

Interruptions in Medicaid Coverage and Risk for Hospitalization for Ambulatory Care–Sensitive Conditions

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Background: Many low-income U.S. citizens experience interruptions in health insurance coverage.

Objective: To determine the rate of hospitalization for ambulatory care–sensitive conditions among Medicaid beneficiaries with interruptions in coverage.

Design: Retrospective cohort study.

Setting: California Medicaid population.

Patients: 4 735 797 adults in California age 18 to 64 years who received a minimum of 1 month of Medicaid coverage between 1998 to 2002.

Measurement: Time to hospitalization for an ambulatory care–sensitive condition.

Results: Sixty-two percent of Medicaid beneficiaries experienced at least 1 interruption in coverage during the study period. The 3 most common ambulatory care–sensitive conditions resulting in a hospitalization were heart failure, diabetes, and chronic obstructive pulmonary disease. Interruptions in coverage were associated with a

higher risk for hospitalization for an ambulatory care–sensitive condition (adjusted hazard ratio, 3.66 [95% CI, 3.59 to 3.72]; $P < 0.001$). In subgroup analyses, the association between interrupted coverage and hospitalization was stronger for beneficiaries eligible through the Temporary Aid to Needy Families program (adjusted hazard ratio, 8.56 [CI, 8.06 to 9.08]) than for beneficiaries eligible through the Supplemental Security Income program (adjusted hazard ratio, 1.72 [CI, 1.67 to 1.76]), who typically retain Medicare coverage even when their Medicaid coverage is interrupted.

Limitation: The study lacked information on why interruptions occurred and whether beneficiaries with interruptions transitioned to other insurance coverage.

Conclusion: Interruptions in Medicaid coverage are associated with a higher rate of hospitalization for ambulatory care–sensitive conditions. Policies that reduce the frequency of interruptions in Medicaid coverage might prevent some of the health events that trigger hospitalization and high-cost health care spending.

Ann Intern Med. 2008;149:854-860.

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Many U.S. citizens experience interruptions in health insurance coverage. A total of 85 million persons, or 38% of the U.S. population, younger than age 65 years were uninsured for at least part of a 3-year period (1). Low-income U.S. citizens are particularly at risk for periodic lack of insurance. Many poor persons move in and out of the Medicaid program with periods of being uninsured in between (2, 3).

Medicaid reenrollment policies affect the number of beneficiaries who experience interruptions in their coverage. A shorter period for eligibility redetermination creates an administrative barrier to continuous coverage (4). Federal law requires that Medicaid eligibility be redetermined at least annually, but many states require this assessment at a shorter interval. In California, for example, adults need to redemonstrate their eligibility for Medicaid every 3 months.

Research suggests that individuals with interrupted insurance coverage are less likely to receive primary care and preventive services (5). One potentially useful but as yet unexplored measure of morbidity and costs associated with interrupted Medicaid coverage is hospitalizations for ambulatory care–sensitive conditions. Ambulatory care–sensitive conditions, such as asthma, diabetes, and hypertension, are conditions that can often be managed with timely and effective treatment in an outpatient setting, thereby preventing hospitalization (6). Hospital admissions for these conditions reflect a decline in health status and, by association, the health consequences of access barriers.

We performed a retrospective cohort study to determine whether interruptions in Medicaid enrollment are associated with an increased risk for hospitalizations in adults with ambulatory care–sensitive conditions.

METHODS

Data

To conduct the analysis, the 1998 to 2002 California hospital patient discharge data available from the California Office of Statewide Health Planning and Development was linked with the Medicaid Monthly Eligibility File for the corresponding period from the California Department of Health Services. A deterministic match was done with social security numbers, sex, and year of birth available in both files, and a probabilistic match by using sex, date of birth, hospital identifier, and hospitalization dates was done on the residual to enhance the linkage. Judging by comparisons with separate Medicaid payment records, the

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Appendix Figure

Conversion of graphics into slides

California Department of Health Services estimated that more than 98% of Medicaid hospitalization records were successfully linked. Approximately 70% of the records were linked by using the deterministic method, and 27% were linked by using the probabilistic method (7). Furthermore, most records lacking a social security number needed for a deterministic match were for newborns, whom we excluded from this analysis. We were unable to correct for out-of-state hospitalizations of Medicaid beneficiaries.

The California hospital patient discharge database includes a unique patient identifier and information about admission and discharge dates, patient demographic characteristics, diagnosis codes, and insurance status for the hospitalization. By linking the information available in the hospital discharge file with that available from the California Department of Health Services, we could confirm whether a hospitalized individual was in fact a Medicaid beneficiary and capture additional information on a monthly basis regarding Medicaid enrollment status, aid category, and whether the care was delivered through fee-for-service or managed care for all Medicaid beneficiaries, regardless of whether they were hospitalized. Furthermore, this linked file enabled us to capture hospitalizations for individuals who at one time may have had Medicaid coverage but did not have coverage at the time of a hospitalization. We limited our analysis to adults age 18 to 64 years.

Outcome Measure

We created longitudinal records of eligibility status and hospitalizations of any persons who were ever enrolled in Medicaid during the 5-year study period. We measured the duration of time within the study period from enrollment in Medicaid until the first hospitalization for an ambulatory care-sensitive condition and the duration of time to subsequent hospitalizations thereafter.

We classified hospitalizations in the patient discharge file as being for ambulatory care-sensitive conditions on the basis of the definition provided by the Agency of Healthcare Research and Quality (AHRQ). We applied the AHRQ definitions of ambulatory care-sensitive conditions, identifying hospitalizations in which the principal diagnosis International Classification of Disease, Ninth Edition, code was listed in the AHRQ 2001 guidelines (8). We have previously reported that these conditions comprise 26% of non-pregnancy-related hospitalizations for Medicaid beneficiaries in California (9). We compared the pattern of hospitalization rates for specific ambulatory care-sensitive conditions between patients with continuous and those with interrupted Medicaid coverage. Because this pattern was quite similar, and for ease of interpretation and presentation, we followed the conventional practice of aggregating hospital admissions for any of the AHRQ ambulatory care-sensitive conditions.

Context

Many persons in the United States experience interruptions in their health insurance coverage.

Contribution

This study of hospitalized California adults with Medicaid found an association between interruptions in coverage and a higher rate of hospitalization for ambulatory care-sensitive conditions, such as heart failure, diabetes, and chronic obstructive pulmonary disease.

Caution

The study sample was limited to hospitalized patients, and some patients with interrupted coverage may have obtained private insurance.

Implication

Interruptions in insurance coverage were associated with hospitalization for ambulatory care-sensitive conditions. Policies that reduce the interruptions in coverage might prevent some of these hospitalizations.

—The Editors

Exposure Variable

We modeled our primary exposure variable as a time-varying covariate indicating whether a beneficiary had or had not experienced an interruption of coverage. We identified an interruption of coverage when a monthly eligibility code after the first enrollment month was no longer present. The California Medicaid Monthly Enrollment file includes a code for Healthy Families, the California State Children's Health Insurance Program (SCHIP). Healthy Families allows persons up to the age of 19 years to qualify for Medicaid-type benefits in California but at somewhat higher income levels. For the purposes of our analysis, we considered enrollment in Healthy Families as a form of Medicaid coverage and did not consider it to be an interruption in coverage if an individual changed between these 2 programs over time. We characterized all periods before the interruption as continuous and those after the interruption as being discontinuous.

Potential Confounders

We measured several characteristics of beneficiaries that could influence their risk for a hospitalization for an ambulatory care-sensitive condition as well as their risk for interrupted Medicaid coverage. These included demographic characteristics, Medicaid aid category, Medicaid health care delivery model, and forms of insurance other than Medicaid. Many of these variables are used to determine payment and were therefore complete in the data set. However, 68 807 beneficiaries (1%) had missing information on race/ethnicity and were classified with those reported as "other."

Beneficiary demographic characteristics and Medicaid aid category provide an estimate of health status. We categorized aid category as Temporary Assistance to Needy Families (TANF), Supplemental Security Income (SSI), or other by using previously described algorithms (10). Medicaid eligibility through TANF is available to low-income children and their parents regardless of their health status. On the other hand, beneficiaries enrolled in Medicaid through the SSI program are eligible as a result of a chronic disability and therefore tend to be sicker on average than those eligible through TANF (11). From calculations using the Medi-Cal eligibility file data, we determined that most (83%) of the “other” group is composed of low-income persons whose incomes are too high for them to qualify for Medicaid but who subsequently do qualify for the medically needy aid category because of their acute out-of-pocket spending on health care services. The remainder of the “other” group is primarily women who are eligible on the basis of a pregnancy (12%) and persons who are eligible through one of several immigration-related programs (4%).

The AHRQ provides an option for including the Elixhauser comorbid condition measure in the calculation of ambulatory care–sensitive hospitalization rates (12). Incorporating diagnoses from administrative data in risk adjustment could introduce overadjustment if the comorbid conditions are a product of the same access-to-care barriers that result in hospitalizations for ambulatory care–sensitive conditions. Nonetheless, we performed additional analyses incorporating the Elixhauser comorbid condition measure and found that its inclusion did not substantially affect our findings. Therefore, to simplify the presentation, we have chosen not to display these results.

Except for the managed care indicator variable, all potential confounders were measured when beneficiaries enrolled in Medicaid. We classified Medicaid beneficiaries as being in managed care depending on whether they spent most of their enrollment time before a hospitalization for an ambulatory care–sensitive condition in managed care. This was necessary because some beneficiaries changed between fee-for-service and managed care during their enrollment time.

Statistical Analysis

We performed descriptive analysis of the characteristics of Medicaid beneficiaries who did and did not have an interruption in their Medicaid coverage and the frequency distribution of the durations of Medicaid coverage interruptions. We also compared the number and frequency of hospitalizations for ambulatory care–sensitive conditions between beneficiaries with and those without an interruption in coverage.

We used the life-table technique to calculate the probability over time of hospitalizations for ambulatory care–sensitive conditions among beneficiaries with continuous and interrupted Medicaid coverage and a Cox proportional

model to compare the average change in relative hazard associated with interrupted Medicaid coverage (13). We adopted the statistical techniques for time to recurrent events (14). The first exposure period starts on the first month of eligibility or the beginning of the study period (1 January 1998) for beneficiaries who were already enrolled in the program. An exposure period ends with a hospitalization for an ambulatory care–sensitive condition, at the end of the study period (31 December 2002), with a person turning 65 years old, or with an interruption in coverage (**Appendix Figure**, available at www.annals.org). A new exposure period begins after an interruption in Medicaid eligibility or a hospitalization for an ambulatory care–sensitive condition. Because the Medicaid eligibility file includes only a month but not a day of enrollment, we assigned the date of enrollment as the 15th of the month. After determining from the Cox model what the average effect of an interruption in Medicaid coverage was on the risk for a hospitalization for an ambulatory care–sensitive condition, we introduced an interaction term for time after an interruption in Medicaid coverage to estimate the duration of the increased risk for such a hospitalization.

Recognizing that other beneficiary characteristics could affect the hospitalization rate and confound our results, we used a Cox proportional hazard model to control for demographic characteristics (age, sex, and race or ethnicity), health care delivery model (fee-for-service or managed care), other insurance coverage (yes or no), temporal trend (year of admission), and Medicaid eligibility categories.

Through readmissions, a patient could contribute more than 1 observation, although this is extremely rare in our data (2%). Nevertheless, we used the fixed-effect partial likelihood method with an aggregate covariance structure to calculate the *P* values. Furthermore, to test for the robustness of our findings, we estimated several variants of our basic model. First, we estimated a model that included a covariate for the number of previous hospitalizations to control for dependence among observations from unmeasured characteristics (15). The parameter estimates and the *P* values generated from this model did not substantially differ from the ones we report in this article and therefore are not displayed. Second, we conducted the analysis on the subset of our data representing only the first hospitalization. We found that the effect of discontinuity was even stronger for this subset than those reported here. Third, because beneficiaries who enrolled before January 1998 (44%) have episode durations with unknown starting times (left-censored), we reestimated our model on the subpopulation of beneficiaries who enrolled after January 1998. Again, our results were very similar and are not displayed. Fourth, we conducted stratified analyses by aid groups to determine whether SSI-eligible Medicaid beneficiaries who tend also to have Medicare coverage were less susceptible to excess hospitalizations for ambulatory care–sensitive conditions in association with an interruption in Medicaid coverage than those who were eligible through

Table 1. Characteristics of the California Medicaid Population Age 18 to 64 Years with Continuous and Interrupted Coverage, 1998 to 2002

Characteristic	Continuous Coverage	Interrupted Coverage	P Value*
Beneficiaries, n (%)	1 797 479 (38)	2 938 318 (62)	
Mean age, y	34	32	<0.001
Female, %	62	66	<0.001
Race/ethnicity, %			
Hispanic	43	47	<0.001
White	27	29	<0.001
Black	12	10	<0.001
Asian	12	8	<0.001
Other†	6	6	1.00
Aid group, %			
TANF	33	28	<0.001
SSI	26	8	<0.001
Other	40	64	<0.001
Managed care, %	20	20	1.00
Other insurance, %	15	9	<0.001
Hospitalized for ambulatory care-sensitive condition, %	2	1	<0.001

SSI = Supplementary Security Income; TANF = Temporary Assistance to Needy Families.
 * All P values for categorical variables were obtained from differences in the proportion test (z test) with Yates correction. The P value for age in years was obtained from the t test.
 † Includes beneficiaries with missing information on race/ethnicity.

TANF or other categories of persons who do not typically have another form of coverage.

To estimate Medicaid’s financial responsibility for hospitalizations for ambulatory care-sensitive conditions among beneficiaries who had an interruption in Medicaid coverage, we used health insurance data in the hospital discharge database to create summary counts by source of payment for beneficiaries who were hospitalized after an interruption in coverage.

The protocol for this data analysis was reviewed and approved by the University of California, San Francisco, institutional review board and the California Committee for the Protection of Human Subjects.

Role of the Funding Source

This study was funded by The Commonwealth Fund. The funding source had no role in conceptualization, design, conduct, or analysis of this study or in the decision to submit the manuscript for publication.

RESULTS

There were 4 735 797 persons between the ages of 18 and 64 years who received Medicaid for at least 1 month during the study period. A total of 62% of eligible beneficiaries, including 58% of TANF, 33% of SSI, and 72% of other beneficiaries, experienced some interruption in their Medicaid coverage during the study period; 80% had only 1 interruption. Beneficiaries with an interruption in Medicaid coverage were younger and were more likely to be

female and Hispanic. They were also less likely to be eligible for Medicaid through TANF or SSI or to have other insurance (Table 1). The mean duration of an interruption was 25 months, and 32% of beneficiaries had an interruption in their Medicaid coverage of less than 1 year during the study period.

More hospitalizations for ambulatory care-sensitive conditions occurred among beneficiaries with continuous rather than interrupted Medicaid coverage (Table 2). The distribution of specific ambulatory care-sensitive conditions was similar in the 2 groups.

Beneficiaries who experienced an interruption in Medicaid coverage had a substantially higher rate of hospitalization for an ambulatory care-sensitive condition than did those who did not experience an interruption (hazard ratio, 7.99 [95% CI, 7.88 to 8.11]) (Figure). As reflected in the Figure, when we incorporated a term into the model for the interaction between an interruption in Medicaid coverage and the time after that interruption, we found that the increased risk for a hospitalization for an ambulatory care-sensitive condition largely occurred in the first 3 months after an interruption in coverage.

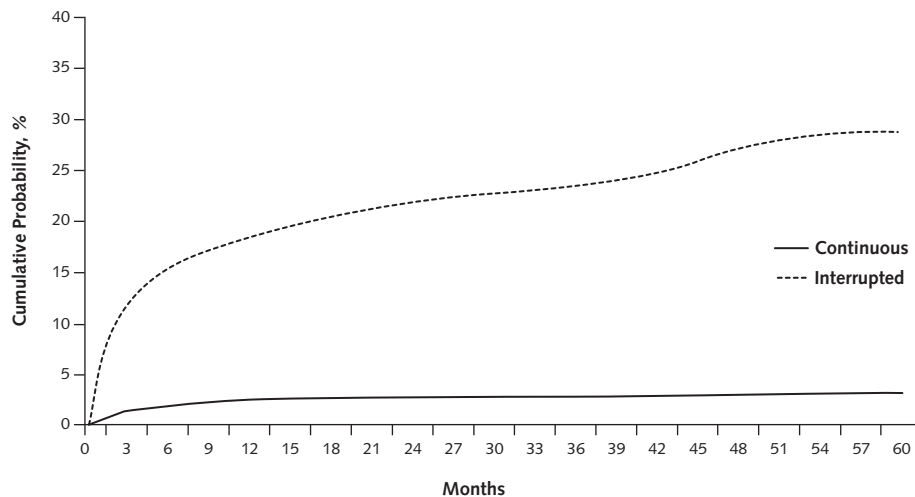
After adjustment for demographic, programmatic, and temporal differences, beneficiaries with interrupted coverage had a higher hospitalization rate than beneficiaries with no interruption (adjusted hazard ratio, 3.66 [CI, 3.59 to 3.72]) (Table 3). Beneficiaries who were older, black, or Hispanic; were eligible for Medicaid through SSI or aid categories other than TANF; or were receiving services through managed care also had a higher risk for hospitalization.

The impact of an interruption in Medicaid coverage varied somewhat for the different eligibility groups. The adjusted relative risk for hospitalization was 1.72 (CI, 1.67 to 1.76) for SSI-eligible beneficiaries, 8.56 (CI, 8.06 to 9.08) for TANF-eligible beneficiaries, and 4.98 (CI, 4.85 to 5.12) for other beneficiaries.

Table 2. Hospitalizations for Ambulatory Care-Sensitive Conditions among California Medicaid Beneficiaries Age 18 to 64 Years, 1998 to 2002

Ambulatory Care-Sensitive Condition	Continuous Coverage, n (%)	Interrupted Coverage, n (%)
Asthma	17 529 (12)	2784 (14)
Angina	2999 (2)	406 (2)
Congestive heart failure	34 516 (23)	4346 (22)
Chronic obstructive pulmonary disease	24 468 (16)	2697 (14)
Dehydration	6937 (5)	782 (4)
Diabetes	26 477 (18)	4539 (23)
Hypertension	1832 (1)	305 (2)
Lower-extremity amputation	5008 (3)	682 (3)
Pneumonia	19 829 (13)	2142 (11)
Ruptured appendix	37 (<1)	4 (<1)
Urinary tract infection	9255 (6)	1127 (6)
Total	148 887 (100)	19 814 (100)

Figure. Probability of hospitalization for an ambulatory care-sensitive condition over time, by Medicaid coverage status, 1998 to 2002.



Hazard ratio², 7.99 (95% CI, 7.88–8.11).

Using health insurance status information available in the hospital discharge data, we found that, among beneficiaries with interruption in Medicaid coverage, 45% regained Medicaid for the hospitalization, 43% had another form of insurance, and 11% were uninsured.

DISCUSSION

We found substantially higher hospitalization rates for ambulatory care-sensitive conditions associated with an in-

terruption in Medicaid coverage. Hospital admissions for ambulatory care-sensitive conditions are indicative of the quality of health care that people receive outside the hospital (16) and reflect a decline in the health status of persons requiring such hospitalizations (6).

Our findings are consistent with a previous study that found higher rates of psychiatric hospitalization among Medicaid patients with mental illness when they had interruptions in their Medicaid coverage (17). Similarly, studies among Medicaid beneficiaries with breast cancer have found that the diagnostic stage and survival are better among persons who have Medicaid at the time of diagnosis than among those who obtain coverage after diagnosis (18, 19). Although these earlier studies found that serious health consequences were associated with interruptions in Medicaid coverage, the inferences that could be drawn from them are generally limited because of the studies’ cross-sectional designs, relatively small sample sizes, and inability to control for differences in the health status of persons with continuous versus interrupted coverage.

Our study builds on earlier ones that explored interruptions in Medicaid coverage by including a broader set of clinical diagnoses and a larger sample size. The link between patient discharge data and Medicaid eligibility files allowed us to look at the contribution of interrupted coverage over time.

The study has several limitations. First, we could not completely capture the insurance status for the group of patients that has interrupted Medicaid coverage. We know on a month-by-month basis whether a person is covered by Medicaid, but if that coverage is disrupted, we do not always know whether the person lost Medicaid coverage because he or she became uninsured or gained private

Table 3. Adjusted Risk for Hospitalization for an Ambulatory Care-Sensitive Condition among California Medicaid Beneficiaries Age 18 to 64 Years, 1998 to 2002*

Beneficiary Characteristic	Relative Risk (95% CI)
Interrupted coverage	3.66 (3.59–3.72)
Age	1.06 (1.06–1.06)
Female	1.04 (1.03–1.05)
Race/ethnicity	
White	1.00 (reference)
Hispanic	2.46 (2.40–2.52)
Black	4.44 (4.33–4.54)
Asian	0.79 (0.76–0.81)
Other†	2.78 (2.71–2.84)
Aid group	
TANF	1.00 (reference)
SSI	9.21 (9.07–9.35)
Other	1.81 (1.77–1.85)
Managed care	1.48 (1.46–1.50)
Other coverage	1.07 (1.06–1.09)

SSI = Supplementary Security Income; TANF = Temporary Assistance to Needy Families.

* In addition to adjustment for the variables listed, the model includes an indicator variable for year of admission. Confidence intervals are corrected for clustering of observations.

† Includes beneficiaries with missing information on race/ethnicity.

health insurance or some other type. The linked data set of Medicaid eligibility and statewide hospital discharges provided us with a unique insight into the subsequent insurance status of patients who once had Medicaid coverage. However, because only a small portion of beneficiaries are hospitalized, we cannot say with certainty whether the pattern of insurance coverage we observed in the hospitalized group is the same for all beneficiaries who lost Medicaid coverage.

Second, misclassification of persons with interrupted Medicaid coverage as being continuously covered was possible. Medicaid-eligible patients without insurance coverage who are hospitalized are sometimes given retroactive Medicaid coverage for up to 3 months that precede the hospitalization. The intention is to cover these individuals' health expenses that were presumed to have occurred before the hospitalization. Retroactive eligibility is most common among Medicaid beneficiaries in the medically needy aid category (20). We categorized medically needy beneficiaries in the aid group other than TANF or SSI, and by controlling for aid category in our analysis, we have reduced the effect of misclassification bias. Furthermore, retrospective coverage would result in our misattributing the hospitalizations for patients with interrupted coverage to those covered by Medicaid. Had we been able to identify these errors, we would expect that correcting them would only increase the difference in hospitalizations for ambulatory care-sensitive conditions we observed between patients with continuous Medicaid coverage and those whose coverage was interrupted.

Third, our findings are not from a randomized trial, and the results might be confounded by patients' health status or some other unmeasured difference in the groups. Assuming patients who have interrupted Medicaid coverage are more likely to have better health status (21), this would introduce a conservative bias toward finding higher rates of hospitalization among Medicaid beneficiaries with continuous coverage. Our analytic approach, however, minimizes this bias. Our study includes patients who have not experienced any interruption in coverage as well as those who have had some periods of interruption. We compared the hospitalization rates before and after the interruption in coverage among the subset experiencing an interruption. In this way, patients serve as their own controls. Furthermore, we control for Medicaid eligibility status that, to some degree, serves as a proxy for health status and determined that the addition of a comorbid condition measure to our analysis had no substantial impact on the results.

Fourth, we do not have any direct measures of use of ambulatory care service among patients who have and have not experienced an interruption in Medicaid coverage. Previous research has demonstrated that loss of health insurance is associated with fewer ambulatory care visits and less use of medication (22). The data available for this study do not include information on ambulatory care services, but

our analysis of TANF and SSI beneficiaries provides some insight. We found that even though SSI beneficiaries have a higher rate of hospitalizations for ambulatory care-sensitive conditions than that of TANF beneficiaries, the relative risk for a hospitalization for an ambulatory care-sensitive condition after an interruption in Medicaid coverage was substantially higher for TANF beneficiaries than for SSI beneficiaries. This is consistent with the fact that, unlike TANF beneficiaries, those eligible for Medicaid through SSI for the most part retain coverage for physician services through Medicare. The higher rate of hospitalizations for ambulatory care-sensitive conditions in SSI beneficiaries who have had an interruption in Medicaid coverage may largely reflect the loss of prescription drug coverage that was not available through Medicare at the time of this study, whereas the relatively greater increase in these hospitalizations for TANF beneficiaries in association with an interruption in Medicaid coverage represents a loss of both prescription and physician services.

Finally, our study examines retrospective data from only 1 state. However, approximately 1 in 6 Medicaid beneficiaries resided in California during our study period (23). We are not aware of any substantial changes in California's Medicaid policies since 2002 that would make the findings less relevant today. If anything, we suspect that interruptions in Medicaid coverage may have become more frequent in association with federal requirements for enhanced documentation of citizenship in association with pursuing eligibility for Medicaid (24).

There is a widespread recognition that too many U.S. citizens are uninsured. Although public insurance programs can make an important difference in reducing the number of uninsured persons, the success of these programs is also related to their administrative burden. Policies that reduce the frequency of interruptions in Medicaid coverage might prevent some of the health events that require hospitalization and trigger high-cost health care spending.

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Disclaimer: The views presented here are those of the authors and are not necessarily those of The Commonwealth Fund, its director, officers, or staff.

Acknowledgment: The authors thank the California Department of Health Care Services and the California Office of Statewide Health Planning and Development, who provided the linked data set used in this analysis; Professor Eric Vittinghof in the Department of Epidemiology and Biostatistics at the University of California, San Francisco, for his helpful comments in reviewing our analytic plan; and Lauren Davidson for her assistance in preparing this manuscript for publication.

Grant Support: By The Commonwealth Fund, a national, private foundation that supports independent research on health and social issues.

Potential Financial Conflicts of Interest: None disclosed.

Reproducible Research Statement: *Study protocol and statistical code:* Available from Dr. Bindman (e-mail, abindman@medsfgh.ucsf.edu). *Data set:* Available by request from the California Department of Health Care Services.

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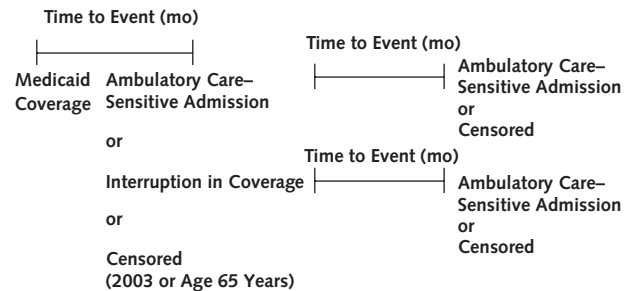
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Appendix Figure. Diagrammatic representation of repeatable events with time-varying covariates.



The exposure time starts on the first month of eligibility or at the beginning of the study period (1 January 1998) for beneficiaries who were already enrolled in the program. An exposure period ends with a hospitalization for an ambulatory care-sensitive condition, at the end of the study period (31 December 2002), with a person turning 65 years of age, or with an interruption in coverage. A new exposure time begins after an interruption in Medicaid eligibility or hospitalization for an ambulatory care-sensitive condition.