

# Intermittent Lack of Health Insurance Coverage and Use of Preventive Services

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Many studies have documented the efficacy of preventive health service use (e.g., cholesterol screenings, mammograms, Papanicolaou (Pap) tests) in reducing morbidity and mortality.<sup>1</sup> For example, according to Kiefe et al., “convincing scientific evidence shows that screening for either breast cancer or cervical cancer in appropriate age groups reduces mortality by 20% to 60%, depending on the condition and baseline risk level of the group being screened.”<sup>2(p357)</sup> Uninsured adults are less likely than those with insurance to use preventive services than are those who are insured.<sup>3–5</sup> The access barriers posed by lack of insurance coverage are especially significant for older adults, who have, in addition to preventive services needs similar to those of younger persons, a greater burden of chronic disease.

Most studies of the uninsured population have focused on individuals who lack insurance coverage at the time they are interviewed or who have been uninsured for all of the previous year. In fact, health insurance coverage is quite dynamic, with many people being uninsured for substantial portions of a year or intermittently uninsured over several years.<sup>6–9</sup> Recent studies have shown that among individuals who lack health insurance coverage for even relatively short periods of time, there is a significantly increased likelihood of delays in seeking recommended follow-up care,<sup>10</sup> care for chronic conditions, and clinically indicated preventive services.<sup>11</sup> Health insurance status can change frequently within a given year and over a period of several years; thus, most figures may substantially underestimate the pool of individuals who are potentially vulnerable to the effects of noncoverage.<sup>8,9,11–13</sup>

We recently reported that being continuously or intermittently uninsured increases the likelihood of adverse health outcomes among the near-elderly population.<sup>14</sup> To examine possible mechanisms in the causal

**Objectives.** This study examined the association between intermittent lack of health insurance coverage and use of preventive health services.

**Methods.** Analyses focused on longitudinal data on insurance status and preventive service use among a national sample of US adults who participated in the Health and Retirement Study.

**Results.** Findings showed that, among individuals who obtain insurance coverage after histories of intermittent coverage, relatively long periods may be necessary to reestablish clinically appropriate care patterns. Increasing periods of noncoverage led to successively lower rates of use of most preventive services.

**Conclusions.** Intermittent lack of insurance coverage—even across a relatively long period—results in less use of preventive services. Studies that examine only current insurance status may underestimate the population at risk from being uninsured. (*Am J Public Health.* 2003;93:130–137)

pathway between insurance status and health outcomes, we undertook an analysis of the relationship between lack of health insurance coverage and use of preventive services. In contrast to previous studies, we used longitudinal data, available in the national Health and Retirement Study (HRS), to focus on how 2 different measures of insurance status—insurance status in 1994 and 1996 and episodes of noncoverage during 1992 through 1996—predicted use of preventive services among older adults over a 2-year reference period. These 2 insurance status measures allowed us to answer the following questions: (1) How does loss or acquisition of insurance affect the use of preventive services? and (2) Do multiple episodes of noncoverage increase the risk of underuse of preventive services?

## METHODS

### Study Population and Statistical Analysis

We used data from 3 waves (1992, 1994, 1996) of the HRS, a nationally representative survey of 9824 respondents aged 51 to 61 years at the time of their 1992 interview. After elimination of 1138 persons lost to follow-up (11.6%) and 377 persons who had died during the study period (3.8%), 8309

individuals were available who had completed all 3 waves of data collection. After further elimination of 343 proxy interviews, 607 individuals who did not respond to cognition items, and 59 persons who were missing responses on other variables (income and insurance), 7300 complete records were available for this analysis. Complete details on the HRS are available elsewhere.<sup>15</sup>

In all analyses, we used the survey subroutines available in Stata 7.0 (Stata Corp, College Station, Tex) to account for sample weighting and to adjust variances for the complex survey design of the HRS. Descriptive statistics presented here include frequency distributions for all of the study variables and cross tabulations of preventive service use by each of the various insurance status measures. Cross-tabulation significance levels were based on second-order corrected Pearson  $\chi^2$  statistics for categorical variables.<sup>16,17</sup>

Multivariate logistic regression models were constructed via the Stata (version 7.0) “svylogit” procedure. This logistic regression subroutine simultaneously applies analytic weights (i.e., adjustments for probability of selection into the sample and for differential response rates, and poststratification adjustments to Bureau of the Census population estimates for age, race/ethnicity, and geographic location) and adjusts variances for complex

survey sampling designs. A *P* value of .05 was used to define statistical significance.

Because the outcomes of interest (use of various types of preventive services) were common in this study, reliance on odds ratios (ORs) would exaggerate the true relative risk. We corrected for this effect by converting adjusted odd ratios to “corrected relative risks,” using the following formula provided by Zhang and Yu<sup>18</sup>: corrected relative risk =  $OR / (1 - P_o) + (P_o \times OR)$ , where OR is the adjusted odds ratio obtained from the exponentiated logistic regression coefficients and  $P_o$  is the prevalence of the outcome of interest for the referent category, expressed as a proportion.

### Outcome Measures

All of the outcome measures included in this study were assessed at the 1996 interview (wave 3) and were based on self-reports. The preventive service use section of the questionnaire begins as follows: “In the last two years, have you had any of the following medical tests or procedures?” We refer to this 2-year time period preceding the 1996 interview as the “reference period.” Subsequent questions ask about specific procedures and tests obtained during the reference period, such as flu shots and cholesterol blood tests. Also, female respondents are asked whether they check their breasts for lumps monthly, as well as whether they have had a Pap test or a mammogram or x-ray of the breast to search for cancer in the previous 2 years. Male respondents are asked whether they have had a prostate examination to screen for cancer.

Responses to these items were coded as 0 (no) or 1 (yes). We refer to our outcome variables as (1) mammography, (2) Pap test, (3) cholesterol test, (4) influenza vaccination, (5) prostate examination, and (6) breast self-examination. Because it is unlikely that lack of insurance coverage poses any constraint or barrier per se on breast self-examination, in that access to a provider is not necessary to engage in this preventive health behavior, we included this outcome variable as a source of “internal control,” thereby providing a test of the validity of the findings.

### Insurance Status

First, we determined each respondent's insurance status at the 1992, 1994, and 1996

interviews. On the basis of self-reports, we categorized individuals as *privately insured* (individually purchased or employment-based coverage), *publicly insured* (coverage via Medicaid, Medicare, veterans', CHAMPUS [Civilian Health and Medical Program of the Uniformed Services], or other government insurance), or *uninsured* (no health insurance of any kind or only catastrophic coverage). In several analyses not described here, there was little difference in the use of preventive services between privately insured and publicly insured individuals (in fact, publicly insured individuals were *more* likely than privately insured individuals to use some of the preventive services examined). Therefore, we combined privately and publicly insured individuals into a single “insured” category for all analyses conducted in this study.

Next, we categorized respondents according to their insurance status at the beginning and end of the reference period (1994 and 1996): insured at both interviews, lost insurance between 1994 and 1996, obtained insurance between 1994 and 1996, or uninsured at both interviews (note that persons with either private or public insurance coverage at the time of the interview were classified as insured). We hypothesized that, in our analyses, the group of individuals who lost insurance during the reference period would exhibit less use of preventive services than the group that obtained insurance.

Finally, we categorized respondents according to the number of times (0 [referent], 1, 2, or 3) they were uninsured at each of the 3 interviews (1992, 1994, and 1996). Again, those with either public or private insurance coverage at the time of the interview were categorized as being insured. Initially, we conducted several analyses with the categorical variable of all possible insurance “states” over the 3 interviews (insured/insured/uninsured, insured/uninsured/insured, etc.). However, there were too few individuals in some of the categories to provide sufficient power for stable and accurate estimates. Thus, we used number of episodes of noncoverage in our final classification. This final classification allowed us to determine whether the risk pool of individuals underusing preventive services is, in fact, larger when intermittent insurance status

over a relatively long time period is taken into account and whether number of episodes of noncoverage has a “dose–response” effect on service use.

### Sociodemographic Characteristics, Health Behaviors, and Health Status Measures

We selected variables a priori according to the categories of predisposing, enabling, and need-related characteristics of Andersen's behavioral model of health service use and included them in all of our multivariate models.<sup>19–21</sup> We also included several “unique” measures in our analysis to better control for the effects of socioeconomic status and educational attainment. For example, we included *net worth* because we wanted to complement the use of total family income adjusted for family size with another measure of wealth, thereby reducing the “residual confounding” associated with inclusion of only income.

Likewise, we included a measure of *cognitive ability* as an additional control factor beyond educational attainment. Because higher levels of educational attainment affect use of services both through their influence on income and through their contribution to a sense of efficacy and control over life,<sup>22,23</sup> some residual confounding could occur if, among a cohort of individuals whose educational opportunities have historically been limited, only an education variable were included. Cognitive ability may also influence efficacy and control. Our inclusion of cognitive ability, which some might refer to as “intelligence,”<sup>24–26</sup> provided an additional measure of control beyond the enabling factor of education alone.

All variables were based on self-reports. Predisposing characteristics were as follows: age in years (discrete, as measured at the time of the 1996 interview), sex (male as referent), and racial/ethnic group membership (non-Hispanic White/“other” [referent], non-Hispanic Black, Hispanic). Enabling factors were insurance status (as described earlier), educational attainment (0–8 years [referent], 9–11 years, high school diploma or equivalent, some college or college degree), cognitive ability quartile (lowest quartile as referent; based on scores on immediate and

delayed word recall and word similarity items included in the HRS; see Wray et al.<sup>27</sup> for further details), 1994 income-to-needs ratio adjusted for family size (less than 100% of poverty [referent], 100%–149%, 150%–199%, 200%–299%, 300%–499%, 500% or more), change in income-to-needs ratio during 1994 through 1996 (continuous measure derived by subtracting 1996 ratio from 1994 ratio; range: –5 to 5), and 1994 total net worth quintile in \$1000s (less than \$20.2 [referent], \$20.2–\$69.0, \$69.1–\$138.0, \$138.1–\$286.0, more than \$286.0).

Need-related factors included 1994 smoking status (never smoked [referent], past smoker, current smoker), 1994 alcohol consumption pattern (abstainer [no alcohol consumption], moderate drinker [1 or 2 drinks per day; referent], heavy drinker [3 or more drinks per day]), and past or current problem drinking behavior (coded as 0 [referent], 1, or 2 or more CAGE score positive indicators).<sup>28</sup> (The CAGE is a 4-question alcoholism screening instrument whose name is a mnemonic designating an individual who has attempted to “cut down” on alcohol consumption, is “annoyed” by criticism of his or her drinking, feels “guilty,” and needs an “eye-opener” drink in the morning. The presence of 2 or more of these characteristics is considered indicative of an alcohol use disorder. CAGE score information was available only from the 1992 interview.) Other need-related factors were 1994 weight status (underweight/normal weight [body mass index below 25 kg/m<sup>2</sup>; referent], overweight [body mass index of 25–25.9 kg/m<sup>2</sup>], or obese [body mass index of 30 kg/m<sup>2</sup> or above]),<sup>29</sup> number of chronic diseases reported in 1994 (hypertension, diabetes, heart disease, chronic lung disease, cancer, arthritis, stroke, or difficulties with vision, summed and coded as 0, 1, 2, or 3 or more), and both 1994 and 1996 self-reported overall health (excellent, very good, good, fair, poor [referent]).

Health behaviors or characteristics such as tobacco use patterns, alcohol use patterns, and body mass index were not included as intrinsically indicative per se of factors affecting use of services. Negative health behaviors were included instead as possible indicators of an individual's having a less healthy approach to

life in general and, hence, being less likely to participate in or seek out preventive services.

## RESULTS

### Population Characteristics

More than 15% of the respondents reported being uninsured at the baseline interview in 1992 (weighted value: 13.7%). Between 1994 and 1996 (the reference period for preventive service use), changes in insurance coverage were common; 3.4% of respondents (weighted value: 3.0%) lost coverage, and 4.9% (weighted value: 4.5%) obtained coverage (Table 1). Overall, 21.2% (weighted value: 19.1%) of the respondents reported having at least 1 episode of noncoverage between 1992 and 1996 (Table 1). Thus, the pool of individuals who were continuously or intermittently uninsured was approximately 40% *greater* than the estimated number of uninsured individuals derived from data on baseline 1992 insurance status alone. Additional participant characteristics are shown in Table 1.

As we have reported previously,<sup>14</sup> there were important differences between participants who were continuously insured and those who were uninsured on 1 or more occasions. Members of Black or Hispanic racial/ethnic groups, female respondents, and unmarried respondents were more likely to be uninsured and had more episodes of noncoverage. Alternatively, those at higher cognitive ability levels and those with more education, higher income-to-needs ratios, and higher levels of net worth were more likely to be insured at all 3 interviews. Current smokers, abstainers and heavy drinkers, and those with higher CAGE scores were more likely to report being uninsured and had more episodes of noncoverage. There were no significant differences according to age or weight status (body mass index categories) between insurance groups.

### Use of Preventive Services

Table 2 presents unweighted and weighted percentages of participants who reported use of preventive services during the reference period. Rates of preventive service use varied from 38.8% for influenza vaccinations to 71.8% for mammograms. Prevalence data

from the Behavioral Risk Factor Surveillance System for the years 1995 and 1996<sup>30</sup> indicate that the overall preventive service use rates observed in this study are comparable to nationwide rates (data not shown). No national data on breast self-examination were available for comparison.

### Insurance Status: 1994 and 1996

Table 3 presents bivariate and multivariate logistic regression results in the form of crude and adjusted relative risks for use of services, by insurance status, in 1994 and 1996. According to the bivariate results, those who reported being uninsured at both the 1994 and 1996 interviews were significantly less likely than those reporting coverage to use preventive services requiring access to a health provider (i.e., mammography, Pap test, cholesterol test, influenza vaccination, and prostate examination) (Table 3). The multivariate results exhibited the same pattern, with those who were uninsured at both interviews having a relative risk of receiving services 29% to 47% less than that of those who were insured at both interviews. Although this group tended to be less likely to perform breast self-examinations, the difference was far less pronounced than the reductions in preventive service use (Table 3).

Crude relative risk results showed that respondents who lost insurance during the reference period were significantly less likely than those who were insured at both interviews to have a mammogram, Pap test, cholesterol test, influenza vaccination, or prostate examination (Table 3). The same pattern persisted in multivariate analyses for all services other than influenza vaccination (results for influenza vaccination were not statistically significant but exhibited the same trend). In the multivariate analyses, results for respondents who obtained insurance coverage during the reference period (and whom we hypothesized might “catch up” in terms of service use) were only marginally better than those for respondents who lost insurance in regard to mammography (RR=0.83; 95% CI=0.71, 0.95 vs RR=0.86; 95% CI=0.75, 0.95) and Pap tests (RR=0.86; 95% CI=0.71, 0.99 vs RR=0.89; 95% CI=0.76, 0.99).

Multivariate results for cholesterol test use showed that respondents who obtained insur-

**TABLE 1—Distribution of Study Variables: Health and Retirement Study, 1992–1996**

	Unweighted No. (n = 7300)	Unweighted % or Mean (SD)	Weighted % or Mean (SE)
1992 insurance status			
Private coverage	5640	77.3	79.7
Public coverage	544	7.5	6.6
Uninsured	1116	15.3	13.7
1994 and 1996 insurance status			
Insured 1994/insured 1996	6202	85.0	87.0
Insured 1994/uninsured 1996	249	3.4	3.0
Uninsured 1994/insured 1996	359	4.9	4.5
Uninsured 1994/uninsured 1996	490	6.7	5.6
No. of episodes of noncoverage, 1992–1996			
0	5755	78.8	80.1
1	786	10.8	10.4
2	359	4.9	4.3
3	400	5.5	4.4
Age in 1996, y	...	59.8 (3.2)	59.9 (0.04)
Sex			
Female	4070	55.8	54.6
Male	3230	44.2	45.4
Race			
Non-Hispanic White/other	5605	76.8	86.4
Non-Hispanic Black	1110	15.2	8.6
Hispanic	585	8.0	5.0
Cognitive ability score	...	100.0 (15.0)	102.0 (0.4)
Education, y			
0–8	757	10.4	8.1
9–11	1090	14.9	13.8
12 or equivalent	2654	36.4	37.0
> 12	2799	38.3	41.1
Marital status in 1994			
Never married	262	3.6	3.9
Separated/divorced/widowed	1554	21.3	21.6
Married	5484	75.1	74.5
1994 income-to-needs ratio			
< 1.00	989	13.6	11.8
1.00–1.49	534	7.3	6.5
1.50–1.99	513	7.0	7.0
2.00–2.99	1041	14.3	13.7
3.00–4.99	1683	23.1	23.3
≥ 5.00	2540	34.8	37.7
1994 total net worth (\$1000s)			
< 20.2	2533	34.7	30.5
20.2–69.0	1514	20.7	20.9
69.1–138.0	1094	15.0	15.9
138.1–286.0	1052	14.4	15.7
> 286.0	1107	15.2	17.0

*Continued*

ance had rates of use that were approximately halfway between those of respondents who lost insurance and those of respondents who had continuous coverage. Their rates “caught up” with the rates of those with continuous coverage only in the case of influenza vaccination. Results for prostate examinations were not statistically significant in the multivariate analysis but again exhibited the same trend as that for cholesterol testing and mammography. Finally, there was no relationship between breast self-examination and insurance status, which again suggests that our finding of less use of preventive services among those with intermittent coverage was not spurious or due to reporting bias.

### Episodes of Noncoverage

Table 4 presents bivariate and multivariate logistic regression results in the form of crude and adjusted relative risks according to number of episodes of noncoverage between 1992 and 1996. All statistical tests involved comparisons with the referent (no episodes of noncoverage) group. In the case of all preventive services requiring access to a health care provider (influenza vaccination, cholesterol test, mammography, Pap test, prostate examination), crude prevalence ratios were statistically significant for respondents in all categories of noncoverage (relative to those reporting no episodes of noncoverage).

The same effect pattern could be seen in the multivariate results, with relative risks of receiving services decreasing steadily as number of episodes without insurance increased. Again, the lack of association between insurance coverage and breast self-examination lends support to the validity of our findings. Additional analyses (data not shown) revealed that the effect of intermittent lack of insurance coverage was consistent across male and female respondents for influenza vaccination and cholesterol testing and relatively consistent across racial/ethnic groups for both gender-specific and gender-neutral preventive procedures.

### DISCUSSION

Our results offer important new evidence that lack of health insurance coverage for any period—even across a relatively long interval

TABLE 1—Continued

1994 weight (based on body mass index)			
Underweight/normal	2579	35.3	36.9
Overweight	2949	40.4	40.2
Obese	1772	24.3	22.9
1994 smoking status			
Never	2700	37.0	36.4
Past smoker	2882	39.5	40.2
Current smoker	1718	23.5	23.4
1994 alcohol use			
Abstainer	3200	43.8	40.8
Moderate drinker	3794	52.0	54.8
Heavy drinker	306	4.2	4.3
CAGE score (1992)			
0	5513	75.5	76.1
1 positive response	810	11.1	10.9
≥ 2 positive responses	977	13.4	13.0
Self-reported health in 1994			
Poor	467	6.4	5.5
Fair	1072	14.7	13.3
Good	2109	28.9	28.2
Very good	2274	31.2	32.5
Excellent	1378	18.9	20.4
Self-reported health in 1996			
Poor	486	6.7	5.9
Fair	1105	15.1	14.0
Good	2045	28.0	27.0
Very good	2339	32.0	33.5
Excellent	1325	18.2	19.6
No. of chronic diseases in 1994			
0	2170	29.7	30.6
1	2463	33.7	34.2
2	1603	22.0	21.6
3 or more	1064	14.6	13.6

Note. The income-to-needs ratio is total household income divided by the poverty guideline for a given household size (see text for details).

TABLE 2—Descriptive Statistics for Respondents Reporting Use of Preventive Services Over Previous 2 Years: Health and Retirement Study, 1996

Preventive Service	Unweighted No.	Unweighted %	Weighted %
Mammography (n = 4070)	2902	71.3	71.8
Pap test (n = 4070)	2750	67.6	67.7
Cholesterol test (n = 7300)	5144	70.5	71.0
Influenza vaccination (n = 7300)	2727	37.4	38.8
Prostate examination (n = 3230)	2095	64.9	66.6
Breast self-examination (n = 4070)	2556	62.8	61.5

of 4 years—leads to lower rates of use of most preventive services. We found a marked “dose–response” effect on preventive service use: as the number of noncoverage episodes rose, use of services steadily declined. Our results extend the findings of other studies showing that periods of noncoverage increase people’s risk of going without needed care and increase the likelihood that they will report problems involving access to care.<sup>4,11</sup> Thus, our study provides additional evidence that national estimates of the pool of uninsured persons who are at risk for negative care experiences and potentially adverse health outcomes need to include those experiencing intermittent periods of noncoverage.

Persons who obtained insurance during the reference period did not rapidly “catch up” with their already-insured peers in regard to use of preventive services. At the time of their 1996 interview, individuals who acquired insurance coverage between 1994 and 1996 were still less likely than individuals who were insured at both interviews to report that they had obtained necessary preventive services over the previous 2 years. This finding suggests that a relatively long period of time may elapse before appropriate patterns of care can be reestablished. We were unable to accurately estimate the interval typically required for this process, but our data suggest that a period in excess of 2 years may be necessary.

Our study involved a number of limitations. First, insurance status was assessed at only 3 points. It is likely that a significant number of people classified as continuously insured experienced changes in coverage that were not reflected in our data. In addition, many individuals who are insured are underinsured and may face high deductibles and copayments that deter their use of preventive services. Such effects can lead to underestimates of the true differences between individuals who are intermittently uninsured and individuals who have continuous insurance with adequate coverage for preventive services. Moreover, some uninsured individuals can take advantage of free cancer screening programs available in their communities. Previous studies have revealed large discrepancies in access to care among uninsured persons in several communities across the

**TABLE 3—Percentages of and Unadjusted and Adjusted Relative Risks (RRs) for Use of Preventive Services, According to 1994 and 1996 Insurance Status, Among Respondents to the Health and Retirement Study, 1992–1996**

Type of Preventive Service	Insurance Status at 1994 and 1996 Interviews			
	Insured at Both Interviews (95% CI)	Lost Insurance (Insured 1994, Uninsured 1996) (95% CI)	Obtained Insurance (Uninsured 1994, Insured 1996) (95% CI)	Uninsured at Both Interviews (95% CI)
<b>Mammography (n = 4070)</b>				
Reported use, %	75.8 (74.0, 77.5)	57.6*** (48.7, 66.0)	56.9*** (49.2, 64.3)	37.3*** (31.2, 43.8)
Crude RR	Referent	0.76*** (0.64, 0.87)	0.75*** (0.65, 0.85)	0.49*** (0.41, 0.59)
Adjusted RR	Referent	0.83** (0.71, 0.95)	0.86** (0.75, 0.95)	0.63*** (0.53, 0.73)
<b>Pap test (n = 4070)</b>				
Reported use, %	70.9 (69.2, 72.6)	55.8*** (45.9, 65.2)	55.6*** (47.4, 63.6)	40.3*** (34.5, 46.5)
Crude RR	Referent	0.79** (0.66, 0.91)	0.78*** (0.67, 0.90)	0.57*** (0.48, 0.66)
Adjusted RR	Referent	0.86* (0.71, 0.99)	0.89* (0.76, 0.99)	0.70*** (0.59, 0.81)
<b>Cholesterol test (n = 7300)</b>				
Reported use, %	73.9 (72.5, 75.2)	56.2*** (50.0, 62.3)	61.3*** (55.8, 66.5)	41.9*** (35.5, 48.4)
Crude RR	Referent	0.76*** (0.67, 0.85)	0.83*** (0.75, 0.90)	0.57*** (0.48, 0.66)
Adjusted RR	Referent	0.81*** (0.71, 0.91)	0.91** (0.83, 0.98)	0.67*** (0.57, 0.76)
<b>Influenza vaccination (n = 7300)</b>				
Reported use, %	40.3 (38.4, 42.2)	30.7* (24.0, 37.7)	34.2* (29.1, 39.6)	23.9*** (18.7, 30.1)
Crude RR	Referent	0.76* (0.59, 0.96)	0.85* (0.71, 0.99)	0.59*** (0.47, 0.74)
Adjusted RR	Referent	0.84 (0.66, 1.04)	0.95 (0.80, 1.12)	0.71*** (0.56, 0.88)
<b>Prostate examination (n = 3230)</b>				
Reported use, %	70.1 (67.9, 72.3)	41.8*** (31.1, 53.3)	51.6*** (39.4, 63.6)	27.1*** (21.1, 34.2)
Crude RR	Referent	0.60*** (0.44, 0.76)	0.74** (0.55, 0.91)	0.39*** (0.30, 0.49)
Adjusted RR	Referent	0.68*** (0.51, 0.86)	0.86 (0.64, 1.06)	0.53*** (0.42, 0.65)
<b>Breast self-examination (n = 4070)</b>				
Reported use, %	61.8 (59.9, 63.7)	64.1 (54.4, 72.8)	62.9 (56.4, 68.9)	55.7 (49.4, 61.8)
Crude RR	Referent	1.04 (0.88, 1.18)	1.02 (0.91, 1.12)	0.90 (0.80, 1.00)
Adjusted RR	Referent	1.00 (0.84, 1.16)	1.00 (0.89, 1.11)	0.89 (0.77, 1.00)

Note. CI = confidence interval. Respondents were aged 51–61 years at the time of their 1992 interview. All results were weighted and adjusted for the complex design of the survey. Both crude RRs and adjusted RRs were considered “corrected relative risks,” following the formula of Zhang and Yu<sup>18</sup> (see text for details), derived from logistic regression coefficients. Adjustments included age, sex, race/ethnicity, education, cognitive ability, 1994 income-to-needs ratio, 1994–1996 change in income, 1994 net worth, 1994 alcohol use, CAGE score, 1994 smoking status, 1994 weight status, chronic diseases in 1994, self-reported overall health in 1994 and 1996. All statistical tests involved comparisons with the referent (“insured at both interviews”) group.

\* $P < .05$ ; \*\* $P < .01$ ; \*\*\* $P < .001$ .

country,<sup>31</sup> so that our results may significantly underestimate the effects of intermittent lack of insurance coverage on use of preventive services in areas that do not have established, well-publicized free screening programs.

Second, there is significant debate about whether prostate examinations are beneficial, raising questions about their utility as an outcome measure. *Healthy People 2000* did not recommend that questions regarding prostate examinations be included in health surveys.<sup>32</sup> In addition, routine rectal examination to screen for prostate cancer is not

recommended by the US Preventive Services Task Force.<sup>1</sup> However, these changes in thinking about the appropriateness of rectal examination cancer screening were not published until 1996, after the data for this study had been collected. Thus, although rectal examination of the prostate is no longer recommended as a screening measure, its use in our study reflects the standard of care at the time the data were collected. The lower rates of use observed here among uninsured individuals may not have any clinical significance, but they nevertheless exemplify the relationship between in-

surance coverage and use of preventive services.<sup>1</sup> Finally, our results are not generalizable to adults in age groups different from those in our study population.

In summary, our results provide additional evidence that intermittent lack of health insurance coverage undermines access to preventive services, even after adjustment for a complex array of variables to account for the potentially confounding effects of socioeconomic status and health behaviors. Because both individuals who are continuously uninsured and those who experience intermittent periods of noncoverage are at higher risk for

**TABLE 4—Percentages of and Unadjusted and Adjusted Relative Risks (RRs) for Use of Preventive Services, According to Number of Episodes of Noncoverage, Among Respondents to the Health and Retirement Study, 1992–1996**

Type of Preventive Service	Episodes of Noncoverage, 1992–1996			
	None (95% CI)	1 Episode (95% CI)	2 Episodes (95% CI)	3 Episodes (95% CI)
<b>Mammography (n = 4070)</b>				
Reported use, %	76.7 (75.0, 78.2)	62.0*** (57.1, 66.7)	53.4*** (46.6, 60.1)	34.7*** (28.3, 41.7)
Crude RR	Referent	0.81*** (0.75, 0.87)	0.70*** (0.61, 0.79)	0.45*** (0.36, 0.55)
Adjusted RR	Referent	0.87*** (0.81, 0.93)	0.81*** (0.71, 0.90)	0.59*** (0.49, 0.70)
<b>Pap test (n = 4070)</b>				
Reported use, %	71.9 (70.2, 73.5)	58.0*** (52.4, 63.5)	51.0*** (43.2, 58.7)	40.4*** (34.1, 47.1)
Crude RR	Referent	0.81*** (0.73, 0.88)	0.71*** (0.61, 0.82)	0.56*** (0.47, 0.66)
Adjusted RR	Referent	0.87*** (0.79, 0.95)	0.83** (0.70, 0.94)	0.69*** (0.58, 0.81)
<b>Cholesterol test (n = 7300)</b>				
Reported use, %	74.4 (73.0, 75.8)	63.9*** (59.9, 67.8)	54.3*** (48.5, 60.1)	41.5*** (34.9, 48.5)
Crude RR	Referent	0.86*** (0.80, 0.92)	0.73*** (0.65, 0.81)	0.56*** (0.47, 0.65)
Adjusted RR	Referent	0.91** (0.84, 0.97)	0.82*** (0.74, 0.89)	0.66*** (0.56, 0.75)
<b>Influenza vaccination (n = 7300)</b>				
Reported use, %	40.7 (38.7, 42.8)	34.2** (30.9, 37.7)	29.4*** (24.6, 34.7)	23.5*** (17.8, 30.3)
Crude RR	Referent	0.84** (0.74, 0.94)	0.72*** (0.60, 0.85)	0.58*** (0.44, 0.73)
Adjusted RR	Referent	0.89 (0.78, 1.00)	0.83* (0.69, 0.97)	0.69** (0.53, 0.88)
<b>Prostate examination (n = 3230)</b>				
Reported use, %	70.9 (68.6, 73.1)	54.4*** (48.3, 60.3)	44.1*** (34.0, 54.8)	23.5*** (17.3, 31.0)
Crude RR	Referent	0.77*** (0.68, 0.86)	0.62*** (0.47, 0.78)	0.33*** (0.25, 0.43)
Adjusted RR	Referent	0.87** (0.79, 0.95)	0.75** (0.57, 0.93)	0.47*** (0.36, 0.60)
<b>Breast self-examination (n = 4070)</b>				
Reported use, %	62.0 (60.1, 63.8)	60.1 (54.4, 65.5)	65.4 (56.5, 73.3)	54.6 (47.2, 61.7)
Crude RR	Referent	0.97 (0.88, 1.05)	1.06 (0.92, 1.18)	0.88 (0.75, 1.00)
Adjusted RR	Referent	0.94 (0.85, 1.03)	1.04 (0.90, 1.17)	0.87 (0.72, 1.00)

Note. CI = confidence interval. Respondents were aged 51–61 years at the time of their 1992 interview. All results were weighted and adjusted for the complex design of the survey. Both crude RRs and adjusted RRs were considered “corrected relative risks,” following the formula of Zhang and Yu<sup>18</sup> (see text for details), derived from logistic regression coefficients. Adjustments included age, sex, race/ethnicity, education, cognitive ability, 1994 income-to-needs ratio, 1994–1996 change in income, 1994 net worth, 1994 alcohol use, CAGE score, 1994 smoking status, 1994 weight status, chronic diseases in 1994, self-reported overall health in 1994 and 1996. All statistical tests involved comparisons with the referent (no episodes of noncoverage) group. \* $P < .05$ ; \*\* $P < .01$ ; \*\*\* $P < .001$ .

underuse of clinical preventive services and for other problems with access to care, the United States should begin formal tracking of the number of individuals who are intermittently uninsured at any point in time over a period of several years. Additional policy initiatives are needed to promote stability in insurance coverage. ■

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### Contributors

J.J. Sudano Jr led the writing and completed the analyses. Both authors helped in conceiving the study, conceptualizing ideas, interpreting results, and reviewing drafts of the article.

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### Human Participant Protection

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