Influence of Health Insurance Coverage on Breast, Cervical, and Colorectal Cancer Screening in Rural Primary Care Settings

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Abstract

Purpose—To determine, in rural settings, the relationship between the type and status of insurance coverage and being up-to-date for breast, cervical, and colorectal cancer screening.

Methods—Four primary care practices in two rural Oregon communities participated. Medical chart reviews conducted between October 2008 and August 2009 assessed insurance coverage and up-to-date status for breast, cervical, and colorectal cancer screening. Inclusion criteria involved having at least one healthcare visit in the past five years, and being age 55 or older for eligibility of study services.

Results—Most patients were female aged 55–70, employed or retired, had private health insurance and an average of 2.5 co-morbid conditions. The overall proportion of eligible women up-to-date for cervical cancer screening was 30%: 27% of women were up-to-date for clinical breast exam, 37% for mammography and 19% for both mammography and clinical breast exam. Thirty-eight percent of men and 35% of women were up-to-date for colorectal cancer screening using any test at appropriate screening intervals. In general, having any insurance versus being

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uninsured was associated with cancer screening. For each type of screening, patients who had at least one health maintenance visit were significantly more likely to be up-to-date, compared with those with no health maintenance visits. We found a significant interaction between having health maintenance visits, having any health insurance, and being up-to-date for cancer screening tests.

Conclusions—Overall, the proportion of patients up-to-date for any cancer screening, especially cervical cancer screening was very low in rural Oregon. Patients with some form of health insurance were more likely to have had a health maintenance visit in the previous two years and to be up-to-date for breast, cervical and/or colorectal cancer screening.

Introduction

Strong evidence indicates that breast, cervical, and colorectal cancer screening result in earlier detection and longer survival rates (1–3). Rates of breast, cervical and colorectal cancer screening increased in the U.S. between 1987 and 2000 (4). Recently, these trends have changed, with screening rates leveling off or, in the case of breast and cervical cancer screening, have decreased (4, 5). Possible explanations for decreases in cancer screening include increases in un- or underinsured (6–13). Most studies on this topic have focused urban settings, while studies of rural populations are lacking.

More recently, health insurance companies have shifted costs through expanded cost-sharing mechanisms, such as deductibles, co-payments, and co-insurance to keep insurance prices affordable for employers and reduce expenditure risks (14, 15). While saving money in the short term, widespread increases in cost sharing could escalate future costs by creating disincentives for cancer screening. In September 2007, the American Cancer Society (ACS) announced that, after tobacco use, lack of affordable healthcare is the largest obstacle to success in the battle against cancer (16). The ACS simultaneously launched the biggest awareness campaign in its 94-year history focusing on inadequate health insurance coverage and access to cancer care (16). Though important changes in health coverage have occurred under the Obama administration, these initiatives have not been fully implemented, and their long-term status is uncertain (17).

The role of health insurance as a determinant of screening for breast, cervical, and colorectal cancer is an important area of research, given changes in healthcare access. Higher cancer mortality rates (1.2 to 2.1 times greater) of uninsured compared to privately insured people reflect a higher likelihood of being diagnosed with late-stage colorectal, breast or cervical cancer (18). The population for whom cancer screening is of greatest significance, those age 50 and older, is also the group most likely to experience co-morbid conditions often resulting in significant out-of-pocket expenditures (19). Most of these studies have used Medicare data, which excludes those aged 50 to 64 (20). Innovative research is needed to: 1) learn how patients will make cancer screening decisions in the future when faced different cost considerations; 2) guide private and public insurers in the establishment of evidence-based and value-based reimbursement policies; and 3) help clinicians become better aware of the burden of costs on patients and interface with available community resources.

We conducted chart reviews of the primary care practices in two rural Oregon communities between October 2008 through July 2009 and identified patients aged 55 or older. We then retrospectively reviewed their screening and insurance records to determine how type and insurance coverage influenced receipt of cancer screening in this understudied population.

Methods

Study Setting

This study was conducted with the Oregon Rural Practice-based Research Network (ORPRN), a statewide network of 32 practices located in 26 rural Oregon communities. Characteristics of the practices are described elsewhere (21). Briefly, all practices serve Oregon rural communities with populations from 357 to 20,500 (21). Two rural communities were selected for this study. One had an area of 533 square miles with a population of 20,500, 27.2% of which were Hispanic. The second community spanned 1,781 square miles with a population of 19,868, 25% of which were Hispanic. Each community had two primary care practices, for a total of four practices. Two practices were private and two were FQHCs, with one private practice and one FQHC in each community. All study activities were reviewed and approved by Oregon Health and Science University's (OHSU) Institutional Review Board.

Data Collection

Chart reviews occurred between October 2008 and August 2009. Data were collected on patient insurance type and coverage, practice and practitioner characteristics, and up-to-date screening status for breast, cervical, and colorectal cancer screening. Criteria for inclusion in the chart review included having made at least one healthcare visit in the past five years, and patient age 55 years at the time of chart review to ensure eligibility for screening services under study. Charts were retrospectively reviewed for up to ten years or as far back as 1998.

Data abstraction was done on site using lap top computers and a database specifically designed and tested for this purpose. Variables collected included patient age, education, race/ethnicity, marital status, occupation, personal and family history of cancer, history of prior abnormal screening test (breast, cervical, and colorectal), smoking status/history, alcohol use, exercise pattern, body mass index, health insurance status (insured/uninsured), type of insurance (PPO, Medicare, Medicaid, Oregon Health Plan, other), length of each patient relationship with a healthcare provider, documented co-morbid conditions, and receipt of mammography, clinical breast exam, Pap test, and any recommended form of colorectal cancer screening (fecal occult blood cards (FOBT), colonoscopy, flexible sigmoidoscopy, or double contrast barium enema). Two trained chart abstractors conducted the chart reviews, and a third abstractor conducted a quality review of 10% of the chart abstractions done by the first two reviewers. Concordance between the two independent abstractors using kappa coefficients ranged from 0.49 to 0.94 for all variables included in the analyses.

Data Definitions and Analyses

The data set used for analysis excluded patients missing age (n=5) and 169 patients with a personal history of breast, cervical or colorectal cancer. The final analysis set contained data on 1,563 males and 1,870 females (total n=3,433). The data set contained information on the number of visits within the last two years for health maintenance visits. Insurance coverage and type were classified using the last recorded insurance coverage in the patient file or billing record. Because multiple coverage types were possible, for analytic purposes coverage was categorized as: 1) Unknown (no record of insurance coverage and no notation of lack of coverage); 2) Uninsured (last recorded insurance status was uninsured); 3) Medicaid Only or Medicare + Medicaid; 4) Medicare Only or Medicare + Private insurance, and 5) Private Insurance Only.

Up-to-date status for cancer screening was defined using the American Cancer Society guidelines (4). Mammography and clinical breast exam screening were classified as up-to-

date for women if the record indicated screenings had been performed within the prior year of the last contact with the clinic. We restricted analyses to women who had not undergone bilateral mastectomy. For women with three consecutive negative Pap tests, cervical cancer screening was classified as up-to-date if a Pap test had occurred within three years prior to the last contact with the clinic. Women without three prior negative screens were classified as up-to-date if they had received a Pap test within one year prior to the last contact with the clinic. We included women aged 55–70 who were not at increased risk for cervical cancer due to family history or a prior history of abnormal Pap tests. For women at increased risk for cervical cancer, we extended the age range to include those over age 70. We restricted our analysis of cervical cancer screening to women who did not have a personal history of cervical cancer and who had not undergone total hysterectomy. For colorectal cancer screening, patients were classified as up-to-date if the medical record indicated the patient had undergone a colonoscopy within 10 years prior to their last contact with the clinic, a double contrast barium enema or flexible sigmoidoscopy within 5 years, or fecal occult blood testing (FOBT) screening within the prior year.

Lastly, we explored the impact of changing screening guidelines to the less conservative U.S. Preventive Services Task Force (USPSTF) guidelines (22) as many clinicians follow those guidelines, which affected our analyses of mammography, cervical and colorectal cancer screening. Clinical breast exams are not recommended by the USPSTF. In addition, mammography is recommended less frequently, and cervical and colorectal cancer screening guidelines from the Task Force recommend suspending screening when patients reach age 65 and 75, respectively.

All analyses were performed using SAS statistical software version 9.2. A random effect logistic regression model assessed the effect of insurance coverage on up-to-date cancer screening status, adjusted for potential confounding variables. Because of possible correlation of patients in the same clinic, clinics were treated as a random effect in the model. Also, the initial analysis suggested that a history of health maintenance visits was both a strong predictor and an effect modifier of up-to-date screening status; thus, the analyses were conducted for overall and by history of health maintenance visits. Odds ratios and 95% confidence intervals were estimated for each level of insurance variable, adjusted for a set of pre-selected confounders. To maintain uniform adjustment for confounders, a single set of demographic variables was selected for adjustment on the basis of a statistically significant association with up-to-date screening status for any cancer in a model with only demographic variables. The selected confounders were age (category), ethnicity, BMI class, smoking status, number of patient visits, length of contact with the clinic, and family history of cancer.

Co-morbidity adjustment variables were included in the analysis if the co-morbidity variable was significantly associated with the cancer specific screening status in a model that included demographic variables but excluded insurance status. Analyses of up-to-date for breast cancer screening were adjusted for asthma, and arthritis co-morbidity. Analysis of up-to-date for cervical cancer screening was adjusted for arthritis and hypertension co-morbidity. Analyses of up-to-date for colorectal cancer screening were stratified by gender and both strata were adjusted for cardiovascular and digestive disease, and history of low back pain.

Results

The median length of contact with all study clinics was 9.6 years for females and 10.3 years for males (inter-quartile range 3–20 years for females and 4–19 years for males). The median number of patient visits in the past 10 years was 10 for males and 11 for females

(data not shown). Two percent of patients received care from multiple clinics. Most patients were female, aged 55–70, employed or retired, had private health insurance (Table 1), and had an average of 2.5 co-morbid conditions, including digestive disorders, chronic pain, and arthritis (range=0–10). The number of health maintenance visits in the previous two years ranged from 0 to 7 in both men and women. Sixty-two percent of men and 52% of women had no record of health maintenance visits within the last 2 years.

Table 2 represents the proportion of patients up-to-date for breast cancer screening overall and the odds of being up-to-date using clinical breast exam only, mammography screening only and both clinical breast exam and mammography screening, according to receipt of any health maintenance visit and insurance type at last healthcare visit. Overall 27% were up-to-date for clinical breast exam, 35% for mammography only and 19% for both mammography and clinical breast exam, which were ACS recommendations during the study period. The likelihood of receiving at least one health maintenance visit was strongly associated with insurance status (OR for any health maintenance visits for uninsured relative to private insurance was 0.57, 95% CI: 0.38–0.87, p=0.01, results not shown), and up-to-date breast cancer screening was higher among women who had at least one health maintenance visit compared to those with none for all 3 breast cancer screening outcomes.

The adjusted analysis indicated that, relative to women with private health insurance, women with private insurance and Medicare or Medicare were more likely to be up-to-date for clinical breast exam, (overall OR =1.63, 95% CI: 1.04–2.56, p=0.03). Examination of the interaction of health maintenance visit history and insurance status indicated that this overall difference was due to a significant association of up-to-date status for CBE with Medicare status in women with no health maintenance visits (OR 1.63, 95% CI: 1.04–4.72, p=0.0.03). The women with unknown health insurance status with at least one health maintenance visit were more likely to be up-to-date for clinical breast exam relative to those with private health insurance who also had at least one health care visit (OR 2.29, 95% CI 1.11–4.72, p=0.03), but the association was not significant in women with no health maintenance visits (OR=1.12, 95% CI 0.73–1.74). A similar association of decreased likelihood of up-to-date mammography screening or mammography with clinical breast exam in women with unknown or uninsured insurance status was observed in women who had no health maintenance visits, but there was no significant difference in likelihood of mammography status associated with uninsured or unknown insurance status in women who had at least one health maintenance visit. Using the USPSTF recommendations for mammography resulted in more women being up-to-date overall (50% versus 37%), but the relative differences associated with insurance coverage were unchanged.

Table 3 presents the proportion of women eligible for cervical cancer screening who were up-to-date for a Pap test and the adjusted relative odds of being up-to-date according to last recorded insurance type. The results are presented according to the receipt of any health maintenance visit. Overall, 30% of women were up-to-date for Pap testing. As with breast cancer screening, the proportion up-to-date was higher among women who had at least one health maintenance visit compared with those who had none. Being uninsured relative to having private insurance represented the group least likely to be up-to-date, except among women with at least one preventive healthcare visit, where this was lowest among those with Medicare or Medicare plus private insurance. The odds ratio for up-to-date Pap test screening in women with any health maintenance visit versus none was 23.1 (95% CI: 10.6 – 50.6, p<0.0001, results not shown). As with mammography screening, the proportion of women up to date for cervical cancer screening increased when applying USPSTF recommendations from 30% to 52%. This difference is affected especially by dropping women aged 65 and older as the USPSTF recommends.

Table 4 presents the proportion of patients who were up-to-date for colorectal cancer screening (using any of four different tests at the appropriate recommended screening interval) and the adjusted relative odds of being up-to-date according to last recorded insurance type. These results are also presented by subgroup according to the receipt of any health maintenance visit. Thirty-seven percent of men and 38% of women were up-to-date for colorectal cancer screening. Of patients with any record of colorectal cancer screening, the most recent screening method used was FOBT for 25% of men and 20% of women, colonoscopy for 64% of men and 74% of women, flexible sigmoidoscopy for 10% of men and 3% of women, and double contrast barium enema for 1% of men and 3% of women. The odds ratio for up-to-date colorectal cancer screening in women with any health maintenance visit versus none was 3.02 (95% CI: 2.13–4.27, p=<0.0001) and for men it was 2.30 (95% CI: 1.50–3.55, p<0.0001). A secondary analysis of female patients which added Mammography status to the analysis described in Table 4 indicated that women who were up to date for Mammography were much more likely to be up-to-date for colorectal cancer screening (OR 1.74, CI 1.38–2.20, p<0.0001, results not shown).

We found very small differences in our results for colorectal cancer screening with the USPSTF guidelines versus ACS guidelines, as the increase in the number of low risk patients who were up to date according to the more lenient USPSTF FOBT guideline (biennial rather than annual) was offset by a decrease in the number of high risk patients that were up to date according to the more restrictive USPSTF colonoscopy guideline (every 5 years rather than every 10 years). The association of USPSTF up to date status with insurance coverage (uninsured compared to private) was slightly increased relative to that of ACS up to date status (OR 0.41, CI 0.18–0.95 compared to OR 0.43, CI 0.19–1.00 for USPSTF and ACS overall up to date in males, respectively and OR 0.44, CI 0.25–0.77 compared to OR 0.45, CI 0.25–0.79 for USPSTF and ACS overall up to date in females, respectively.

Discussion

This study focused on cancer screening and health insurance in rural residents. Most data on this underserved population are from the Centers for Disease Control's Behavioral Risk Factor Surveillance System (BRFSS), which indicated that 51.8% of rural female residents (over age 50) have had a mammogram in the past year vs. 61.5 % of their urban counterparts (p<0.01) (23). Similarly, other studies using BRFSS data indicate that 28.2% of rural U.S. residents have had a sigmoid/colonoscopy within the past 5 years and 35.0% have had an FOBT at least once (9), compared to general U.S. at 45.6% and 52.1% respectively, among the general U.S. population (4). The present study, using medical record review data from four rural Oregon primary care practices, found breast cancer screening rates to be approximately 12% lower than previously reported. Rates were similarly low for Pap testing among age-eligible rural women and for colorectal cancer screening using any screening test. Data from this study suggests that BRFSS data likely over-estimate screening rates, perhaps because of social response bias or because older patients eligible for screening do not recall accurately when their last screening test occurred. Our findings did not change significantly when we explored using the USPSTF recommendations rather than those of the ACS. The only real change was an increase in the number of patients up-to-date for screening mammography and pap test screening because biennial screening is recommended rather than annual by ACS and the denominator greatly changed for cervical cancer screening because it is not recommended for patients age 65 and older.

Our findings cannot be explained by lack of access to healthcare since all study subjects were patients of established primary care practices and many had several healthcare visits during the study period. Though patients had two to three co-morbid conditions, we adjusted

for this in our analysis and the screening rates were overall very low. We examined the impact of health insurance status and type as well as whether one or more health maintenance visit occurred in the past two years, both of which were found to be significantly associated with higher rates of cancer screening for tests that are not done in the office, such as mammography and colonoscopy. Screening tests done in the office, such as clinical breast exams and Pap tests were less likely to be affected by insurance status and more likely to be influenced by having had a health maintenance visit. It is likely, as has been reported elsewhere (24), that clinicians in this study face many competing demands during the medical encounter, such as multiple diverse patient issues and acute illnesses. These demands likely take precedence during the health care visit and, in the absence of a clinic visit devoted to health maintenance, may make it less likely that patients will receive preventive services.

As with other studies (25), we found that very few patients had received flexible sigmoidoscopy for colorectal cancer screening and that most patients received either FOBT or colonoscopy. This shift may also represent the known benefits of polyp removal in reducing the incidence of colorectal cancer in the general population (26).

Among women with at least one health maintenance visit, those with unknown insurance status were twice as likely to be up-to-date for a clinical breast exam compared to women with private insurance. We speculate that these women may have had a breast symptom and requested an exam that would not be as costly as a mammogram. Their insurance status as unknown requires some speculation on our part. Patients indicating they were self-pay were classified as uninsured, a different categorization entirely from Unknown.

We explored the hypothesis that being up-to-date for screening for one type of cancer increases the likelihood of being up-to-date for screening for other types, as willingness to participate in one screening might extend to other types of screening. This is supported by the increased likelihood for up to date colorectal screening status in women who are up to date for mammography.

The recent healthcare reform law (27) will likely increase reimbursements to primary care physicians for health maintenance visits and increase both office-based and off-site cancer screening. Changes in health policy alone could go a long way toward increasing the number of patients who are up-to-date for cancer screening, as well as increasing the number who are current for other preventive or health surveillance activities. Although uncertainty remains as to whether the legislation will be implemented in its original form, it is clear that having fully covered primary care health maintenance visits could improve the receipt of cancer screening in both urban and rural settings (28).

The strengths of our study include that we used medical records to assess cancer screening activities rather than physician or patient survey, which may be affected by recall or social response bias. Accuracy of patient self-report of cancer screening tests has been extensively studied (29–31) including a recent meta-analysis (31), which found that patient self-report consistently overestimates rates of cancer screening. Thus, we are confident that our use of medical charts for this analysis was the best approach. There is additional support for the representativeness of our study population to a more general population regarding employment status, as we found our rates of employment comparable to those reported on a national survey (32). The tests under study require a laboratory report or report in the medical record on clinical findings, which is more accurate than using the medical record for physician recommendations where documentation bias may be problematic. We studied four clinics operating in rural settings, two of which were private and two of which were

federally qualified health center, providing diversity in the type of settings where care is provided in rural areas.

The weaknesses of our study included that we did not assess the perspectives of patients or physicians about barriers to cancer screening, which should be further studied in rural settings. We also did not focus on the recommendations physicians gave to patients about cancer screening. Though we collected this information, we were concerned that physician recommendations collected by chart review would significantly underestimate actual recommendations, as it is not clear that all clinicians document the advice they provide. We also experienced some missing data related to race and ethnicity and insurance status. Though we worked hard to abstract this information, it was not always available. This is due, in part, to the fact that assessing race and ethnicity is not required in private practice as it is in FQHCs, and because FQHCs tend to provide care for the un- and underinsured, insurance status is more likely to be missing. Lastly, this study did not assess cancer screening among patients who do not have an established relationship with a healthcare provider, though we expect screening rates would be even lower among patients who do not have access to health care.

In conclusion, we found that the proportion of age eligible patients being up-to-date for risk appropriate cancer screening in rural primary care settings is lower than reported elsewhere. This is especially true for cervical and breast cancer screening and less so for colorectal cancer. Having some form of health insurance is associated with being more likely to have a health maintenance visit in the past two years and being up-to-date for breast, cervical and colorectal cancer screening.

Acknowledgments

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Table 1

Patient Demographic Characteristics

Characteristic	Males	Females
	N=1,563	N=1,870
Community		
Community A	621 (40%)	608 (33%)
Community B	942 (60%)	1,262 (67%)
Age[*]		
50–59	629 (40%)	717 (38%)
60–69	536 (34%)	647 (35%)
70–79	270 (17%)	301 (16%)
80+	128 (8%)	205 (11%)
BMI		
Less than 18.5	4 (0.3%)	26 (1%)
18.5–30	658 (42%)	810 (43%)
Greater than 30	433 (28%)	556 (30%)
Not computable	468 (30%)	478 (26%)
Race		
White	888 (57%)	1,132 (61%)
Other	47 (3%)	53 (3%)
Unknown/Unspecified	628 (40%)	685 (37%)
Ethnic Group		
Hispanic	184 (12%)	239 (12%)
Non-Hispanic	436 (28%)	632 (34%)
Unspecified	943 (60%)	999 (53%)
Marital Status		
Married/Partnered	1,082 (69%)	1,047 (57%)
Un-partnered	333 (21%)	649 (35%)
Unknown	148 (9%)	164 (9%)
Employment Status		
Employed	735 (47%)	694 (37%)
Unemployed	72 (5%)	177 (9%)
Retired	509 (33%)	542 (29%)
Other	71 (5%)	80 (4%)
Unknown	176 (11%)	377 (20%)
Last Reported Insurance		
Private only	831 (53%)	1,009 (54%)
Medicare or Medicare + Private	251 (16%)	322 (17%)
Medicaid or Medicare + Medicaid	83 (5%)	107 (6%)

Characteristic	Males	Females
	N=1,563	**N=1,870**
Uninsured	111 (7%)	172 (9%)
Unknown	287 (18%)	266 (13%)
Smoking Status		
Non-user	721 (46%)	1,176 (63%)
Former User	489 (31%)	377 (20%)
Current User	264 (17%)	216 (12%)
Unknown	89 (6%)	101 (5%)
Alcohol Use		
Non-user	502 (32%)	952 (51%)
Former User	173 (11%)	73 (4%)
Current User	764 (49%)	673 (36%)
Unknown	124 (8%)	172 (9%)
Family History of Cancer[1]		
Breast	65 (4%)	200 (11%)
Cervical	6 (0.4%)	22 (1%)
Colorectal	29 (2%)	64 (3%)
Other Cancer	394 (25%)	451 (24%)
None	1,070 (68%)	1,152 (62%)
Personal History of Cancer[1, 2]		
Breast	0 (0%)	106 (5%)
Cervical	0 (0%)	28 (1%)
Colorectal	22 (1%)	23 (1%)
Other Cancer	264 (17%)	189 (10%)
None	1299 (82%)	1658 (88%)

[*] Age was missing for 5 patients

[1] Some subjects had a history of multiple types of cancer.

[2] Those with a prior persona history of breast, cervical, and colorectal cancer were excluded from other analyses.

Table 2

Association of Up-to-date Breast Cancer Screening Status with Insurance Coverage in Women in Rural Oregon

Clinical Breast Exams

Last Recorded Insurance	Proportion UTD[1] n/N(%)			Adjusted[2] Odds Ratios (95% CI) for UTD		
		UTD by Health Maintenance Visits			UTD by Health Maintenance Visits[3]	
	Overall UTD	No Visits	At least 1 Visit	Overall UTD	No Visits	At least 1 Visit
Unknown Insurance Status	83/259 (32%)	2/133 (2%)	81/126 (64%)	0.57 (0.25 – 1.31)	0.19 (0.04 – 0.83)	1.93 (1.17 – 3.18)
Uninsured	41/130 (25%)	4/108 (4%)	37/63 (59%)	0.76 (0.39 – 1.48)	0.44 (0.14 – 1.34)	1.37 (0.74 – 2.53)
Medicaid or Medicaid+Private	28/107 (26%)	2/61 (3%)	26/46 (57%)	0.98 (0.41 – 2.31)	0.57 (0.13 – 2.61)	1.74 (0.88 – 3.47)
Medicare or Medicare+Private	76/319 (24%)	13/176 (7%)	63/143 (44%)	1.63 (1.04 – 2.56)	2.28 (1.11 – 4.72)	1.12 (0.73 – 1.75)
Private	283/1003 (28%)	33/485 (7%)	250/518 (48%)	Referent	Referent	Referent
Total	**511/1859 (27%)**	**54/963 (6%)**	**457/896 (51%)**			

Mammography Screening

Last Recorded Insurance	Proportion UTD[1] n/N(%)			Adjusted[2] Odds Ratios (95% CI) for UTD		
		UTD by Health Maintenance Visits			UTD by Health Maintenance Visits[3]	
	Overall UTD	No Visits	At least 1 Visit	Overall UTD	No Visits	At least 1 Visit
Unknown Status	67/259 (26%)	8/133 (6%)	59/126 (47%)	0.59 (0.35–1.02)	0.38 (0.17–0.87)	0.95 (0.57–1.58)
Uninsured	38/171 (22%)	5/108 (5%)	33/63 (52%)	0.44 (0.24–0.79)	0.20 (0.08–0.51)	1.04 (0.57–1.89)
Medicaid or Medicaid+Private	31/107 (29%)	11/61 (18%)	20/46 (43%)	0.67 (0.41–1.09)	0.73 (0.36–1.47)	0.61 (0.32–1.16)
Medicare or Medicare+Private	103/319 (32%)	35/176 (26%)	68/143 (48%)	0.73 (0.53–1.02)	0.89 (0.56–1.41)	0.60 (0.39–0.90)
Private	443/1003 (44%)	126/485 (26%)	317/518 (61%)	Referent	Referent	Referent
Total	**682/1859 (37%)**	**185/963 (19%)**	**497/896 (55%)**			

[1] ACS guidelines recommend annual screenings for women over 50 years old. Analysis limited to women over 50 years old. Analysis limited to women without history of bilateral mastectomy, or recent abnormal mammogram.

[2] Adjusted for BMI, age, smoking status, number of patient visits, length of contact with clinic, family history of cancer, ethnicity, and asthma and arthritis co-morbidity. Clinic was included as a random effect.

[3] Health maintenance visits within 2 years of last contact with clinic.

Association of Up-to-date Cervical Cancer Screening Status with Insurance Coverage in Rural Oregon Women

Last Recorded Insurance	Proportion UTD[1] for PAP test n/N(%)			Adjusted[2] Odds Ratios (95% CI) for UTD		
		UTD by Health Maintenance Visits			UTD by Health Maintenance Visits[3]	
	Overall UTD	No Visits	At least 1 Visit	Overall UTD	No Visits	At least 1 Visit
Unknown Insurance Status	47/167 (28%)	1/81 (1%)	46/86 (53%)	0.40 (0.13–1.32)	0.17 (0.02–1.37)	1.06 (0.55–2.03)
Uninsured	24/115 (21%)	2/73 (3%)	22/42 (51%)	0.48 (0.19–1.24)	0.28 (0.06–1.32)	0.87 (0.38–1.97)
Medicaid or Medicaid+Private	15/48 (31%)	1/22 (5%)	14/26 (54%)	0.79 (0.24–2.58)	0.67 (0.08–5.51)	0.95 (0.38–1.97)
Medicare or Medicare+Private	14/75 (18%)	2/28 (7%)	12/47 (26%)	0.62 (0.25–1.55)	1.14 (0.24–5.49)	0.32 (0.14–0.70)
Private	179/529 (34%)	19/235 (8%)	160/294 (54%)	Referent	Referent	Referent
Total	**279/934 (30%)**	**25/439 (6%)**	**254/495 (51%)**			

[1] Annual screen unless 3 negative PAP tests were reported. Screen within 3 years if record of 3 negative PAP tests reported. Average CVC risk status: Analysis limited to women under age 70 without history of hysterectomy or cervical cancer. High-risk CVC status: limited to women without history of hysterectomy, no age limit.

[2] Adjusted for BMI, age, smoking status, number of patient visits, length of contact with clinic, family history of cancer, ethnicity, and arthritis, and hypertension.

[3] Health maintenance visits within 2 years of last contact with clinic.

Table 4

Association of Up-to-date Colorectal Cancer Screening Status with Insurance Coverage in Rural Oregon

Males	Proportion UTD[1] with CRC Screening: n/N UTD (% UTD)			Adjusted[2] Odds Ratios (95% CI) for UTD CRC Screening		
Last Recorded Insurance	Overall UTD	UTD by Health Maintenance Visits		Overall UTD	UTD by Health Maintenance Visits[3]	
		No Visits	At least 1 Visit		No Visits	At least 1 Visit
Unknown Insurance Status	43/287 (15%)	20/231 (9%)	23/56 (41%)	0.88 (0.52 – 1.51)	0.62 (0.33 – 1.16)	1.25 (0.61 – 2.58)
Uninsured	12/111 (11%)	9/98 (9%)	3/13 (23%)	0.43 (0.19 – 1.00)	0.46 (0.21 – 1.02)	0.40 (0.09 – 1.72)
Medicaid or Medicaid+Private	26 /83 (31%)	12/51 (24%)	14/32 (44%)	0.60 (0.34 – 1.05)	0.80 (0.38 – 1.68)	0.45 (0.20 – 1.02)
Medicare or Medicare+Private	105/251 (42%)	49/151 (32%)	56/100 (56%)	0.77 (0.53 – 1.10)	1.00 (0.63 – 1.58)	0.59 (0.35 – 0.98)
Private	407/831 (49%)	156/442 (35%)	251/389 (65%)	Referent	Referent	Referent
Total	**593/1563 (38%)**	**246/973 (25%)**	**347/590 (59%)**			

Females	Proportion UTD[1] with CRC Screening; Females n/N UTD (% UTD)			Adjusted[2] Odds Ratios (95% CI)for UTD CRC Screening		
Last Recorded Insurance	Overall UTD	UTD by Health Maintenance Visits		Overall UTD	UTD by Health Maintenance Visits[3]	
		No Visits	At least 1 Visit		No Visits	At least 1 Visit
Unknown Status	47/260 (18%)	7/133 (5%)	40/127 (32%)	0.43 (0.25 – 0.74)	0.28 (0.12 – 0.67)	0.62 (0.39 – 1.10)
Uninsured	23/172 (14%)	8/108 (7%)	15/64 (23%)	0.45 (0.25 – 0.79)	0.35 (0.16–0.79)	0.57 (0.28 – 1.16)
Medicaid or Medicaid+Private	47/107 (44%)	21/61 (34%)	26/46 (57%)	1.27 (0.80 – 2.04)	1.13 (0.61 – 2.09)	1.44 (0.74 – 2.86)
Medicare or Medicare+Private	131/322 (41%)	49/178 (28%)	82/144 (57%)	0.74 (0.54 – 1.03)	0.65 (0.41 –1.01)	0.86 (0.56 – 1.31)
Private	425/1009 (42%)	152/488 (31%)	253/521 (52%)	Referent	Referent	Referent
Total	**673/1870 (35%)**	**237/968 (24%)**	**436/902 (48%)**			

[1] ACS up-to-date guidelines: FOBT within 1 year, Flex sig or DCBE within 5 years or Colonoscopy within 10 years.

[2] Adjusted for BMI, age, smoking status, number of patient visits, length of contact with clinic, family history of cancer, ethnicity, and cardiovascular or digestive disease, and history of low back pain co-morbidity

[3] Health maintenance visits within 2 years of last contact with clinic.