1999 Medicare data to assess disparities in colorectal cancer screening (FOBT, flexible sigmoidoscopy, and colonoscopy) among elderly dual Medicare-Medicaid enrollees (or *duals*) versus non-duals (i.e., individuals with Medicare but not Medicaid coverage). Results showed a significantly ($p < 0.001$) lower prevalence of colorectal cancer screening among duals than among non-duals after adjusting for individual-level and county-level factors.

Parker et al.,[20] using Medicare data from 1993 and 1994 for female California residents ages 65 or older, also found that those with dual Medicaid and Medicare were significantly less likely than those with Medicare only to receive mammography, after controlling for race and ethnicity, age, and certain community-level factors. As noted above, these results could reflect differences in factors related to socioeconomic status and/or reimbursements between the dual and non-dual populations.

Overall, the results of these studies highlight the importance of insurance coverage as a predictor of cancer screening utilization and demonstrate that differences in utilization among uninsured compared with insured individuals persist across racial/ethnic and economic groups. Further, type of insurance affects screening utilization. Expanding coverage of adequate insurance can increase screening rates, as can programs that provide free (or low-cost) cancer screening to underserved populations. McCoy et al.[21] and others have shown that such programs can lead to the diagnosis of cancer at an earlier stage among those who participate.

Association Between Health Insurance and Cancer Stage at Diagnosis

A limited number of studies have evaluated the association between insurance status and the stage at which cancers are diagnosed. The studies examining this topic included in this literature synthesis are summarized in Table 2 and are divided in to three subsections: studies using national data; those using state-specific data; and those evaluating duration of Medicaid enrollment. The last subsection reflects the constraints in evaluations of Medicaid insurance status at the time of diagnosis, as uninsured individuals diagnosed with cancer may retroactively receive Medicaid coverage. For example, the Breast and Cervical Cancer Treatment Act, effective October 1, 2000, gave states the option to provide women diagnosed with these cancers with Medicaid coverage through the National Breast and Cervical Cancer Early Detection Program (NBCCEDP). Thus, in many studies, it is not be possible to determine whether patients classified as having Medicaid coverage at the time of diagnosis were covered by Medicaid prior to diagnosis or were uninsured at diagnosis.

Table 2. Summary of the literature relating to associations of insurance coverage with cancer diagnosis/stage at diagnosis

Author and Citation Number	Data	Cancer Type	Sample	Insurance Category	Dependent Variable	Statistical Analysis	Results
A. Studies Using National Data							
Chen et al.[24]	1996-2003 NCDB data	Invasive oropharyngeal cancer	Adults ages 18+ (N=40,487)	Uninsured, Medicaid, Medicare ages 18-64, Medicare ages 65+, other government, & private insurance	Disease stage at diagnosis, lymph node stage at diagnosis, tumor stage at diagnosis	Multivariate logistic regression	Compared with those with private insurance, patients with Medicaid or the uninsured were significantly more likely (based on multivariate regression odds ratios) to have advanced stage disease, the largest tumors (T4), and the greatest degree of lymph node involvement (N3).
Chen et al.[25]	1996-2003 NCDB data	Invasive laryngeal cancer	Adults ages 18+	Uninsured, Medicaid, Medicare ages 18-64, Medicare ages 65+, other government, & private insurance	Disease stage at diagnosis, lymph node stage at diagnosis, tumor stage at diagnosis	Multivariate logistic regression	Compared with those with private insurance, patients with Medicaid or the uninsured were more likely to have advanced stage disease.
Halpern et al.[22]	1998-2003 NCDB data	Invasive female breast cancer	Women ages 40+ (N=533,715)	Uninsured, Medicaid, Medicare ages 18-64, Medicare ages 65+, other government, & private insurance	Stage of disease at diagnosis	Multivariate logistic regression	Compared with privately insured women, Medicaid and uninsured women were each 1.5 times more likely to be diagnosed with Stage II and 2.5 times more likely to be diagnosed with Stages III/IV vs. Stage I disease ($p<0.001$).

Table 2. Summary of the literature relating to associations of insurance coverage with cancer diagnosis/stage at diagnosis *(continued)*

Author and Citation Number	Data	Cancer Type	Sample	Insurance Category	Dependent Variable	Statistical Analysis	Results
A. Studies Using National Data (continued)							
Halpern et al.[23]	1998-2004 NCDB data	Female breast, colorectal, kidney, lung, melanoma, non-Hodgkin's lymphoma, ovary, pancreas, prostate, urinary bladder, uterus, & thyroid	Men and women ages 18+ (N=3,742,407)	Uninsured, Medicaid, Medicare ages 18-64, Medicare ages 65+, other government, & private insurance	Stage of disease at diagnosis	Multivariate logistic regression	Uninsured and Medicaid-insured patients had substantially increased risks of presenting with advanced-stage cancers at diagnosis; these results were most prominent for patients who had cancers that could be detected early with screening tests or symptom assessment (i.e., breast, colorectal, and lung cancers, as well as melanoma).
B. State-Specific Studies							
Bradley et al.[26]	3 linked databases: 1996-1998 Michigan cancer registry, Medicaid enrollment, & death certificates	Breast, uterine cervix, lung, prostate	Men and women ages 25+ (N=91,802 incident cancer cases with N=11,552 deaths)	Medicaid, Medicare, both, & neither	Incidence, stage at diagnosis, and death, by cancer type	Multivariate logistic regression	Later stage at diagnosis for Medicaid enrollees; Medicaid enrollees also had greater risk of death.
O'Malley et al.[27]	1996-1999 California Cancer Registry-Medicaid linked file	Invasive cervical cancer	Women ages <65 (N=4,682)	Medicaid & non-Medicaid	Stage of disease at diagnosis	Multivariate logistic regression	Compared with women without Medicaid coverage, women diagnosed during their first month of Medicaid enrollment had 2.8 times higher odds for late-stage diagnosis; women who were intermittently enrolled in Medicaid before diagnosis had 1.3 times higher odds for late-stage diagnosis.
Hahn et al.[29]	1990-1992 population-based case-control study data, metropolitan Atlanta	Invasive female breast cancer	White and African-American women ages 20-54 (N=829)	Private, government (Medicare/Medicaid), none, unknown	Disease stage at diagnosis (I vs. IIA, I vs. IIB, I vs. III/IV)	Univariate, polytomous, and multiple logistic regression	Insurance status was a significant predictor of higher stage at diagnosis in univariate but not multiple logistic regression models. However, results suggested that racial differences in stage were explained in part by insurance status.

Table 2. Summary of the literature relating to associations of insurance coverage with cancer diagnosis/stage at diagnosis *(continued)*

Author and Citation Number	Data	Cancer Type	Sample	Insurance Category	Dependent Variable	Statistical Analysis	Results
B. State-Specific Studies (continued)							
Roetzheim et al.[28]	Florida Cancer Data System linked with Florida Agency for Health Care Administration data and census data	Colorectal, female breast, prostate, and melanoma	N=28,237. Mean age ranged from 62.3 (melanoma) to 71.6 (colorectal cancer)	Medicare, Medicaid, commercial indemnity, commercial PPO, commercial HMO, civilian health & medical program, other, and uninsured	Stage at diagnosis	Logistic regression	Increased odds of late stage at diagnosis among patients who were uninsured or who were insured by Medicaid as compared with privately insured individuals.
C. Studies of Duration of Medicaid Enrollment							
Bradley et al.[30]	1997-1997 Michigan Cancer Registry, linked to 1996-1998 death certificate and Medicaid enrollment data	Breast cancer	Women ages 25+ with a primary breast cancer diagnosis who were enrolled in Medicaid (N=1,636)	Medicaid at diagnosis, Medicaid after diagnosis, Medicaid with Medicare at diagnosis	Late stage at diagnosis and survival	Multivariate logistic regression and proportional hazards regression	Younger women (<65) who were enrolled in Medicaid after diagnosis were 1.71 times more likely to be diagnosed with late-stage disease compared with younger women enrolled in Medicaid before diagnosis ($p \leq 0.05$).
Bradley et al.[31]	1996-1997 Michigan Cancer Registry files linked to Medicaid enrollment files	Breast, cervical, colorectal, and lung cancer	Adults ages 24-64 (N=5,852)	Medicaid enrolled before diagnosis, Medicaid enrolled after diagnosis, & non-Medicaid	Cancer stage at diagnosis, stratifying by each cancer type	Multivariate logistic regression	Compared with those with prior Medicaid enrollment, cervical, colorectal, and lung cancer patients with later enrollment were 2-3 times more likely to have late stage at diagnosis ($p<0.01$). Compared with non-Medicaid-enrollees, patients with later Medicaid enrollment were 2-5 times more likely to have late stage at diagnosis ($p< 0.01$), while only breast and cervical cancer patients with prior Medicaid enrollment were 2 times more likely to have late stage at diagnosis (p<0.01).

Table 2. Summary of the literature relating to associations of insurance coverage with cancer diagnosis/stage at diagnosis *(continued)*

Author and Citation Number	Data	Cancer Type	Sample	Insurance Category	Dependent Variable	Statistical Analysis	Results
C. Studies of Duration of Medicaid Enrollment (continued)							
Bradley et al.[32]	Medicaid and Medicare administrative data linked with the 1997-2000 Michigan Tumor Registry	Prostate, lung, breast, or colorectal cancer	Patients ages 66+ (N=46,109)	Medicaid enrollment 12+ months before diagnosis, <12 months before diagnosis, or after diagnosis & Medicare only	Diagnosis during the same month as death, invasive but unknown stage, and regional or distant stage disease	Multivariate logistic regression	Those enrolled in Medicaid <12 months before diagnosis had greater odds of a breast and lung cancer diagnosis in the month of death than the Medicare-only patients. Patients with enrollment before diagnosis had greater odds of diagnosis of invasive but unknown stage breast, lung, and prostate cancer. Patients enrolled after diagnosis had greater odds of diagnosis of late-stage colorectal, breast, and lung cancer.

HMO = health maintenance organization; NCDB = National Cancer Data Base; PPO = preferred provider organization

Despite limitations in being able to accurately assess Medicaid vs. uninsured status at the time of cancer diagnosis, studies have reported generally consistent findings regarding health insurance status and cancer stage at diagnosis: uninsured patients and patients with Medicaid coverage are generally diagnosed at a more advanced stage than are patients with private insurance or Medicare coverage. Four recent studies used national data to assess the relationship between stage at diagnosis and insurance status; most earlier studies used data from a single state. Additionally, several studies evaluated the impact of duration of Medicaid enrollment (before cancer diagnosis) on the likelihood of diagnosing cancer at an advanced stage. Given the possibility of retroactive Medicaid enrollment among uninsured cancer patients, these studies help to clarify the impact of being uninsured versus being enrolled in Medicaid on stage at diagnosis, and they illustrate the potential benefits of longer-term Medicaid enrollment (which may permit greater continuity of care and use of screening services).

Studies Using National Data

Four recent studies used the National Cancer Data Base (NCDB), a national hospital-based registry jointly sponsored by the American Cancer Society and the American College of Surgeons, to assess the association between insurance status and stage at diagnosis. Halpern et al.[22] reported that among a population of women with invasive breast cancer, those who were uninsured or had Medicaid coverage were approximately 50 percent more likely to present with stage II versus stage I disease and were more than twice as likely to present with advanced disease (stage III/IV) as were women with private insurance.

Halpern et al.[23] reported similar findings across multiple types of cancers in separate analyses of 12 cancer sites (breast [female], colorectal, kidney, lung, melanoma, non-Hodgkin lymphoma, ovary, pancreas, prostate, urinary bladder, uterus, and thyroid). In this broad analysis, patients with private insurance were more likely to be diagnosed with early stage disease than were uninsured patients or patients with Medicaid coverage. This association

between insurance status and stage at diagnosis was most pronounced among patients diagnosed with cancers that could potentially be detected early by screening or symptom assessment (breast, colorectal, and lung cancers, and melanoma).

In a similar analysis of patients diagnosed with oropharyngeal cancer, Chen et al.[24] reported that those presenting with advanced stage disease at diagnosis were significantly more likely to be uninsured or covered by Medicaid than to have private insurance. Uninsured and Medicaid patients were also more likely than those with private insurance to present with large tumors and greater degrees of lymph node involvement at diagnosis. Chen et al.[25] reported similar findings for patients with laryngeal cancer: those who were uninsured or had Medicaid coverage were more likely to present with advanced disease than were those with private or Medicare coverage.

State-Specific Studies

Other studies of the association between health insurance status and cancer stage at diagnosis have provided similar results. However, these other studies have been based on small study populations, generally focusing on data from a single state. Some studies have used state cancer registries linked to Medicaid data to compare stage at diagnosis and other outcomes for patients with Medicaid coverage versus those not enrolled in Medicaid. The non-Medicaid group will likely consist mainly of individuals with private insurance (for populations younger than 65), but some proportion will be uninsured. This mixing of privately insured and uninsured patients in the control group limits the interpretation of results from such studies. However, these studies have consistently reported that Medicaid insurance is associated with more advanced stage at diagnosis than is observed in the non-Medicaid population.

Bradley et al.[26] studied individuals diagnosed with cancers of the breast, uterus, cervix, lung, or prostate from the Michigan cancer registry between 1996 and 1998, comparing stage at diagnosis among Medicaid enrollees with stage among individuals not enrolled in Medicaid. Among both men and women younger than 65, for all cancers studied, Medicaid enrollees

were significantly more likely than the non-Medicaid population to be diagnosed at an advanced stage. Further, among those younger than age 65, Medicaid enrollees with cancer were significantly more likely to die of cancer than were non-Medicaid individuals with cancer. The increased risk (hazard ratio) for cancer death among Medicaid enrollees ranged from an almost two-fold increased risk of death from lung cancer to a more than three-fold increased risk of death from breast cancer compared with non-Medicaid patients.

In a similar analysis, O'Malley et al.[27] used a California Cancer Registry–Medicaid linked file to identify 4,682 women diagnosed with invasive cervical cancer during 1996-1999. Results from multivariate logistic regression showed 2.8 times higher odds for late-stage diagnosis among women who were diagnosed during their first month of enrollment in Medicaid and 1.3 times higher odds for late-stage diagnosis among those intermittently enrolled in Medicaid before diagnosis (i.e., enrolled at the time of diagnosis and for between 1 and 11 months during the year before the diagnosis), each compared with women without Medicaid coverage (a combined group of women with private insurance and uninsured women). Results suggest the need for more outreach to these at-risk women to ensure their access to screening services.[27]

Roetzheim et al.[28] used information from the 1994 Florida Cancer Data System to evaluate the association between insurance status and stage at diagnosis among individuals with colon, melanoma, breast, or prostate cancers. The uninsured population had a significant increase in risk of more advanced stage at diagnosis for all types compared with individuals covered by private (commercial indemnity) insurance after adjusting for age, marital status, race, income, and comorbidities. The increased risk of advanced stage at diagnosis among uninsured individuals ranged from 1.4 for breast cancer to 2.6 for melanoma.

Hahn et al.[29] used data from a previous population-based case-control study of women residing in Cobb, Fulton, or DeKalb counties in metropolitan Atlanta, Georgia, diagnosed with invasive and in situ breast cancer between May 1, 1990, and December 31,

1992, to evaluate factors associated with advanced-stage disease at diagnosis. They analyzed 829 black (30.2 percent) and white (69.8 percent) women ages 20 to 54 with unilateral invasive breast cancer. In unadjusted analyses, the odds of advanced (stage III/IV) disease versus stage I disease among black women were almost four times those of white women. However, the authors concluded that these racial differences may be explained largely by insurance status, poverty, history of mammography, method of tumor detection, and body mass index. When controlling for these other factors (as well as age) using polytomous logistic regression, the odds of stage IIA, IIB, or III/IV breast cancer at diagnosis among black women were not statistically significantly greater than among white women. Although this finding suggests that insurance status may partially explain differences in stage at diagnosis between black and white women, insurance status was not a significant predictor of advanced stage at diagnosis in the final multivariate regression model.

Studies That Include Duration of Medicaid Enrollment

When evaluating the association between Medicaid insurance coverage and cancer outcomes, accounting for the enrollment periods of Medicaid coverage is important; that is, did patients classified as Medicaid enrollees have Medicaid coverage before cancer diagnosis or only after cancer diagnosis? In many states, uninsured patients who develop certain types of cancer may be eligible for retroactive enrollment in Medicaid; therefore, the stage at diagnosis for such patients would not necessarily correspond to the stage at diagnosis for patients enrolled in Medicaid months or years before cancer diagnosis. Most of the studies reviewed for this research report were unable to account for Medicaid enrollment periods because this information is generally not available in cancer registries and similar data sources, even when insurance status is reported. This is a considerable limitation in interpreting reported associations between cancer patients' outcomes and Medicaid coverage.

Bradley et al.[30] were able to account for Medicaid enrollment periods in their analyses of 1,636 Medicaid insured women with a primary breast cancer diagnosis recorded in the Michigan Cancer

Registry during 1996-1997. Analyses were stratified into women younger than 65 years and women 65 and older. Among the younger women, those without Medicaid coverage before diagnosis (i.e., enrolled in Medicaid at the time of or after diagnosis) had significantly higher odds of late stage disease (OR = 1.71, 95% CI = 1.13-2.58) and a significant increase in risk of death (HR = 1.67, 95% CI = 1.09-2.56) compared with those with Medicaid coverage before diagnosis. In contrast, among women age 65 or older, those with and those without Medicaid coverage before diagnosis did not differ significantly regarding stage at diagnosis and risk of death.[30] This difference may reflect the availability of mammography for these two populations. Women enrolled in Medicare have coverage for mammography (as well as physician services to assess self-detected breast symptoms), regardless of whether or not they are also enrolled in Medicaid. However, while the NBCCEDP and other programs cover the costs of mammography for uninsured women, rates of mammography in this population (as discussed in the previous section on cancer screening services) are lower than those among insured women, including those with Medicaid coverage.[8]

In a separate study, Bradley et al.[31] evaluated differences in stage at diagnosis for cancer patients enrolled in Medicaid before versus after diagnosis as well as differences between Medicaid enrollees and non-Medicaid enrollees. The study sample included all incident cases of breast, cervical, colorectal, and lung cancer from the 1996-1997 Michigan Cancer Registry files in patients who were 24 to 64 years of age at diagnosis; these cases were further linked to Medicaid enrollment files (N = 5,852). Compared with those enrolled in Medicaid before diagnosis, cervical, colorectal, and lung cancer patients enrolled in Medicaid after diagnosis were 2 to 3 times more likely to be diagnosed with late stage disease (*p* < 0.01 for each). Cancer patients enrolled in Medicaid after diagnosis were 2 to 5 times more likely to be diagnosed with late stage disease (*p* < 0.01 for each of the four cancer sites) than were cancer patients not enrolled in Medicaid (i.e., combined patients with private insurance or uninsured). In contrast, among cancer patients enrolled in Medicaid before diagnosis, only breast and cervical cancer patients were

significantly more likely to be diagnosed with late stage disease ($p < 0.01$ for each) than were patients not enrolled in Medicaid.

In a recent study, Bradley et al.[32] examined the relationship between advanced cancer at diagnosis and Medicaid enrollment in patients ages 66 and older using Medicaid and Medicare administrative data linked with the Michigan Tumor Registry. The study sample included 46,109 patients diagnosed during 1997-2000 with prostate, lung, breast, or colorectal cancer as their first primary cancer. Medicaid enrollment status was categorized as being enrolled 12 or more (>12) months before diagnosis, less than 12 (<12) months before diagnosis, after diagnosis, or not enrolled in Medicaid (i.e., Medicare only, which was the referent group in each analysis).

As essentially all patients in this study had Medicare coverage at the time of diagnosis, Medicaid enrollment reflects the patient's economic status rather than a new coverage based on a cancer diagnosis. For this study population, Medicaid enrollment before diagnosis indicates a lower income than that of patients not enrolled in Medicaid; Medicaid enrollment after diagnosis suggests a decrease in income following diagnosis, potentially because of patient-borne costs of cancer treatment.

All patients enrolled in Medicaid before diagnosis had a higher likelihood than Medicare-only patients of the following outcomes: death during the same month as diagnosis (lung cancer patients in the >12 and <12 months enrollment groups and breast cancer patients in the <12 months group); diagnosis with invasive but unknown stage (lung cancer patients in the >12 and <12 months enrollment groups, breast cancer patients in the <12 months group, and prostate cancer patients in the ≥12 months group); and regional or distant stage at diagnosis (lung cancer patients in the <12 months group). Both lung and breast cancer patients enrolled in Medicaid after diagnosis were more likely than Medicare only patients (i.e., not enrolled in Medicaid) to have regional or distant stage disease at diagnosis, which (in general) is associated with greater treatment costs than is early stage disease. Based on these results, the authors concluded that advanced stage cancer tends to precipitate Medicaid enrollment.[32] It may also be concluded that

Medicaid enrollment (and thus lower income) before cancer diagnosis is associated with increased risk of advanced stage diagnosis and death.

Overall, the reviewed studies that included duration of Medicaid enrollment indicate that individuals younger than 65 who are not enrolled in Medicaid until the time of cancer diagnosis are more likely to be diagnosed with later stage disease than are those who enroll in Medicaid before diagnosis. In contrast, these studies also indicate that among individuals age 65 and older, the presence of or duration of Medicaid enrollment before diagnosis may not affect the likelihood of advanced disease.

The studies included in this section on insurance status and stage at diagnosis, while limited in their ability to control for individual socioeconomic status and other individual-level characteristics, provide population-based evidence of more advanced cancer stages at diagnosis among populations that are uninsured or have Medicaid insurance. The lower rates of utilization for cancer screening services among uninsured adults, discussed in the first section of this report, may be the principal reason for diagnosis at more advanced stages of cancer than among insured adults.

Information on rates of cancer screening among Medicaid patients compared with patients with private insurance is very limited, so it is difficult to link cancer screening behaviors to increased likelihood of advanced disease for the Medicaid population. In addition, significant associations have been observed between being uninsured or having Medicaid coverage and being diagnosed with lung cancer at a more advanced stage; lung cancer is not normally detected early by screening. Thus, the relationship between being uninsured or covered by Medicaid and advanced stage at diagnosis goes beyond the impact of screening rates.

Multiple factors associated with Medicaid status and being uninsured (including race/ethnicity, socioeconomic status, health practices and beliefs, and having a usual source of care or a medical home) are likely associated with decreased access to care (e.g., resulting in delays in follow-up care) and decreased quality of care, leading to increased risk of advanced disease at diagnosis.

Association Between Health Insurance and Cancer Treatment Patterns or Outcomes

Studies of the relationship between health insurance status and either cancer treatment patterns (i.e., the type of treatment received) or cancer outcomes (mainly survival) are summarized in Table 3.

Studies of Health Insurance and Cancer Treatment Patterns

A small number of studies have analyzed associations between insurance coverage and cancer treatment using data from a single institution, single state, or group of states; the evidence from these studies is mixed. Among nine studies included, five found that uninsured or Medicaid patients were less likely than privately insured patients to receive guideline therapies.33-37 Mitchell et al.,[33] using 1988 and 1991 hospital discharge data from four states, found that leukemia and lymphoma patients (1) enrolled in Medicaid, (2) uninsured, or (3) in HMOs were less likely than their counterparts enrolled in private FFS insurance plans to receive bone marrow transplantation.

Roetzheim et al.[34] studied women younger than 65 diagnosed with early stage breast cancer in Florida during 1994. These researchers reported that women who were uninsured or insured by Medicaid had lower utilization of radiotherapy after breast-conserving surgery than did privately insured women. A separate study by Roetzheim et al. using 1994 Florida data[35] found that uninsured or Medicaid-insured colorectal cancer patients had lower utilization of guideline therapies than did privately insured patients.

Voti et al.[36] studied receipt of "standard treatment" (i.e., guideline-approved therapy) among Florida resident women diagnosed with local stage breast cancer between July 1997 and December 2000 (N = 26,423). Standard treatment was defined as mastectomy or breast-conserving surgery followed by radiation therapy. Compared with privately insured patients, those with Medicare were 1.36 times more likely (95% CI = 1.22-1.51) to receive standard treatment. In contrast, patients with Medicaid were 0.71 times as likely (95% CI = 0.53-0.96), and

uninsured patients were 0.76 times as likely (95% CI = 0.59-0.96) to receive the standard treatment.

Bradley et al.[37] used data from the Metropolitan Detroit SEER (Surveillance, Epidemiology and End Results) registry to identify women diagnosed with breast cancer during 1996-1997 (N = 5,719), then linked these records to Michigan Medicaid enrollment files to identify patients with Medicaid coverage. Compared with women who were not Medicaid-insured (which, as discussed above, likely includes a mix of privately insured and uninsured patients), women with Medicaid coverage (either HMO or FFS) had significantly greater odds of being diagnosed at a later stage; no significant difference in odds of having had breast-conserving surgery alone; and significantly decreased odds of having had breast-conserving surgery with radiation. In addition, women with Medicaid FFS plans had significantly greater odds of having died as a result of their breast cancer (OR = 3.11, 95% CI = 2.19-4.42); the risk for death was not significantly different for the Medicaid HMO population.

In contrast, three other studies reported no significant association between insurance status and cancer treatment patterns, and one study reported a significantly negative association.38-41 Analyzing pattern of surgery among early-stage breast cancer patients treated at a single institution from 1993-2000, Parviz et al.[38] found no association between insurance coverage and surgery treatment pattern. Harlan et al.[39] studied 11 types of cancer in the 1995-1999 National Cancer Institute Patterns of Care Study and found that lack of insurance had only a weak impact on the receipt of guideline treatments. Adherence to guidelines is a broad measure and may not be sensitive enough to pick up differences in care associated with insurance status in this population. In a small study population (N = 303) using 2001 Louisiana Cancer Registry data, Wu et al.[40] did not find a significant association of postoperative chemotherapy with insurance coverage among stage III colon cancer patients. In one study reporting a negative association, Richardson et al.[41] found that uninsured and Medicaid breast cancer patients in Florida were more likely to receive chemotherapy than were privately insured and Medicare patients among those diagnosed in non-teaching hospitals from 1997-2000.

Table 3. Summary of the literature relating to associations of insurance coverage with cancer treatment and cancer outcomes

Author and Citation Number	Data	Cancer Type	Sample	Insurance Category	Dependent Variable	Statistical Analysis	Results
A. Studies of Insurance Status and Cancer Treatment							
Bradley et al.[37]	1996-1997 Metropolitan Detroit SEER registry linked to Michigan Medicaid enrollment files	Female breast cancer	(N=5,719)	Medicaid HMO, Medicaid FFS, & non-Medicaid	Late stage at diagnosis, breast-conserving surgery, breast-conserving surgery with radiation, no surgery, and death	Multivariate logistic regression	Compared with the non-Medicaid-insured, women with Medicaid HMO plans were more likely to have later stage at diagnosis, equally likely to have BCS alone, less likely to have BCS with radiation, and equal in likelihood of survival; while women with Medicaid FFS plans were more likely to have later stage at diagnosis, equally likely to have BCS alone, less likely to have BCS with radiation, and more likely to die.
Harlan et al.[39]	1995-1999 NCI Patterns of Care study (newly diagnosed cancers)	11 types of cancer (aggregate analysis)	Adults ages 20+ (N=7,134)	Uninsured, Medicaid, private, Medicare, & other	Guideline therapy	Bivariate and multivariate analysis	Patients with no insurance or private insurance were significantly more likely to receive guideline therapy than patients with Medicare and Medicaid.
Mitchell et al.[33]	1988 and 1991 inpatient hospital discharge data from 4 states	Leukemia and lymphoma	Adults ages <65 (N=38,420)	Private commercial, Medicaid, HMO, uninsured, & other	BMT	Multivariate logistic regression	Medicaid, uninsured, and HMO patients are significantly less likely than privately insured patients to receive a BMT.
Parviz et al.[38]	1993-2000 single institute chart review	Breast cancer, stage 0-II	All ages (N=928)	Uninsured, Medicaid, private, & Medicare	Treatment: BCS vs. mastectomy	Pearson chi-square, logistic regression, t-test	624 of 928 had BCS; insurance status was not associated with type of surgery (not based on regression analysis).
Richardson et al.[41]	1997-2000 Florida cancer registry	Breast cancer	All ages (N=11,175)	Uninsured, Medicaid, Medicare, & privately insured	Adjuvant chemotherapy for patients with regional-stage disease	Multivariate logistic regression	Uninsured and Medicaid patients were significantly more likely to receive chemotherapy than privately insured and Medicare patients.
Roetzheim et al.[34]	1994 Florida cancer registry, followed through 1997	Stages I and II breast cancer	Adults ages <65 (N=9,551)	Uninsured, Medicaid, Medicare, Medicare HMO, commercial indemnity, commercial HMO/PPO, & other	Survival and BCS with radiotherapy	Multivariate logistic and survival analyses	Uninsured patients were less likely to receive BCS than privately insured patients. Among patients receiving BCS, insurance was not significantly associated with use of radiation therapy. In addition, insurance was also not associated with survival.
Roetzheim et al.[35]	1994 Florida cancer registry, followed through 1997	Colorectal cancer	All ages (N=11,113)	Uninsured, Medicare FFS, Medicare HMO, commercial HMO, commercial FFS, & others	Treatment (surgery, radiation, or chemotherapy) and survival	Multivariate logistic and survival (Cox proportional hazards) models	Medicaid and uninsured patients were less likely than privately insured patients to receive surgery treatment, but not radiotherapy or chemotherapy; Medicaid and uninsured patients had lower survival rates than privately insured patients.

Table 3. Summary of the literature relating to associations of insurance coverage with cancer treatment and cancer outcomes *(continued)*

Author and Citation Number	Data	Cancer Type	Sample	Insurance Category	Dependent Variable	Statistical Analysis	Results
A. Studies of Insurance Status and Cancer Treatment (continued)							
Voti et al.[36]	July 1997 - December 2000 Florida cancer registry linked to Florida Agency for Health Care Administration databases	Local stage female breast cancers	(N=23,817)	Uninsured, private insurance, Medicare, & Medicaid	Receipt of mastectomy or BCS followed by radiation therapy	Multivariate logistic regression	Compared with privately insured patients, those with Medicare were 1.36 times more likely (95% CI = 1.22-1.51), those with Medicaid were 0.71 times as likely (95% CI = 0.53-0.96), and uninsured patients were 0.76 times as likely (95% CI = 0.59-0.96) to receive the standard treatment.
Wu et al.[40]	2001 Los Angeles cancer registry	Stage III colon cancer	Adults ages 20+ (N=303)	Private & public/ uninsured	Postoperative chemotherapy	Univariate and multivariate logistics regression	Neither univariate nor multivariate analyses found statistically significant associations of insurance coverage and post-operative chemotherapy.
B. Studies of Insurance Status and Cancer Outcomes							
Allareddy & Konety[45]	2000-2003 Nationwide Inpatient Sample	Patients with a primary diagnosis of head and neck cancer	(N=24,803)	Medicare, Medicaid, self-pay/no charge/ other, & private	In-hospital mortality after hospitalizations for head and neck cancer	Multivariate logistic regression	Patients who were self-pay/ no charge/other had 1.42 ($p< 0.01$) greater odds of in-hospital mortality compared with patients with private insurance.
Bradley et al.[30]	1997-1997 Michigan Cancer Registry, linked to 1996-1998 death certificate and Medicaid enrollment data	Breast cancer	Women ages 25+ w/ primary breast cancer diagnosis who were enrolled in Medicaid (N=1,636)	Medicaid during month of diagnosis, Medicaid after month of diagnosis, Medicare with Medicaid during month of diagnosis	Late stage at diagnosis and survival	Multivariate logistic regression and proportional hazards regression	Younger women (ages <65) who were not enrolled in Medicaid after diagnosis had a 1.67-fold increase in risk of death from the disease compared with younger women enrolled in Medicaid before diagnosis ($p\leq0.05$).
Bradley et al.[43]	1996-1997 Michigan Tumor Registry data linked to Medicaid enrollment files	Breast, colorectal, and lung cancer	Adults ages <65 (N=13,740)	Medicaid enrollment 12+ months before diagnosis, <12 months before diagnosis, & non-Medicaid	Survival stratified by cancer type, stage at diagnosis (early or late), and gender	Multivariate Cox proportional hazards regression analyses	The risk of death for both groups of Medicaid patients was nearly 2 to 3 times greater ($p<0.05$) than for non-Medicaid patients, over all type, stage, and gender strata. However, the risk of death was not significantly different between the enrolled and the late-enrolled Medicaid patients.
Kelz et al.[44]	1997-98 hospitalized patients in Nationwide Inpatient Sample	Nonrecurrent, nonmetastatic colorectal carcinoma	Adults ages 40-64 (N=13,415)	Uninsured, private insurance, & Medicaid	Postoperative complications and in-hospital mortality	Multivariate logistic regression	Only Medicaid patients were more likely to have complications and death in hospitals than privately insured patients.

Table 3. Summary of the literature relating to associations of insurance coverage with cancer treatment and cancer outcomes *(continued)*

Author and Citation Number	Data	Cancer Type	Sample	Insurance Category	Dependent Variable	Statistical Analysis	Results
B. Studies of Insurance Status and Cancer Outcomes (continued)							
Kirsner et al.[46]	1985-2001 SEER-Medicare data	Incident female breast and colorectal cancer	Adults ages 65+ and entitled to Medicare part A and part B	Medicare HMO & Medicare FFS	Overall and cancer-stage-specific survival	Multivariate Cox proportional hazards regression models	HMO Medicare patients had significantly improved survival for both breast cancer (HR=0.91, 95% CI=0.88-0.93) and colorectal cancer (HR=0.94, 95% CI=0.92-0.97) compared with FFS Medicare patients.
McDavid et al.[42]	1995-98 Kentucky Cancer Registry, followed until 1999	Breast, lung, colorectal, prostate	Adults ages 18-99 (N=40,207)	Private, Medicare with supplement, Medicare, other federally funded, Medicaid/ welfare, uninsured, & unknown	Death	Chi-squared test, poisson regression	Among prostate cancer, 3-yr survival was 98% for the privately insured and 83% for the uninsured; results were 91% and 78% for breast cancer, 71% and 53% for colorectal cancer, and 23% and 13% for lung cancer; in regression analyses, Medicaid patients had worse survival than privately insured patients for all 4 cancers, and uninsured patients had worse survival than privately insured patients in lung and breast cancers.
Okunade et al.[47]	1990-1997 time-series data pooled across the US	Breast cancer	Adults ages 25+	Medicaid, Medicare, & uninsured	Breast cancer mortality rate (per 100,000 female population)	State fixed effects with multivariate GLS regression	Higher % uninsured or Medicaid population was associated with higher mortality rates.
Penson et al.[48]	1995-1998 CaPSURE database from 25 community and 1 academic urologic practice	Prostate cancer	All ages (N=860)	Medicare, Medicare/ Medigap, PPO, HMO, FFS, & uninsured	HRQOL (measured by SF-36 and UCLA Prostate Cancer Index)	Multivariate mixed (longitudinal) regression analyses	In comparison to HMO patients, uninsured patients generally had lower HRQOL; there was no difference in HRQOL among insured patients.
Ward et al.[15]	1999-2000 NCDB	All types combined, plus more detailed analyses of breast and colorectal cancer	Men and women ages 18-64	Private insurance, Medicaid insurance, & uninsured	Five-year all cause survival	Cox proportional hazards regression analysis that included insurance status, income based on zip code, age, race, and sex	Privately insured patients exhibited better survival than did Medicaid or uninsured patients across all types combined. Privately insurance patients with breast or colorectal cancer also had better survival than did corresponding uninsured Medicaid patients in separate analyses by race/ethnicity and stage at diagnosis.

BCS = breast-conserving surgery; BMT = bone marrow transplant; CI = confidence interval; FFS = fee-for-service; GLS = generalized least-squares; HMO = health maintenance organization; HR = hazard ratio; HRQOL = health-related quality of life; NCDB = National Cancer Data Base; NCI = National Cancer Institute; PPO = preferred provider organization; SEER = Surveillance, Epidemiology, and End Results

Overall, these results suggest that insurance status is not a consistent predictor of cancer treatment. However, the limited number of available studies and the potentially nongeneralizable populations included in the studies (either from single institutions or single states) make drawing firm conclusions difficult. Additional research is needed to assess more thoroughly associations between insurance status and cancer treatment patterns. Studies should evaluate relationships between insurance and both guideline-based care and new treatment modalities.

Studies of Health Insurance and Cancer Outcome

Three of the studies reviewed in the previous section[26,30,37] reported that certain groups of Medicaid patients with cancer were at greater risk of death than were non-Medicaid patients. Nine additional studies included in this report also examined associations between insurance and health outcomes among cancer patients.[15,34,35,42-47] Eight of these found that uninsured or Medicaid patients had worse health outcomes than privately insured patients.[15,35,42-47] Of these, three were based on data from single states. Roetzheim et al.,[35] using data from the 1995 Florida Cancer Registry, found that uninsured and Medicaid colorectal cancer patients had greater all-cause mortality rates compared with privately insured colorectal cancer patients. Similarly, based on data from the 1995–1998 Kentucky Cancer Registry, McDavid et al.[42] found (while adjusting for age, sex, race, stage at diagnosis, treatment, and year of follow-up) that uninsured and Medicaid patients with breast or lung cancer had significantly greater all-cause mortality than did privately insured patients, while Medicaid patients with colorectal or prostate cancers also had greater mortality compared with privately insured patients.

Bradley et al.[43] used Michigan Tumor Registry data linked to Medicaid enrollment files to examine survival for adults less than 65 years of age diagnosed with breast, colorectal, or lung cancer during 1996–1997. Medicaid patients enrolled before their cancer diagnosis were evaluated separately from patients enrolled after diagnosis. The risk of all-cause death for both groups of Medicaid patients was significantly greater than that for non-Medicaid patients, across

all included type, stage, and sex strata. That is, Medicaid patients (whether enrolled before or after diagnosis) were more likely to die following a cancer diagnosis compared with non-Medicaid patients when matched by cancer type, sex, and early- versus late-stage diagnosis. However, the risk of death was not significantly different between Medicaid patients enrolled before versus after cancer diagnosis.

Five studies reported significantly worse outcomes for uninsured or Medicaid patients based on national data sources. Using hospital discharge data from the 1997–1998 National Inpatient Sample, Kelz et al.[44] found that Medicaid (but not uninsured) colorectal cancer patients were at higher risk for in-hospital mortality and postoperative complications than their privately insured counterparts. Allareddy and Konety[45] used the 2000–2003 Nationwide Inpatient Sample to evaluate in-hospital mortality among patients with a primary diagnosis of head and neck cancer (N = 24,803). Patients who were self-pay/no charge/other had 1.42 ($p < 0.01$) greater odds of in-hospital mortality compared with patients with private insurance. While these two studies give further insight into the problems of inadequate access to care, they lack information on disease stage at diagnosis and other patient-related factors that can substantially impact patient survival.

Kirsner et al.[46] evaluated differences in survival of patients with breast cancer and colorectal cancer at diagnosis between patients with Medicare FFS and Medicare HMO coverage using the National Cancer Institute's SEER data linked with Medicare claims. Medicare HMO patients had significantly improved survival for both breast cancer (HR = 0.91, 95% CI = 0.88-0.93) and colorectal cancer (HR = 0.94, 95% CI = 0.92-0.97) compared with Medicare FFS patients. These results are likely due, in part, to a greater likelihood of HMO patients' using preventive services such as cancer screening. However, HMO patients also tend to be healthier than FFS patients before enrollment, which could influence these findings.

Ward et al.[15] analyzed 1999–2000 data from the NCDB to assess all-cause mortality among individuals with cancer. Survival analyses using proportional hazards regression controlled for age

at diagnosis, race/ethnicity, sex, and zip code based household income. For all cancer types combined, patients who were uninsured and those who were Medicaid-insured at the time of diagnosis were 1.6 times more likely to die in five years compared with those with private insurance. More detailed analyses of survival following breast cancer or colorectal cancer diagnosis were also performed. For both of these cancer types, with all disease stages combined, significantly increased 5-year all-cause mortality was consistently observed among Medicaid and uninsured individuals in separate analyses of white, black, and Hispanic patients.[15]

Stage-specific 5-year mortality was also greater for uninsured and Medicaid patients (compared with privately insured patients) with breast or colorectal cancer in separate analyses by race and by ethnicity. Analyses of stage-specific 5-year survival for colorectal cancer patients showed that privately insured white and black patients with Stage II disease had greater 5-year survival than did uninsured or Medicaid patients with Stage I disease. Similarly, privately insured white and black colorectal cancer patients with Stage III disease had better survival than did corresponding Medicaid and uninsured patients with Stage II disease.[15]

Okunade et al.[47] analyzed state-level data from 1990 to 1997 from a variety of sources, including the BRFSS; NCI's SEER registry; and the US Bureau of the Census. In an ecological analysis, these investigators found that breast cancer mortality was greater among women living in states with higher rates of uninsured or Medicaid populations. However, this study also reported higher breast cancer mortality rates for states with higher income or education levels. Given the ecological nature of this study (rather than patient-based analyses, as used in other studies included), it is difficult to differentiate the impact of insurance status versus breast cancer incidence (which may be greater in women with higher income/education) on breast cancer mortality.

Only one study we identified found no association between insurance coverage and survival for cancer patients. Roetzheim et al.[34] analyzed data from

breast cancer patients younger than 65 diagnosed in Florida and followed through 1997. Stage-adjusted survival for uninsured and Medicaid patients was not significantly different from that of privately insured patients. In this study, the authors concluded that differences in survival by insurance status reflected differences in stage at diagnosis.

Although mortality is the final outcome measure for any condition, cause-specific mortality provides a more specific measure than does all-cause mortality. However, the studies reviewed above generally included only all-cause mortality. Cause-specific mortality is more difficult to obtain, often requiring death certificates or linkage with the National Death Index, and it does have limitations regarding the listed cause or causes of death. In assessments of associations between insurance status and cancer outcomes, evaluating morbidity and related outcomes such as health-related quality of life would also be useful. Unfortunately, almost no information is available on the association between insurance status and morbidity or quality of life among cancer patients. The one study in this area that we identified[48] investigated the association of insurance coverage with quality of life among prostate cancer patients using data from the 1995–1998 CaPSURE database. CaPSURE (Cancer of the Prostate Strategic Urologic Research Endeavor) is a longitudinal observational study of prostate cancer patients nationwide, with more than 11,000 enrolled patients (http://www.capsure.net). This study found that lack of health insurance was associated with decreased quality of life, measured by both generic and disease-specific instruments.

The majority of studies included in this section indicate an association between insurance status and outcomes, but many of them were unable to control fully for patient socioeconomic status. Socioeconomic status is strongly associated with health outcomes (both morbidity and mortality) and with insurance status. For that reason, caution must be exercised in attempting to link insurance status with long-term or final health outcomes without taking into account other relevant patient characteristics.

Discussion

Although the literature summarized in this synthesis provides somewhat mixed evidence, the overall finding is that insurance status is significantly associated with use of cancer screening services, cancer stage at diagnosis, and survival outcomes. The relationship between insurance status and cancer treatment patterns or outcomes is less clear, but a relationship likely exists for certain types of treatment.

The studies we included have several strengths. Using data from a diverse range of sources and differing geographic regions, they generally found similar results. Several studies used data from national health care surveys or large-scale registries, and so they are generalizable to the entire US cancer population or to large subsets of this population. Many of the analyses found significant impacts of insurance status while controlling for sociodemographic factors such as race or ethnicity, income, and/or education.

Multiple limitations are associated with the studies reviewed. Many studies involved patients from a single institution or state, and they have limited generalizability on their own. Insurance status, the characteristics on which this literature synthesis focused, is based on self-report in some studies (e.g., those using data from national health care surveys) and may be subject to bias. Even in those studies with verified information on health insurance status (e.g., based on hospital billing information), there is little or no information on the duration of insurance coverage before cancer diagnosis, the type of preventive or screening services covered by the insurance, and the deductibles, co-payments, and other out-of-pocket expenses that may influence use of cancer screening, diagnostic, and treatment services. Several studies included only limited insurance status groups; for example, several studies included only Medicare patients. Even though comparisons between individuals with Medicare alone versus those with dual Medicare-Medicaid coverage are important, these results are not likely to be generalizable to younger cancer patients.

Further, the insurance status groups examined in the reviewed studies do not represent homogenous populations. Although the majority of uninsured cancer patients likely have incomes that are too low to purchase health insurance, a minority of this population (particularly younger adults) may choose not to purchase insurance despite having adequate income.[49,50] The privately insured population comprises individuals with a tremendous range of plan types, each with variation in covered services, out-of-pocket expenses, lifetime expenditure limitations, and pre-approval requirements. Clearly, having private insurance does not necessarily imply that all needed cancer-related services are covered; many private insurance plans may be inadequate, and cancer patients with these plans find themselves to be underinsured.

Few studies have assessed associations between insurance status and cancer treatment patterns or outcomes. The main outcome studied with respect to insurance status is all-cause mortality, which is not likely to differentiate the impact of treatment patterns or quality of care as specifically as would cause-specific mortality. Little information is available on the relationship between insurance status and delays in care, which are likely to affect both stage at diagnosis and patient outcome. Further, studies combining patients with different cancer types and/or insurance types into a single group may miss associations of individual cancer or insurance types with treatment patterns and health outcomes. For example, studies that analyzed the association of insurance status and compliance with guideline-approved therapies among multiple types of cancer combined may not detect some effects because insurance status may affect compliance with treatment guidelines differently by type of cancer.

Multiple barriers other than insurance status also affect receipt of timely medical care. These include both patient factors (e.g., low interest in screening, lack of trust in the health care system) and health-system factors (e.g., availability of information in formats or languages that can be understood by patients, ease of transportation to medical care facilities). Although our literature synthesis indicates that lack of adequate insurance is an important factor regarding decreased use of cancer screening services and is probably associated with decreased medical

care quality and outcomes, addressing lack of health insurance or inadequate insurance alone is unlikely to resolve all disparities in cancer screening and treatment.

The reviewed studies strongly indicate that insurance status is associated with screening utilization and early diagnoses, and it may be associated with treatment and its outcomes. In particular, individuals with private insurance and/or Medicare coverage are more likely to have greater utilization of cancer screening services, to be diagnosed at earlier stages, and to have better clinical outcomes than do those who are uninsured or have Medicaid coverage. More research is needed to evaluate fully the effects of type of insurance status on outcomes of screening and subsequent cancer patient care. Links between these components of care must be explored, to understand the mechanisms by which insurance status affects stage at diagnosis, treatment patterns, and outcomes. For example, do lack of insurance and other factors affecting access to care lead to delays in follow-up from abnormal screening results or scheduling of timely and high quality cancer treatment?

Finally, the research suggests that the benefits of extending appropriate insurance coverage to uninsured and underinsured individuals could be substantial. These benefits are likely to include reduced morbidity, improved quality of life, and increased survival for cancer patients as well as a positive impact on overall health care and societal costs.

Conclusions

Individuals who are uninsured or have insurance coverage through Medicaid programs are significantly less likely to receive cancer screening services and significantly more likely to present with advanced stage cancer at diagnosis. These individuals also have significantly worse survival. The available evidence (from fewer studies) also suggests that uninsured cancer patients are likely to receive less optimal treatment. Providing appropriate and adequate insurance coverage for all uninsured and underinsured individuals will likely expand cancer screening for underserved populations, increase prevention and early detection of cancer, and improve outcomes for cancer patients.

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