Impact of the 2008–2009 Economic Recession on Screening Colonoscopy Utilization Among the Insured

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Abstract

BACKGROUND & AIMS—Economic factors might affect the use of recommended preventative services. We sought to determine whether the recent, severe economic recession was associated with diminished screening colonoscopy rates among an insured population and to assess the relationship between out-of-pocket (OOP) costs and screening colonoscopy use.

METHODS—Administrative data from 106 health plans (LifeLink™ Health Plan Claims Database) were analyzed to determine monthly rates of screening colonoscopies performed on 50–64 year old beneficiaries between January 2005 and November 2007 (pre-recession), as well as December 2007 through June 2009 (recession). Segmented regression models were used to

evaluate changes in screening colonoscopy rates, as well as the relationship between screening and OOP costs before and during the recession.

RESULTS—Compared to pre-recession trends, during the recession screening colonoscopy rates decreased by 68.9 colonoscopies/1,000,000 individuals per month (95% confidence interval, decreased of 84.6–53.1; *P*<.001). Application of study estimates to the entire US population indicated that during the recession, commercially insured, 50–64 year olds underwent approximately 500,000 fewer screening colonoscopies. Compared to those with low OOP costs, those with high OOP procedure costs had lower rates of screening before and during the recession, and had a greater reduction in screening rates during the recession (*P*=.035).

CONCLUSIONS—During the recession of December 2007–June 2009, insured individuals reduced their use of screening colonoscopy, compared with the 2 years before the recession began. OOP costs were inversely related to screening use, especially during the recession. Policies to reduce cost sharing could increase adherence to recommended preventive services such as colonoscopy examinations.

Keywords

colon cancer; CRC; prevention; healthcare spending

BACKGROUND

The recent U.S. economic recession was the longest and most severe since World War II.[1] During this period, personal health care expenditures[2] grew at the slowest rate in almost 50 years.[3, 4] Data from surveys[5–7] and financial statements[8, 9] indirectly suggest that during the recession Americans used less health care. If true, cut-backs were most likely among the five million non-elderly Americans who lost their health insurance.[10] However, in the face of falling household incomes[11] and rising economic insecurity,[12] the majority of Americans who remained continuously insured may have also curtailed their use of health care, especially costly, elective services.[5]

Colorectal cancer screening is recommended for all adults 50 years or older.[13, 14] Colonoscopy is the most popular screening option.[15] However, many patients referred for colonoscopy fail to undergo the procedure,[16, 17] in part because of high direct out-of-pocket (OOP) costs (e.g., co-payment and co-insurance).[18] During tough economic times these costs may become unaffordable and further limit adherence to screening recommendations. Down the line, this may increase health care costs[19] and the proportion of individuals diagnosed with late stage colorectal cancer.[20]

We sought to determine whether rates of screening colonoscopies in an insured population fell during the economic recession. Additionally, we assessed whether changes in utilization rates were associated with patient cost sharing. We hypothesized that during the recession screening rates dropped, especially among those with high direct OOP costs.

METHODS

Study design and population

We conducted a time-series analysis using health insurance claims data within the LifeLink™ Health Plan Claims database (formerly Pharmetrics). The database contains fully adjudicated medical and pharmaceutical claims from approximately 100 health plans across the US and has been reported to be nationally representative of the commercially insured U.S. population.[21] The study sample selected consisted of a 10% random sample of all persons in the database with at least 6 months of continuous health plan enrollment. For each month between January, 2005 and June, 2009, we assembled the sample of actively enrolled 50 to 64 years old beneficiaries.

Identification of screening colonoscopies

Colonoscopy is performed for colorectal cancer screening (i.e., asymptomatic individuals without precancerous lesions), colorectal cancer surveillance (i.e., asymptomatic individuals with a history of prior removal of a pre-cancerous lesion),[22] and diagnostic purposes (e.g., diarrhea or hematochezia). Algorithms that use administrative claims data to distinguish between these types of colonoscopies have been developed in a health maintenance organization population (Haque et al),[23] as well as the Veterans Affairs System (El Serag et al[24], subsequently modified by Fisher et al.[25]). However, these algorithms were not developed for use in commercially insured populations (such as the one in this study) and often misclassify screening and diagnostic procedures.[26] This likely stems from the fact that the Haque algorithm, which only includes two colonoscopy Current Procedural Terminology (CPT) codes, does not identify enough colonoscopies, while the Fisher algorithm, which includes over 30 International Classification of Diseases (ICD-9) diagnosis codes, classifies too many colonoscopies as diagnostic. Therefore, we identified patients in the above source population who underwent a screening colonoscopy each month as any beneficiary with at least one inclusionary CPT code from Fisher's algorithm (Step 1) and without any exclusionary ICD-9 codes from Haque's algorithm (Steps 2–4) [Appendix 1]. This screening algorithm maximized sensitivity of identifying screening procedures, and optimized statistical power and precision, at the expense of lower specificity. We also performed confirmatory analyses using screening colonoscopies identified with the Haque and Fisher algorithms.

Screening colonoscopy rates before and during the recession

A segmented regression model[27] was employed to compare trends in the monthly rate of screening colonoscopy utilization (per 1,000,000 eligible beneficiaries) prior to the economic recession (January, 2005 to November, 2007) to monthly rates during the economic recession (December, 2007 to June, 2009). These time periods were defined by the National Bureau of Economic Research,[28] the nation's leading nonprofit economic research organization and official arbiter for dating recessions. Segmented regression may be used to capture changes in both the trend of screenings as well as discontinuity in the use of screenings resulting from the recession. We hypothesized a priori that there would not be an abrupt decline in screenings given the recession's gradual onset and therefore chose to

only model changes in the trend of screenings before and during the recession. The specific time-series model used was:

$$Y = \beta_0 + \beta_1 * \text{Time}_{(month)} + \beta_2 * \text{Time in Recession}_{(month)} + \varepsilon$$

where *Y* is the monthly rate of colonoscopy screening, *Time* is a continuous variable indicating time in months for the entire study period from January, 2005 (*Time* = 1) to June, 2009 (*Time* = 54). *Time in Recession* is a continuous variable counting the number of months during the recession from December, 2007 (*Time in Recession* = 1) to June, 2009 (*Time in Recession* = 19) and is coded 0 for the months before the recession. In the model, β_0 estimates the screening rate at the baseline (January, 2005), β_1 estimates the trend of screening rates in pre-recession period (January 2005 to November 2007), β_2 estimates the change of the trend of screening rates moving from the pre-recession period to the recession period (December, 2007 through June, 2009), and $\beta_1 + \beta_2$ estimates the trend of screening rates in the recession period (December, 2007 through June, 2009).

Rates of alternative colorectal cancer screening tests before and during the recession

In addition to colonoscopy, the US Preventive Services Task force also recommends fecal occult blood testing (FOBT) and sigmoidoscopy as options for colorectal cancer screening.[17] We used CPT codes to identify FOBT (82270, 82271, and 82272) and flexible sigmoidoscopy (45330, 45331, 45333, 45335, 45338, 45339, G0104) and then calculated monthly rates of these procedures (per 1,000,000 eligible beneficiaries) for each month throughout the study period (January, 2005 through June, 2009).

Screening colonoscopy rates stratified by out-of-pocket costs before and during the recession

In addition to examining the effect of the recession on overall screening colonoscopy trends, we also examined whether these trends differed based on direct OOP costs. We hypothesized that if screening rates declined during the recession, the steepest drop would be observed among those with the highest OOP costs. For subjects who underwent screening colonoscopy, we defined direct OOP costs as the costs a plan contractually allowed for minus the amount the plan itself actually paid. We considered all same-day medical costs, except dispensing of prescription drugs, as colonoscopy related. Based on an assumption that median OOP procedure costs for each plan would, on average, apply to all individuals in that plan, we stratified each plan into a low OOP cost group (less than or equal to $50), average OOP cost group (between $51–$299), and high OOP cost group ($300 and higher) determined over each six month period (January to June, and July to December for each year). Plans with fewer than 20 than colonoscopies were excluded to increase the precision of the cost estimates. These OOP cost cut-offs were determined a priori using the distribution of OOP costs across plans (roughly 1/3rd of the population was assigned to each cost group). Of note, it was possible for a plan to move from one OOP cost strata to another each six month period. Using these data, we created segmented regression models to compare the utilization rate among the three OOP cost strata:

$$Y = \beta_{0low} * OOP_{low} + \beta_{1low} * OOP_{ow} * \text{Time}_{(month)} + \beta_{2low} * OOP_{low} * \text{Time in Recession}_{(month)} + \beta_{0avg} * OOP_{avg} + \beta_{1avg} * OOP_{avg} * \text{Time}_{(month)} + \beta_{2avg} * OOP_{avg}$$

$$*Time\ in\ Recession_{(month)} + \beta_{0high}*OOP_{high} + \beta_{1high}* OOP_{high} *Time_{(month)} + \beta_{2high}* OOP_{high} *Time\ in\ Recession_{(month)} + \varepsilon$$

where OOP_{low} is the indicator variable representing plans with low median direct OOP costs, OOP_{avg} is for plans with average direct OOP costs, and OOP_{high} is for plans with high direct OOP costs. Similar to model 1 above, β_{0low}, β_{0avg}, and β_{0high} estimate the screening rate at baseline (January 2005) for three sub-groups respectively. β_{1low}, β_{1avg}, and β_{1high} estimate the coefficients for the trend of colonoscopies from January 2005 (*Time* = 1) to June 2009 (*Time* = 54), while β_{2low}, β_{2avg}, and β_{2high} estimate the change of the trend for each sub-group resulting from the recession from December 2007 (*Time in Recession* = 1) to June, 2009 (*Time in Recession* = 19) for beneficiaries in low, medium, and high generosity plans respectively. Finally, the slope change of the high and low OOP plans were compared to assess whether the drop in screening rates was greater among those in the high OOP sub-group compared to those in the low OOP sub-group [(β_{2low}) − (β_{2high})].

Out-of-pocket costs of screening colonoscopy before and during the recession

We also posited that falling direct OOP costs during the recession would suggest that those with higher direct OOP costs were preferentially forgoing screening colonoscopy, irrespective of their specific health plan. Accordingly, we calculated and compared median direct OOP costs for the procedure before and during the recession using non-parametric two-sample t-tests. We also used segmented regression to assess the trends in median OOP costs before and during the recession.

For all segmented regression models, we explored the possibility of autocorrelation and seasonal trends to improve model fit. We noted the presence of a significant yearly auto-correlation in the disturbances of time points being 12 months apart and therefore used auto-regressive integrative moving average (ARIMA) to correct for it. We employed robust standard errors in these models to correct for heteroskedasticity and improve the precision of our parameter estimation. SAS® (version 9.1.3, Cary NC) was used to extract the study sample from the claims database. Stata® (version 9, College Station TX) was used to conduct the segmented regression analysis. Our study was exempted from review by the University of North Carolina Institutional Review Board.

RESULTS

Screening colonoscopy utilization before and during the recession

The screening algorithm identified 86,644 individuals who underwent screening colonoscopies (49.7% of 174,312 individuals with at least one colonoscopy CPT code, a very similar proportion to what has been previously reported[29, 30]) (Appendix Figure A). As predicted, the rates of screening colonoscopy increased before and then decreased during the recession. Prior to the recession screening colonoscopy use increased at a rate of 38.2 (95% Confidence Interval: 32.4, 43.9) more colonoscopies per 1,000,000 insured individuals per month. Conversely, during the recession screening colonoscopy use declined at a rate of 30.7 (− 42.2, −19.1) fewer colonoscopies per 1,000,000 insured individuals per month. In sum, compared to what would have been expected based on pre-recession trends, during the recession screening colonoscopy use declined at a rate of 68.9 (−84.6, −53.1) fewer

colonoscopies per 1,000,000 insured individuals per month (p<0.001) (Figure 1; also see Appendix Table 1). The results based on analyses of colonoscopies identified using the other two algorithms were both in the same direction, of similar magnitude, and statistically significant (Appendix Table 1 and Figure 1).

Rates of alternative colorectal cancer screening tests before and during the recession

Rates of FOBT and sigmoidoscopy declined both before and during the economic recession. Between the first and last months of the study, rates of FOBT declined by 34% and sigmoidoscopy by 61%.

Screening rates stratified by out-of-pocket costs before and during the recession

Also as predicted, screening rates were lower among beneficiaries of health plans with high direct OOP costs throughout all time periods. Furthermore, during the recession screening rate trends declined most among members of high OOP cost plans (Figure 2; also see Appendix Table 2). Based on the pre-recession trends, during the recession screening colonoscopy use declined at a rate of 58.1 (−74.5, −41.6) fewer colonoscopies than expected / 1,000,000 insured individuals with low out-of-pocket costs ($50) per month, compared with a rate of 81.5 (−96.3, −66.7) fewer colonoscopies than expected / 1,000,000 insured individuals with high out-of-pocket costs ($300) per month (p=0.035). The results based on analyses of colonoscopies identified using the other two algorithms were in the same direction, though statistically significant for the Haque (p=0.048) but not Fisher (p=0.65) algorithm (Appendix Figure 2 and Table 2).

Out-of-pocket costs before and during the recession

Median direct OOP costs incurred for screening colonoscopy before the recession were significantly higher than those during the recession ($145 vs. $127, p<0.001). Median OOP costs increased at a rate of $5.52 ($0.48, $10.56) per year prior to the recession, and then decreased at a rate of $33.84 (−$53.4, −$23.04) per year during the recession (p<0.001) (Figure 3 and Appendix Table 3). The results based on analyses of colonoscopies identified using the other two algorithms were both in the same direction and statistically significant (Appendix Figure 3 and Table 3).

DISCUSSION

During the recent economic recession insured 50 – 64 year old Americans reduced their use of screening colonoscopy. Applying the decreased utilization documented here to the 39.5 million commercially insured, 50–64 year old Americans,[31] over the entire 19 month recession period this would have resulted in 516,309 (95% CI: 456,360, 576,258) fewer colonoscopies than what would have been expected based on pre-recession trends. Screening rates fell most among individuals with high direct OOP costs for the procedure. These findings reflect the intimate link between socioeconomic factors and health care use;[32] when faced with economic insecurity, asymptomatic individuals may be unable to afford screening colonoscopy, or may perceive it to be less important than competing demands for their more limited resources.

Because colonoscopy is a cost-effective[19, 33] screening modality recommend by multiple governmental agencies[17] and professional societies,[13] reduced screening rates during the recession -- which were undoubtedly even more extreme among those who lost their health insurance[34] and were not met by a commensurate rise in FOBT nor sigmoidoscopy utilization-- may ultimately increase health care costs and result in cancer related deaths. This is consistent with literature in other fields of medicine. For instance, during difficult economic times women are more likely to be diagnosed with advanced rather than local breast cancer.[35, 36] Similarly, over one-half of family physicians surveyed in May, 2009 reported seeing more health problems caused by their patients forgoing needed preventive care.[6]

Those with high OOP procedure costs had lower screening rates over time, and experienced a greater drop in screening rates during the recession. While factors aside from OOP costs may have affected the decision to undergo screening colonoscopy during the recession, our findings add to the growing body of literature suggesting that cost-sharing is a disincentive for preventive services.[37, 38] For example, when a group of employees were compelled to switch to a high-deductible health plan (an extreme form of cost sharing) they significantly reduced their use of screening colonoscopy.[39, 40] Likewise, requiring women to pay a mere $10 to $20 copayment makes them 8% less likely to undergo mammography.[41] In our study, those individuals in health plans with high direct OOP costs for colonoscopy were less likely to undergo the procedure throughout the entire study period, and during the recession this tendency was accentuated. Taken together, these studies argue for strategies to reduce patient cost sharing for colorectal cancer screening. Recently, the Patient Protection and Affordable Care Act eliminated Medicare and Medicaid copayments and deductible requirements for all preventive services recommended by the United States Preventive Services Task Force, including screening colonoscopy.[42] Commercial insurers may follow suit by offering value based insurance designs that promote high value services through financial incentives, such as reduced copayments.[43]

The study had several potential limitations related to the use of administrative data. First, algorithms for distinguishing screening from surveillance and diagnostic colonoscopy are not exact and none have been assessed in a commercially insured popualtion.[26] We are reassured that the proportion of colonoscopies our algorithm classified as screening (approximately one-half) was nearly identical to those reported in two other national studies that used medical records and practice surveys to classify colonoscopies.[29, 30] Additionally, we performed confirmatory analyses using two other classification algorithms. In all these analyses, the direction and magnitude of the results were consistently similar. Finally, any misclassification (i.e., considering a diagnostic colonoscopy as screening and vice versa) would be non-differential with respect to time and should therefore bias the results towards the null.[44] A second limitation is that we relied on median OOP costs at the health plan level as a surrogate for OOP costs at the individual level. However, we also demonstrated that median direct OOP costs at the individual level irrespective of health plan increased before and decreased during the recession, further suggesting that during the recession those with high direct OOP costs were preferentially less likely to have undergone screening. Third, other factors such as socioeconomic status may have affected the associations between the economic recession, cost-sharing, and screening colonoscopy utilization. However, lower

income Americans tend to belong to health plans with less cost-sharing,[45] so it would be expected that any confounding by socioeconomic status would bias our study's results to the null. Fourth, it is possible that non-economic factors such as a change in the proportion of individuals due for colon cancer screening, increased use of computed tomographic colonography (CTC) use, and other secular trends may have reduced screening colonoscopy utilization during the recession. With regards to CTC, the growth of this screening modality has been generally slow. In 2005, 13% of hospitals offered CTC; by the end of 2008, this proportion only increased to 17%.[46] Even at the select hospitals that offer this test, the use of CTC likely pales in comparison to use of conventional (optical) colonoscopy, in part because screening CTC is not covered by most commercial insurers.[47] Finally, while the study population was representative of the commercially insured U.S. population, it is unclear if these data generalize to the Medicare population. For this reason, we conservatively extrapolated these data only to insured Americans between the ages of 50 and 64 years old.

In summary, during the recent economic recession rates of screening colonoscopy decreased among insured Americans. Members of health plans with high colonoscopy OOP costs were less likely to undergo colonoscopy at all time points, and this differential utilization worsened during the recession. Thus, policies to reduce patient cost sharing for colonoscopy and other recommended, cost-effective preventive services should be considered.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Abbreviations

CPT	Current Procedural Terminology
CTC	computed tomographic colonography
ICD-9	International Classification of Diseases-9
OOP	out-of-pocket.

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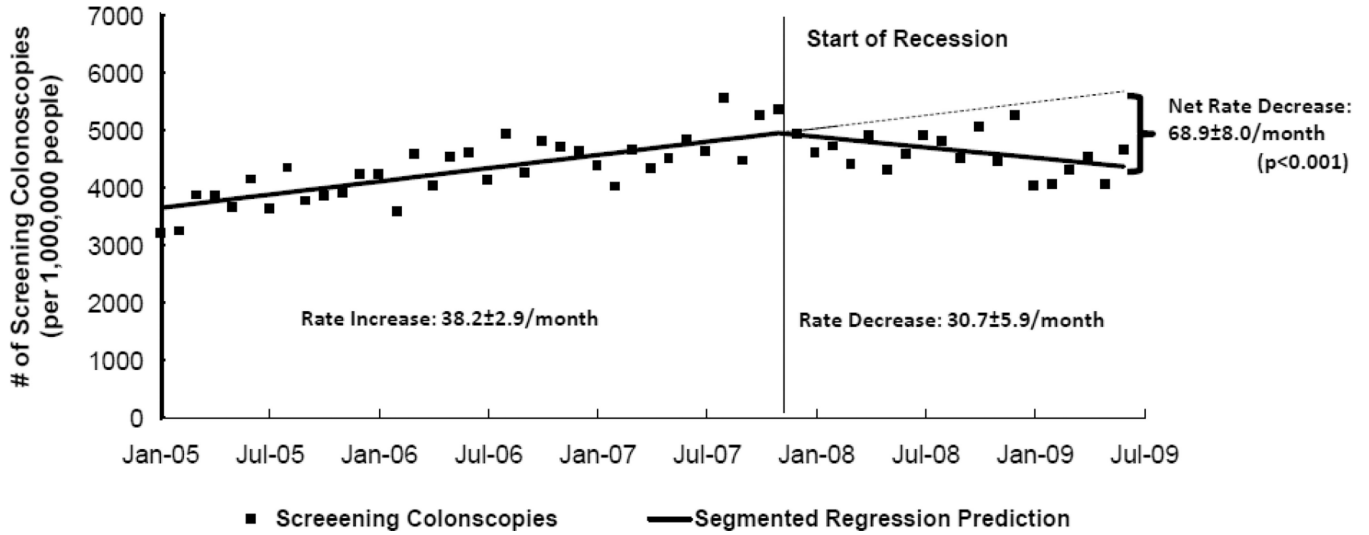
Figure 1. Screening Colonoscopy Utilization among Insurance Beneficiaries Before and During the Economic Recession

*p-value for test of trend change between pre-recession to recession periods.

Black boxes represent rates of screening colonoscopy each month. Solid lines represents rate predicted by segmented regression models before and during the economic recession. Broken line represents recession era rates that would have been expected based on projections of pre-recession trends. Numerical data displayed in Appendix 2, Table 1. Data source: LifeLink™ Health Plan Claims Database (January, 2005 through June, 2009)
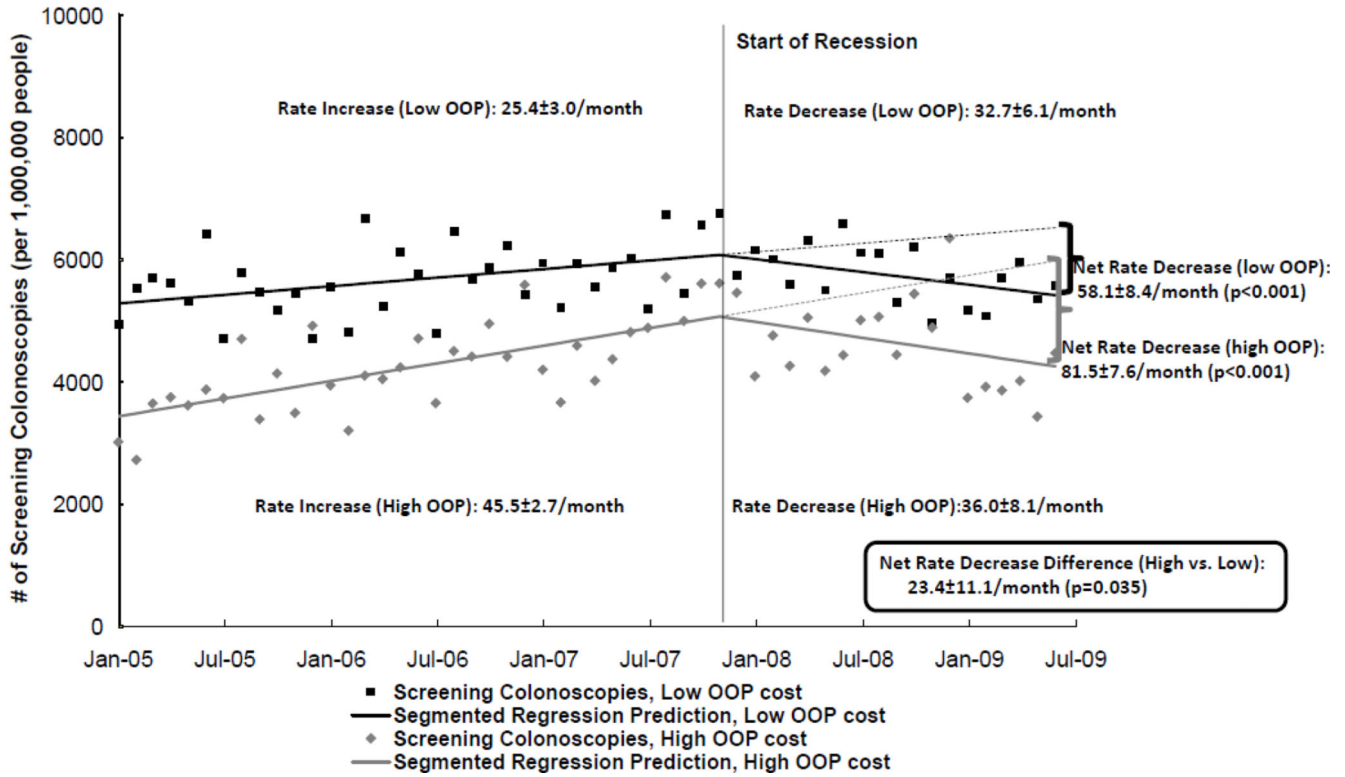
Figure 2. Screening Colonoscopy Utilization Among Insurance Beneficiaries of Plans with High (≥$300) and Low (≤$50) Out-of-pocket (OOP) Costs Before and During the Recession

Black boxes represent rates of screening colonoscopy each month and solid black line represents screening colonoscopy rates predicted by segmented regression models before and during the economic recession among members of plans with low OOP costs. Gray diamonds represent rates of screening colonoscopy each month and solid gray line represents screening colonoscopy rates predicted by segmented regression models before and during the economic recession among members of plans with high OOP costs. Broken line represents recession era rates that would have been expected based on projections of pre-recession trends. Net decrease represents the difference between these recession-era predicted rates and observed rates. P-value for test of trend change from pre-recession to recession period between plans with high OOP costs and low OOP costs. Numerical data displayed in Appendix 2, Table 2. Data source: LifeLink™ Health Plan Claims Database (January, 2005 through June, 2009)
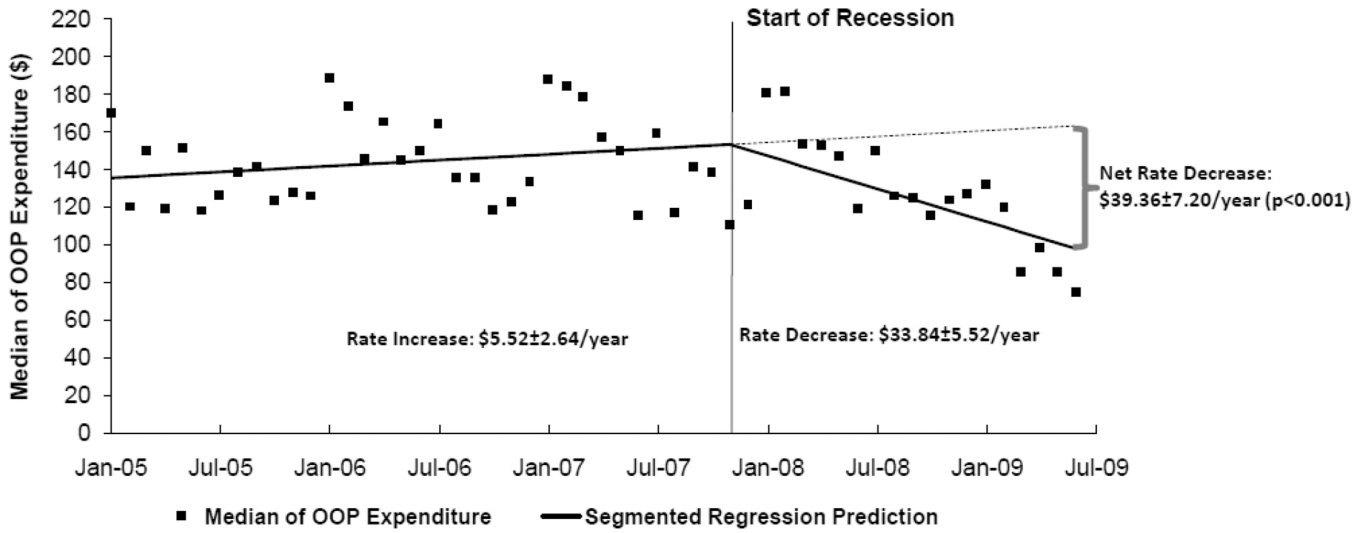
Figure 3. Median Out-of-Pocket (OOP) Costs for Screening Colonoscopy
Black boxes represent the median out-of-pocket (OOP) cost incurred for all colonoscopies performed each month. Solid lines represent median cost predicted by segmented regression models before and during the economic recession. Broken line represents what the expected recession-era OOP costs would have been based on projection of pre-recession trends. Net decrease represents the difference between median costs during the recession that would have been expected based on pre-recession trends and the median costs that were actually observed. p-value is for test of trend change between pre-recession to recession periods. Numerical data displayed in Appendix 2, Table 3.

Data source: LifeLink™ Health Plan Claims Database (January, 2005 through June, 2009)