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RESEARCH ARTICLE

State-Level Unemployment and the Utilization of Preventive Medical Services

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Objective. To study the association between macroeconomic conditions and preventive medical service utilization.

Data Sources/Study Setting. Secondary data collection of a survey of the civilian, non-institutionalized population of adults (age 18 and older) in the United States between 1987 and 2010.

Study Design. Regression analyses that adjust for individual-level demographic and socioeconomic determinants, state and time-fixed effects, and state-specific time trends.

Data Collection/Extraction Methods. State health departments, with technological and methodological assistance from the Centers for Disease Control and Prevention, conducted a cross-sectional yearly telephone survey using a standardized questionnaire.

Principal Findings. The use of preventive medical services is procyclical: a 1 percentage point increase in the state-level unemployment rate is associated with a 1.58 percent decrease in the quantity of distinct preventive care services utilized. Women and economically disadvantaged populations are shown to be especially sensitive to macroeconomic fluctuations.

Conclusions. Policy makers should be aware of cyclical changes in preventive care use, particularly among disadvantaged populations, when making challenging budgetary decisions during economic downturns. As physician recommendations can have a strong impact on patients' use, health care providers could increase efforts to persuade patients to seek screening exams and necessary vaccinations during periods of high unemployment.

Key Words. Preventive health services, unemployment, economic conditions

Preventive medical services are under-utilized in the United States: only 55 percent of adults receive recommended preventive care, and only half of individuals receive overall recommended medical care, demonstrating widespread departures in health-related behaviors from those considered to be

health-maximizing (McGlynn et al. 2003). Like other health-related behaviors, the consumption of preventive care may be sensitive to macroeconomic fluctuations (Ruhm 2000). These services directly affect health status in a health production model where a decrease in the utilization of health care leads to a decrease in health status, all else equal (Grossman 1972). Furthermore, adverse macroeconomic shocks may generate uncertainty and stress for individuals regardless of income or employment status changes, forcing a reallocation of resources (Ruhm 2000). In contrast to other health care services that are utilized in close temporal proximity to illness or injury, the effects of preventive care use on health status often lag the date of utilization by many years. Preventive care use may differ substantially from other health care use if during periods of economic hardship an individual chooses to forego preventive care because limited resources are allocated to other pressing needs. In this sense, preventive care may be comparable to behaviors with long-term health consequences such as smoking, diet, and physical activity.

Employment levels may be positively or negatively related to preventive care use. Quinn, Catalano, and Felber (2009) explain that persons who become unemployed may face barriers to obtaining preventive care, such as through the loss of health insurance. Cawley, Moriya, and Simon (2011) report that a 1 percentage point increase in the state unemployment rate between 2004 and 2010 was associated with a 1.67 percentage point decrease in the likelihood that men had health insurance. Catalano, Satariano, and Ciemins (2003) propose that individuals may be distracted from seeking routine medical or dental care during periods of economic stress due to limited energy available for activities that are not immediately pressing. This may also extend to individuals whose employment status remains unchanged. Alternatively, Ruhm (2003) explains that an increase in nonmarket time among those who become unemployed or work fewer hours decreases the time cost of health investments. If scheduling and obtaining preventive care is time intensive, these services may increase during economic downturns. Finally, the supply of preventive care may also be related to employment fluctuations. For example, Stevens et al. (2011) find evidence that employment for doctors and nurses is procyclical, while employment for less skilled aides is countercyclical.

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Employing data from the 1987–1995 waves of the Behavioral Risk Factor Surveillance System (BRFSS) annual survey, Ruhm (2000) studies the consumption of preventive medical care. His results show a negative but insignificant relationship between the unemployment rate and utilization of four sub-categories of preventive care. Accordingly, he does not consider these estimates as sufficient evidence to contradict the study's primary finding that health status changes countercyclically.

Other recent studies are mixed regarding the cyclicality of preventive medical services, in large part because of the diversity of services studied. Dehejia and Lleras-Muney (2004) examine newborn health and associated parental behaviors, showing that prenatal care use is positively related to the unemployment rate in part due to selection into motherhood but also because of improved health behaviors among mothers. The likelihood of detecting early-stage breast cancer decreases during periods of unexpectedly high unemployment (Catalano and Satariano 1998; Catalano, Satariano, and Ciemins 2003), suggesting that screening or preventive care use declines in such periods. Similarly, Quinn, Catalano, and Felber (2009) report that the use of preventive dental services declined during periods of high unemployment in the Seattle and Spokane areas, even though the studied population was dentally insured.

We hypothesize that temporary fluctuations in economic conditions lead individuals to forego or defer recommended preventive care to adapt to changing time costs and assessments of current and near-term income changes. In contrast to all previous work, we examine aggregate measures of preventive medical care utilization, describing each individual's participation and total volume of use rather than only considering individual health care services. This approach hypothesizes that individuals treat preventive services as a category of goods, due to the immediate cost but delayed benefits. To isolate demand side effects, we address the changing supply of medical services as an alternative mechanism. Indeed, if the association between unemployment and preventive medical services is driven largely by changes in demand, then individuals may forego some or all treatments whose costs are immediate but whose benefits are delayed (Laibson 1997; O'Donoghue and Rabin 1999; Baicker, Mullainathan, and Schwartzstein 2012). Furthermore, this aggregated approach to preventive care may also be of interest to policy makers if their primary concern is about whether current investment in future health is affected overall during periods of economic distress. In contrast to earlier work (Ruhm 2000), we demonstrate strong evidence that the use of preventive care is procyclical.

METHODS

Data Sample

Individual-level data are drawn from the 1987–2010 responses to the BRFSS survey. The BRFSS is a telephone survey of the civilian, noninstitutionalized population conducted by the U.S. Centers for Disease Control and Prevention (CDC 1987–2010) to produce data on preventive health services and risky behaviors among adults 18 years or older in the United States (Centers for Disease Control and Prevention [CDC] 2006).

This study focuses on the utilization of seven services: mammograms, Pap tests, colorectal cancer (CRC) scope exams, prostate-specific antigen (PSA) tests, digital rectal exams, annual checkups, and seasonal influenza vaccinations. Although questions about other preventive medical services are asked of BRFSS respondents, those studied here are recommended to be utilized more than once in a lifetime (see online appendix table S1 for more details). Questions on the same topic are comparable across all years. Because the use of many services is age- and gender-specific, BRFSS does not survey every respondent. Rather, questions are usually asked of individuals for whom the procedure is generally recommended in normal risk cases, and we exclude from our sample individuals for whom the procedure would not be recommended. For example, only men over the age of 50 are recommended to have PSA tests; we exclude men younger than 50 for this procedure to avoid omitted variable bias due to characteristics such as poor health status or a family history of disease. In these cases, individuals may be less sensitive to fluctuations in macroeconomic conditions.

We use two measures to represent the aggregated use of preventive health services. The first is a variable measuring participation: a dichotomous indicator of whether the respondent reported using any of the listed services in the 12 months prior to the interview date. The second variable measures the number of unique preventive services used. If respondents consider preventive services to be substitutes for one another in the overall production of future health, then it is important to consider how the overall quantity of services fluctuates. Implicit in this construction of the second variable is the assumption that each type of preventive service is considered by the respondent to be equally important in producing health. This measure also assumes that with respect to economic conditions, respondents change their utilization rate proportionally for all services regardless of the recommended frequency for each service.

This two-part representation measures both the choice of whether to utilize preventive medicine and the level of use. Furthermore, these measures provide an overall description of the activity of preventive health care use despite variation of use across specific types of preventive care. As the aggregate measures change systematically over time (BRFSS asks about only some of the services in earlier survey years), we include a rich set of interactions in the empirical models to account for mean differences across years in the dependent variables; this empirical approach is discussed in greater detail below.

The 1987–2010 waves of BRFSS provide data on 5,056,289 interviews. After dropping observations with missing demographic information, we report descriptive statistics for the remaining 4,777,455 observations in Table 1. The sample is roughly 48 percent male and 82 percent white, with over 25 percent of respondents having completed college and more than half of the sample married. Use varies by service, with 69 percent of individuals

Table 1: Descriptive Statistics, 1987–2010 BRFSS

	Mean	*SD*	*Obs*
Age	45.09	17.55	4,777,455
Male	0.48	—	4,777,455
Race/ethnicity			
White	0.82	—	4,777,455
Black	0.10	—	4,777,455
Hispanic	0.11	—	4,777,455
Education			
High school grad	0.31	—	4,777,455
Some college	0.27	—	4,777,455
College grad	0.28	—	4,777,455
Marital status			
Married	0.60	—	4,777,455
Preventive medical care in last 12 months			
Mammogram	0.56	—	1,392,985
Pap test	0.64	—	1,920,173
CRC scope exam	0.16	—	1,057,597
PSA test	0.42	—	457,273
Digital rectal exam	0.46	—	464,735
Annual checkup	0.69	—	3,826,897
Seasonal flu vaccine	0.31	—	3,955,278
Any preventive service	0.71	—	4,777,455
Number of distinct preventive services used	1.24	1.18	4,777,455

Note. Sample means are reported using BRFSS sample weights.
Source: BRFSS, 1987–2010.

having a yearly checkup but only 16 percent having a CRC scope exam in the year prior to their interview. The average use of any preventive medical service is 71 percent, with respondents obtaining a mean of 1.24 distinct types of services in the past year.

Our empirical strategy is first to study the *total* business cycle effects of changes in economic conditions while initially controlling only for exogenous characteristics that are less likely to change due to the business cycle. Later, we explore other potential mechanisms by restricting attention to subgroups according to employment status, income, health insurance, and health status.

The key independent variables in this study are measures of macroeconomic conditions reflecting aggregate state-level unemployment and income: the state unemployment rate and real state-level annual per capita income. Monthly, state-level unadjusted unemployment rates are drawn from the US Bureau of Labor Statistics (BLS) Local Area Unemployment Statistics (LAUS 1987–2010). Individuals are matched with their state average monthly unemployment rate in the 12 months prior to interview, as preventive care recommendations are usually not more frequent than every 12 months. Individuals are also matched with state-level annual per capita income from the year of interview, which is provided by the Bureau of Economic Analysis (BEA 1987–2010). Income is measured in thousands of 2010 USD, deflated by the unadjusted Consumer Price Index (CPI 1987–2010), also provided by the BLS.

Empirical Framework

The empirical model is:

$$H_{ismt} = \beta_X X_{ismt} + \beta_U U_{smt} + \beta_M M_{st} + \gamma_s + \lambda_m + v_t + \gamma_s * t + AgeGroup_i * YearGroup_t * Male_i + \epsilon_{ismt}$$

where H_{ismt} is the measure of preventive health services utilized by individual i in state s who was interviewed in month m of year t. The vector X_{ismt} is a set of demographic controls, including age, age squared, gender, ethnicity, education level, and marital status. The term U_{smt} is the average unemployment rate in the respondent's state s in the 12 months leading up the month m and year t, and M_{st} is the real per capita income in the individual's state s in year t. The fixed effects γ_s, δ_m, and v_t account for unobserved determinants of consumption of preventive medical services at the state, month, and year level. Also included are linear state-specific time trends, denoted $\gamma_s{*}t$, which accounts for unobserved trends that vary by state.

We include a set of interactions that accounts for mean differences across groups that are asked varying sets of questions about preventive medical services depending on their age, year of interview, and sex. In the model specification this is denoted by an interaction of AgeGroup_i (a categorical variable consisting of age ranges such that within each range, the set of preventive service questions does not vary by age), YearGroup_t (a categorical variable consisting of year ranges such that within each range, the set of preventive services questions does not vary by survey year), and Male_i (an indicator variable denoting whether the respondent is male). The AgeGroup categories are 18–39, 40–49, 50–74, and 75+ years old. This stratification is based on information from the US Preventive Services Task Force ([USPSTF] 2010), which makes recommendations to clinicians and payors on age guidelines for preventive services. Among the studied services, age guidelines included 18 and older (e.g., Pap test), 40 and older (e.g., mammogram), and 50-75 years (e.g., colonoscopy). YearGroup is based on the differences in BRFSS questionnaires from year to year, which changes the possible maximum number of preventive services. Finally, the binary variable *Male* was included to reflect differences in recommendations across gender, which would also affect the maximum number of preventive services available. For example, in 1988–1996 all persons were asked about digital rectal exam use, but from 2001 to 2010 only males were given this question.

An illustrative example for why these interactions are included is as follows. Female and male respondents in 1987 would be able to report a different *total possible* number of preventive services used in part due to the fact that men are not eligible for mammograms. Also, women who are younger than 40 are not recommended to receive a mammogram and are therefore not asked about mammograms, again creating a difference in total possible preventive services. Women interviewed in 1988 asked about mammograms would also vary in their total possible responses from women of the same age in 1987 because women were not asked about Pap tests until 1988. The complete set of interactions of all four distinct age categories, seven distinct year categories, and the male indicator variable accounts for differences in the total possible number of services for each respondent (and in an analogous manner the mean differences in the probability of using any service).

For specifications measuring the binary participation measure of preventive services, a least-squares linear probability model is employed. Linear probability models do not specifically account for the dichotomous structure of the dependent variable, but this is mitigated in the present analysis by the very large sample size and robust regression controls (Aldrich and Nelson

1984). For estimates involving the aggregate count variable, an ordinary least-squares (OLS) model is employed. As robustness checks, we also conduct the estimation using a probit model for binary measures and an ordered probit model for aggregate measures of services, and find that the results are very similar, and in fact somewhat strengthened, when compared to those estimated using the linear probability model (results are available upon request). All reported standard errors are heteroskedasticity-robust and clustered by state (Bertrand, Duflo, and Mullainathan 2004).

RESULTS

Full, Working Age, and 65 or Older Samples

A rising unemployment rate likely affects individuals through increased stress, decreased income, and decreased time cost of investment in health-related behaviors. Individuals in the labor force may be particularly sensitive to fluctuations in the unemployment rate. As such, pre-retirement age adults may exhibit greater changes in health care utilization behavior. Furthermore, all individuals over the age of 65 are eligible for Medicare, which offered partial coverage for preventive screenings during the sample period. If the elderly face only a small portion of the cost of such medical care, they may be less likely to modify their consumption during periods of macroeconomic fluctuation.

Table 2 reports results estimating the association between the average state unemployment rate in the 12 months prior to interview, along with the number of and probability of using any preventive medical services for the full, working age, and 65 and older samples. The models include the demographic characteristics and fixed effects discussed above. Overall, the results demonstrate a negative relationship between the unemployment rate and the use of preventive medical care after controlling for state per capita personal income. The main results are qualitatively similar when state per capita personal income is excluded from the regression models (results are available upon request).

Specifications using the number of distinct preventive services as the dependent variable indicate that a 1 percentage point increase in the unemployment rate is associated with a decrease of 0.0196 distinct preventive services utilized. This represents a 1.58 percent decrease from the mean for the full sample. The decrease is slightly larger (0.0200) for the working age sample and slightly smaller (0.0185) for the 65 and older sample, providing some

Table 2: Determinants of Preventive Medical Service Use: Full, Working Age, and 65 or Older Samples

	Full Sample		*Working Age Sample*		*65 and Older Sample*	
	Any	*Volume*	*Any*	*Volume*	*Any*	*Volume*
State unemployment rate (12 mo. lagged avg)	−0.0017 (0.0015)	−0.0196 (0.0080)**	−0.0027 (0.0018)	−0.0200 (0.0080)**	0.0017 (0.0008)*	−0.0185 (0.0087)**
State per capita personal income, 1000's (2010 $)	−0.0005 (0.0025)	−0.0029 (0.0079)	−0.0007 (0.0029)	−0.0027 (0.0076)	0.0011 (0.0015)	−0.0023 (0.0094)
Age	−0.0086 (0.0003)***	−0.0136 (0.0007)***	−0.0168 (0.0004)***	−0.0422 (0.0008)***	0.0379 (0.0010)***	0.1560 (0.0050)***
Age squared	0.0001 (0.0000)***	0.0002 (0.0000)***	0.0002 (0.0000)***	0.0006 (0.0000)***	−0.0002 (0.0000)***	−0.0011 (0.0000)***
Male	−0.0117 (0.0011)***	−0.3705 (0.0204)***	−0.0717 (0.0024)***	−0.3140 (0.0219)***	−0.0122 (0.0010)***	−0.4035 (0.0209)***
White	−0.0142 (0.0037)***	−0.0086 (0.0121)	−0.0181 (0.0038)***	−0.0179 (0.0103)*	0.0045 (0.0054)	0.0374 (0.0315)
Black	0.0537 (0.0041)***	0.1117 (0.0125)***	0.0643 (0.0043)***	0.1346 (0.0108)***	0.0134 (0.0059)**	0.0307 (0.0310)
Hispanic	0.0110 (0.0041)**	0.0296 (0.0122)**	0.0147 (0.0041)***	0.0345 (0.0110)***	0.0036 (0.0028)	0.0125 (0.0168)
High school grad	0.0244 (0.0019)***	0.1138 (0.0065)***	0.0288 (0.0024)***	0.1025 (0.0072)***	0.0192 (0.0012)***	0.1263 (0.0054)***
Some college	0.0450 (0.0025)***	0.1800 (0.0081)***	0.0555 (0.0031)***	0.1783 (0.0088)***	0.0282 (0.0016)***	0.1905 (0.0071)***
College grad	0.0726 (0.0037)***	0.2797 (0.0108)***	0.0884 (0.0046)***	0.2884 (0.0123)***	0.0414 (0.0018)***	0.2832 (0.0082)***
Married	0.0385 (0.0014)***	0.1240 (0.0036)***	0.0424 (0.0016)***	0.1171 (0.0037)***	0.0294 (0.0012)***	0.1516 (0.0035)***
Observations	4,777,455	4,777,455	3,599,697	3,599,697	1,177,758	1,177,758
R-squared	0.166	0.322	0.152	0.316	0.044	0.241

Note. Each column represents a separate regression. Coefficients are estimated using heteroskedasticity-robust standard errors, clustered by state. The regressions also include state, month, and year fixed effects; state-specific time trends; and a complete set of interactions between age, sex, and year categories corresponding to question categories in BRFSS.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$.

evidence that working-age individuals are more responsive to macroeconomic changes. Specifications measuring participation as the dependent variable fail to reach statistical significance except for the 65 and older sample where there is a *positive* association between the unemployment rate and the likelihood of preventive medical service use. Although this result is arguably inconsistent, we later show that it is uniquely not robust to the inclusion of controls for measures of health care industry employment.

The signs of the other coefficient estimates are broadly consistent with previous research on the relationship between demographic characteristics and preventive care utilization. In a survey of large metropolitan areas, Asch et al. (2006) find that the logistic regression adjusted percent of respondents receiving recommended preventive care was lower for women than men, lower for whites than for either blacks or Hispanics, lower for both ages 31–64 or 65+ than for 18–30, and lower for respondents who did not complete high school.

Demographic Subgroups

Table 3 reports coefficient estimates from regressions separately estimated using sample subgroups according to sex, race/ethnicity, marital status, and educational achievement. (Although personal per capita income is included as a control variable in every preventive care utilization regression, we do not continue to report its coefficients because they are never statistically significant.) They are similar to the results for the full sample, but there are important differences among subgroups. In particular, they indicate that the aggregate effects appear to be driven by fluctuations in the propensity of obtaining preventive medical services among women. For women, a 1 percentage point increase in the unemployment rate is associated with a decrease of 0.0327 distinct preventive services utilized. This represents a 1.96 percent decrease from the mean for this group. Women are also significantly less likely to obtain any preventive medical services as the unemployment rate increases: the likelihood decreases by 0.3 percentage points for each percentage point increase in the unemployment rate. Asch et al. (2006) report that females were 7.7 percentage points more likely than men to receive recommended preventive care between October 1998 and August 2000. As the unemployment rate was generally low during that period, ranging between only 3.8 and 4.7 percent, we can infer that during periods of higher unemployment women would obtain preventive care at a lower rate, closer to that of men.

Table 3: Determinants of Preventive Medical Service Use: Demographic Subgroups

	Sex				*Race*					
	Male		*Female*		*White*		*Black*		*Hispanic*	
	Any	*Volume*	*Any*	*Volume*	*Any*	*Volume*	*Any*	*Volume*	*Any*	*Volume*
State unemployment rate (12 mo. lagged avg)	0.0002 (0.0017)	0.0006 (0.0047)	−0.0030 (0.0018)*	−0.0327 (0.0127)**	−0.0016 (0.0015)	−0.0198 (0.0085)**	−0.0064 (0.0024)**	−0.0318 (0.0098)***	−0.0022 (0.0021)	−0.0193 (0.0080)**
Observations	1,879,340	1,879,340	2,898,115	2,898,115	4,076,511	4,076,511	397,598	397,598	274,958	274,958
R-squared	0.177	0.334	0.112	0.265	0.167	0.324	0.165	0.324	0.168	0.315
	Marital Status				*Education*					
	Married		*Single*		*HS Grad*		*Some College*		*College Grad*	
	Any	*Volume*	*Any*	*Volume*	*Any*	*Volume*	*Any*	*Volume*	*Any*	*Volume*
State unemployment rate (12 mo. lagged avg)	−0.0018 (0.0016)	−0.0193 (0.0083)**	−0.0015 (0.0015)	−0.0191 (0.0078)**	−0.0025 (0.0016)	−0.0212 (0.0084)**	−0.0034 (0.0015)**	−0.0228 (0.0078)***	−0.0006 (0.0016)	−0.0182 (0.0079)**
Observations	2,649,838	2,649,838	2,127,617	2,127,617	1,499,935	1,499,935	1,280,749	1,280,749	1,458,516	1,458,516
R-squared	0.162	0.338	0.173	0.305	0.171	0.313	0.162	0.322	0.169	0.355

Note. Each column in each panel represents a separate regression. Coefficients are estimated using heteroskedasticity-robust standard errors, clustered by state. The regressions also include real state per capita income and demographic characteristics; state, month, and year fixed effects; state-specific time trends; and a complete set of interactions between age, sex, and year categories corresponding to question categories in BRFSS.

Turning to the remaining stratifications in Table 3, the response in seeking preventive medical services appears not to depend on marital status. Black respondents exhibit a larger (in absolute value) negative response to a higher unemployment rate than either white or Hispanic respondents, and their likelihood of obtaining any treatment decreases by more than twice the decline for women. College graduates exhibit the weakest response relative to respondents with high school diplomas or some college experience. Although the reason that the decline is so pronounced for black respondents is unclear, the fact that respondents with a college education exhibit the weakest decline foreshadows the next set of regression results, which consider differences across subgroups according to economic circumstances.

Results by Employment, Income, Health Insurance, and Health Status

Contrary to the previous results, if economic contractions were to have a positive effect on the utilization of preventive services due to a reduced price of leisure, it would likely be observed among individuals engaged in the labor market through employment. A change in the unemployment rate would not change the time price for unemployed individuals, so the overall effect would no longer be observed in this population. Conversely, if procyclicality is maintained for both groups, stress caused by economic downturns is likely an important mechanism for this pattern across all individuals (Dee 2001).

The coefficient estimates across subgroups according to employment status, level of annual household income, health insurance, and health status reported in Table 4 do not support the hypothesis that a changing time price plays an important role. Instead, the results are broadly consistent with real price and income effects. The decline in preventive service use is greater for the unemployed, for lower income households (defined by a threshold of $35,000 in 2010), and for the uninsured. Changes in the use of preventive medical services do not vary by self-reported health status when responses are classified as either "Good/Fair/Poor" or "Excellent/Very Good." In whole, these results suggest that higher unemployment increases financial stress across all groups, but disproportionately more among those who are economically disadvantaged, leading to an elevated decline in their use of preventive care. Uninsured respondents may reduce medical service use by more than insured respondents even if their incomes decline similarly during an economic downturn, because the uninsured are more likely to pay the full price of medical care. Additionally, changes in the unemployment rate may be accompanied by greater stress for lower income households, in that a reduction in

Table 4: Determinants of Preventive Medical Service Use: Employment, Income, Health Insurance, and Health Status Subgroups

	Employment Status			
	Employed		*Unemployed*	
	Any	*Volume*	*Any*	*Volume*
State unemployment rate (12 mo. lagged avg)	−0.0018 (0.0019)	−0.0173 (0.0076)**	−0.0012 (0.0011)	−0.0213 (0.0087)**
Observations	2,732,352	2,732,352	2,033,490	2,033,490
R-squared	0.160	0.330	0.133	0.283
	Household Income			
	≤ $35k		*> $35k*	
	Any	*Volume*	*Any*	*Volume*
State unemployment rate (12 mo. lagged avg)	−0.0041 (0.0016)**	−0.0248 (0.0088)***	−0.0019 (0.0017)	−0.0218 (0.0101)**
Observations	1,132,548	1,132,548	2,552,494	2,552,494
R-squared	0.168	0.273	0.183	0.352
	Health Insurance Status			
	Uninsured		*Insured*	
	Any	*Volume*	*Any*	*Volume*
State unemployment rate (12 mo. lagged avg)	−0.0057 (0.0021)**	−0.0176 (0.0071)**	−0.0002 (0.0015)	−0.0151 (0.0090)*
Observations	530,542	530,542	3,984,572	3,984,572
R-squared	0.128	0.194	0.168	0.328
	Self-Reported Health Status			
	Good/Fair/Poor		*Excellent/Very Good*	
	Any	*Volume*	*Any*	*Volume*
State unemployment rate (12 mo. lagged avg)	−0.0021 (0.0013)	−0.0212 (0.0090)**	−0.0023 (0.0019)	−0.0212 (0.0099)**
Observations	2,032,432	2,032,432	2,297,315	2,297,315
R-squared	0.176	0.307	0.171	0.332

Note. Each column represents a separate regression. Coefficients are estimated using heteroskedasticity-robust standard errors, clustered by state. The regressions also include real state per capita income and demographic characteristics; state, month, and year fixed effects; state-specific time trends; and a complete set of interactions between age, sex, and year categories corresponding to question categories in BRFSS.

income or job loss for those households may place a greater strain on their ability to pay for services.

An alternative approach to exploring total effects in subgroup analysis is to estimate the marginal effects of the unemployment rate after controlling for all potential confounders, including employment, income, insurance, and health status. Results from re-estimating the regressions in Table 2 when including these controls are reported in the online appendix table S2 (the unemployment rate coefficients are similar and are generally slightly larger in absolute value).

Preventive Care Use Conditional on an Annual Checkup

It is possible that the reduction in preventive care use is in part due to a reduction in annual checkups, which may reflect decreased contact with primary care physicians during periods of high unemployment. To explore this hypothesis, we investigated whether individuals decrease utilization volume even if they maintain physician attachment by estimating the same volume models as in Table 2 but restricting the sample to only those persons who had an annual checkup in the last 12 months, separated by sex (regression results available upon request). The working age (female) sample still shows the largest response in absolute value to a change in the unemployment rate. Although men do not exhibit a change in preventive care use conditional on an annual checkup, the coefficient for the full sample of women is approximately 50 percent greater than the unconditional estimate presented in Table 3. Taken together, these results imply that men reduce the quantity of annual checkups during periods of high unemployment while women decrease the utilization of follow-up preventive care.

Controlling for the Supply of Medical Services

In this section, we incorporate measures of health care supply to test the robustness of our earlier estimates and more clearly isolate the behavioral responses of consumers. We draw state-by-month counts of employment in the health care industry from the Current Employment Statistics (CES) survey provided by BLS (1990–2011) from 1990 to 2010 (the data used below are not available prior to 1990). CES categorizes employment using the Standard Industrial Classification (SIC) and, more recently, the North American Industry Classification System (NAICS). To measure employment in the health care industry, we separately count employment in the major sub-categories of

health care services within the top-level category Health Care and Social Assistance (NAICS code 62): Ambulatory Health Care Services (621), Hospitals (622), and Nursing and Residential Care Facilities (623). Although these sub-categories are relatively broadly defined, restricting further to smaller sub-categories substantially reduces coverage across the time period and states.

We first investigated whether health care employment fluctuates with the state unemployment rate to explore whether it is a potential channel through which the unemployment rate is associated with preventive medical services (regression results available upon request). Overall health care employment varies procyclically, such that a 1 percentage point increase in the unemployment rate is associated with a reduction in average state health care employment by 760 jobs (from a mean of 283,271). Focusing separately on the subcategories, ambulatory services and hospitals show no significant change in employment as the unemployment rate increases, but employment in nursing and residential care facilities significantly declines by 299 jobs when the unemployment rate increases by 1 percentage point. Therefore, part of the observed decline in obtained preventive medical services could be related to a decline in the available supply. Interestingly, the procyclical variation in nursing and residential care facilities employment stands in contrast to estimates by Stevens et al. (2011) that show staffing in skilled nursing facilities moves countercyclically. They also study the cyclicality of employment among skilled versus unskilled health care workers, however, and find that the former exhibit procyclical fluctuations while the latter show countercyclical fluctuations (skilled nursing facilities paradoxically employ a relatively high proportion of less skilled health care workers, such as nursing aides). As preventive medical service delivery involves health care workers from many skill levels, we view overall employment counts as an approximation of the supply of preventive health care services.

Table 5 includes results from the regressions reported in Table 2 with controls for health care employment added. The coefficients on controls for ambulatory workers and hospitals are intuitive as preventive services are usually provided in an ambulatory care setting but not hospitals. The negative association between nursing home workers and preventive care use is perhaps surprising. However, Asch et al. (2006) report that older respondents (age 65 or older) were less likely to receive recommended care, so if a larger number of nursing home workers is associated with an older population and lower

Table 5: Determinants of Preventive Medical Service Use, Controlling for Health Care Industry Employment

	Full Sample		*Working Age Sample*		*65 and Older Sample*	
	Any	*Volume*	*Any*	*Volume*	*Any*	*Volume*
State unemployment rate (12 mo. lagged avg)	−0.0025 (0.0017)	−0.0244 (0.0104)**	−0.0034 (0.0020)	−0.0245 (0.0105)**	0.0009 (0.0013)	−0.0236 (0.0105)**
Ambulatory workers (1,000s)	0.0019 (0.0006)***	0.0059 (0.0024)**	0.0022 (0.0007)***	0.0057 (0.0024)**	0.0010 (0.0004)**	0.0068 (0.0025)**
Hospital workers (1,000s)	0.0002 (0.0008)	0.0011 (0.0028)	0.0002 (0.0009)	0.0013 (0.0027)	−0.0000 (0.0004)	0.0000 (0.0032)
Nursing home workers (1,000s)	−0.0033 (0.0011)***	−0.0070 (0.0039)*	−0.0035 (0.0013)**	−0.0057 (0.0037)	−0.0022 (0.0008)**	−0.0102** (0.0045)
Observations	2,669,833	2,669,833	1,989,791	1,989,791	680,042	680,042
R-squared	0.175	0.329	0.162	0.324	0.048	0.244

Note. Each column represents a separate regression. Coefficients are estimated using heteroskedasticity-robust standard errors, clustered by state. The regressions also include real state per capita income and demographic characteristics; state, month, and year fixed effects; state-specific time trends; and a complete set of interactions between age, sex, and year categories corresponding to question categories in BRFSS.

quality of available preventive care services, then the negative association may be interpreted as an indication of lower supply.

When including controls for health care employment, the negative association between the unemployment rate and preventive medical services use strengthens relative to the coefficients reported in Table 2. Additionally, the previously unexplained positive and significant coefficient for the 65 and older sample is no longer significant. Truly separating changes in the demand for preventive care from its supply would require an exogenous source of variation in supply, but we take the results in Table 5 as providing supportive evidence that changes in preventive care use during economic downturns are indeed driven by changes in demand.

DISCUSSION

We find that an increase in the unemployment rate is associated with a significant decline in the use of preventive medical care. Especially in volume of use, economic downturns are linked to lower consumption of services. This effect is stronger for individuals who are of working age and appears to be driven in the aggregate by women. Men reduced their number of annual checkups during periods of high unemployment while women reduced preventive care other than checkups. Economically disadvantaged populations are also shown to be disproportionately sensitive to macroeconomic fluctuations.

Preventive medical care is distinct in important ways from other health-related behaviors with long-term consequences, such as smoking, diet, and physical activity. Preventive care can carry a relatively high one-time cost, so fluctuations in temporary or perceived permanent income may have a greater effect on the use of preventive services. Preventive services also require a smaller time investment than some other health-related behaviors such as physical activity, so higher time costs during economic expansions may only be a secondary consideration. Furthermore, within the realm of health care, preventive services may be considered by some to be a luxury or elective procedure relative to acute care services.

The procyclical fluctuation of preventive medical care has significant policy and public health implications. Because preventive care is already under-utilized, policy makers should be aware of any additional decrease in use during recessions. Such declines are harmful to public health insofar as less disease will be averted; this may also lead to long-term increases in aggregate health care expenditures. If time costs of preventive care are less important

and its high cost is the primary deterrent to use, lawmakers should account for the overall fiscal impacts of preventive medical service use and may consider implementing legislation to further facilitate or subsidize its utilization. Such policies could be especially vital during economic downturns.

The Patient Protection and Affordable Care Act of 2010 (ACA) includes several provisions to this end. All new private health insurance policies initiated after September 2010 are required to cover certain preventive health measures without copayment; likewise, Medicare enrollees have been covered for the same services without charge since January 2011 (Koh and Sebelius 2010). However, the ACA does not guarantee cost-free coverage of preventive medical care for Medicaid beneficiaries (Koh and Sebelius 2010; US Congress 2010). Unemployed individuals and low-income households are especially sensitive to periods of high unemployment with respect to obtaining preventive medical care; these groups are also more likely to be covered by Medicaid (Holahan and Garrett 2001). During periods of high unemployment, an increase in Medicaid beneficiaries could strain state budgets, leading to short-term disincentives in the coverage of preventive medicine.

Health care providers should also be aware of the procyclicality of preventive care. Numerous studies of cancer screening utilization show that physician recommendations have a strong positive impact on patients' use of such care (Fox, Murata, and Stein 1991; Brawarsky et al. 2004). Armed with an understanding of health care–seeking behavior across periods of macroeconomic fluctuation, physicians could accordingly increase efforts to persuade patients to seek screening exams and necessary vaccinations. Such work by health care providers might offset some of the decline in the use of recommended preventive care.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.

Table S1: BRFSS Questions.

Table S2: Determinants of Preventive Medical Service Use, Full and Working Age Samples, Including Additional Controls.