Medicaid Expansion and Mechanical Ventilation in Asthma, Chronic Obstructive Pulmonary Disease, and Heart Failure

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Abstract

Rationale: The Affordable Care Act's Medicaid expansion has led to increased access to chronic disease care among newly insured adults. Despite this, its effects on clinical outcomes, particularly for patients with asthma, chronic obstructive pulmonary disease, and heart failure, are uncertain.

Objectives: To assess whether Medicaid expansion was associated with changes in mechanical ventilation rates among hospitalized patients with heart failure, asthma, and chronic obstructive pulmonary disease.

Methods: Difference-in-differences analysis comparing discharge data from four states that expanded Medicaid in 2014 (Arizona, Iowa, New Jersey, and Washington) and three comparison states that did not (North Carolina, Nebraska, and Wisconsin) was performed. Models were adjusted for patient and hospital factors.

Results: Mechanical ventilation rates at baseline were 7.2% in nonexpansion states and 8.8% in expansion states. Medicaid expansion was associated with a decline in mechanical ventilation rates at -0.2% per quarter (95% confidence interval [CI], -0.3% to 0.0% ; $P = 0.010$). We did not observe a change in the rate of ICU admission (-0.4% per quarter; 95% CI, -0.8% to 0.1% ; $P = 0.10$) or in-hospital mortality (0.1% per quarter; 95% CI, 0.0% to 0.1% ; $P = 0.30$). In a negative control among adults aged 65 years or older, changes in mechanical ventilation rates were similar, though the CIs crossed zero (-0.1% ; 95% CI, -0.2% to 0.0% ; $P = 0.08$).

Conclusions: Medicaid expansion may have been associated with a decline in mechanical ventilation rates among uninsured and Medicaid-covered patients admitted with heart failure, chronic obstructive pulmonary disease, and asthma.

Keywords: asthma; chronic obstructive pulmonary disease; health policy; heart failure; insurance

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Severe exacerbation of asthma, chronic obstructive pulmonary disease (COPD), and congestive heart failure (CHF) are common causes of intensive care unit (ICU) admission and mechanical ventilation (1, 2). However, early, accessible ambulatory treatment may improve disease control among these patients, reducing the rate of downstream complications (3–8). By expanding eligibility criteria for Medicaid, the Affordable Care Act (ACA) enhanced access to ambulatory care for lower-income adults, leading to increased use of primary and preventive care and better access to routine chronic disease management (9–13). Despite improved access to ambulatory care, it is uncertain whether the ACA's Medicaid expansion translated into improvements in clinical outcomes among these or other patients.

Several studies of insurance expansion have reported declining use of emergency department (ED) or inpatient care among newly insured adults (14, 15). Other studies reported stable or increased rates of ED and inpatient use (10, 12, 16–19). Together with methodological differences, these conflicting results have been attributed to differences in care-seeking behavior among patient populations, health plan coverage features, and wide practice variation among ED and ambulatory providers surrounding the decision to admit patients or refer them for emergency care (20). For asthma, COPD, and CHF, the decision to mechanically ventilate a patient is less susceptible to financial pressures or patient and provider discretion than ED referrals or hospital admissions and so may be a valuable lens for evaluating complex policy changes.

This study tested the hypothesis that rates of mechanical ventilation declined among uninsured or Medicaid-covered patients with asthma, COPD, and CHF after Medicaid expansion. To test this hypothesis, this study used variation among states in adoption of the ACA's Medicaid expansion as a natural experiment in a difference-in-differences study design. It further evaluated changing rates of insurance coverage, ICU admission, hospital length of stay, and mortality among patients hospitalized with these conditions after Medicaid expansion. Some of these results were reported previously in the form of an abstract (21).

Methods

Data Sources and Population

We conducted a retrospective cohort study using hospital discharge records from seven states between January 1, 2012, and September 30, 2015. Admissions during the fourth quarter of 2015 were excluded to avoid introducing misclassification stemming from the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM), to ICD-10 transition, which took place on October 1, 2015. Hospital discharge data were obtained from the Healthcare Cost and Utilization Project's State Inpatient Databases, maintained by the Agency for Healthcare Research and Quality. The State Inpatient Databases include more than 95% of hospital discharges from hospitals in participating states (22). Hospital characteristics were obtained from the American Hospital Association's annual surveys from 2012 to 2015 (23). U.S. Census annual population estimates from 2012 to 2015 were used to obtain annual state populations (24). Data from the Health Resources and Services Administration's Area Health Resource File were used to adjust for changing health resources and population characteristics (25).

Selection of Study States

Patients admitted in Arizona, Iowa, Nebraska, New Jersey, North Carolina, Washington, and Wisconsin were eligible for inclusion in the study. Arizona, Iowa, New Jersey, and Washington implemented the ACA's Medicaid expansion on January 1, 2014, increasing eligibility limits to 138% of the federal poverty level among childless adults (26). Nebraska, North Carolina, and Wisconsin did not enact the ACA's Medicaid expansion, although Wisconsin had previously obtained a federal waiver to implement a more modest expansion up to 100% of the federal poverty level (27).

Medicaid expansion was adopted heterogeneously across the country, with nearly all states in the northeastern and western United States expanding Medicaid coverage and nearly all states in the southern and southeastern United States opting not to expand Medicaid coverage (28). Included states were selected to be both representative of the underlying population of Medicaid expansion and nonexpansion states and, when possible, similar across selected

demographic, coverage-related, and economic factors (see Table E1 in the online supplement).

Patient Selection

Patients were included if they were between the ages of 19 and 64 and admitted to an acute care hospital with asthma, COPD, or CHF. This age group was selected because individuals younger than 19 qualify for the Children's Health Insurance Program, and adults aged 65 years or older are eligible for Medicare coverage. As a result, individuals aged 19–64 years were the principal beneficiaries of the ACA's Medicaid expansion. ICD-9-CM codes were used to identify asthma, COPD, and CHF as primary diagnoses or as secondary diagnoses with acute respiratory failure as the primary diagnosis (Table E2). These conditions were selected because they are common causes of ICU admission and mechanical ventilation, can present with a wide range of severity, and have previously been characterized by the Agency for Healthcare Research and Quality as being sensitive to early, effective ambulatory care (29).

Variable Definitions

The primary outcome of interest was mechanical ventilation, defined using the presence of ICD-9-CM procedure code 96.7x for invasive mechanical ventilation (30). Because the Medicaid expansion began in January 2014, January 2012 to December 2013 was considered the preexpansion period, and January 2014 to September 2015 was considered the postexpansion period. Patients admitted in Arizona, Iowa, New Jersey, and Washington were included in the Medicaid expansion group, and patients admitted in North Carolina, Nebraska, and Wisconsin were assigned to the nonexpansion (control) group. Although postintervention data were limited to 21 months after the start of Medicaid expansion, Arizona, Iowa, New Jersey, and Washington, experienced a significant early increase in Medicaid enrollment within the first 6 months of 2014 (19, 21, 20, and 37 percentage points above their preexpansion averages, respectively) (31).

Statistical Analysis

Prior studies have revealed declining mechanical ventilation rates over time among patients with CHF and COPD (32). As a result, a difference-in-differences

design was used to evaluate the effects of Medicaid expansion in the context of preexisting secular trends (33). The difference-in-differences estimator was obtained from regression models by examining the interaction between a variable indicating assignment to the intervention group (Medicaid expansion) and a linear variable indicating time after Medicaid expansion in quarter-years (*see* online supplement for detailed methods). This estimator corresponded to the quarterly change in each outcome among expansion states after subtracting the change in nonexpansion states and any preintervention trends; it can be interpreted as the change in rates of an outcome in expansion states over rates in those states if they had not expanded Medicaid, based on the experience of nonexpansion states. We used logistic regression with robust variance estimates and clustering of observations at the hospital level for binary outcomes (with a value of 1 indicating presence of each outcome) and linear regression for length of stay.

Several secondary outcomes, including ICU admission, in-hospital mortality, length of stay, and discharge destination, were also evaluated. ICU admission was ascertained through relevant revenue center codes (34). Because Arizona combined intensive and intermediate care (e.g., step-down care) in its revenue center charge data, it was excluded from the analysis of ICU admission. Insurance coverage was defined using the primary payer variable.

Because changing hospital admission practices may confound the relationship between inpatient mechanical ventilation rates and Medicaid expansion, *per capita* hospitalization rates for asthma, COPD, and CHF were plotted over time and examined by state expansion status. State-level *per capita* hospital admission rates were included as covariates in each regression model. In addition, all models were adjusted for several patient, hospital, and regional factors, including age, sex, zip code income quartile, Elixhauser comorbidities, hospital size, hospital teaching status, ICU capacity, nurse/patient ratios, rural/urban status, *per capita* income, rates of high school graduation, and *per capita* rates of primary care physicians (Appendix E1) (35). Scatterplots employed locally weighted scatterplot smoothing to account for seasonal differences (36).

Sensitivity Analyses

We performed several sensitivity analyses to examine the robustness of our findings. First, we conducted a falsification test—or negative control—among adults aged 65 years or older to examine whether declining mechanical ventilation rates were related to Medicaid expansion or contemporaneous policy or practice changes. Because this population was not the principal target of Medicaid expansion, a positive result in this group would suggest that other simultaneous changes may have been occurring. Second, to account for changing patterns in the use of noninvasive ventilation (NIV) for asthma, COPD, and CHF, we repeated our analysis including NIV (ICD-9-CM code 93.90) in the definition of mechanical ventilation. Third, to determine how sensitive our findings were to our selection of control states, we repeated the analysis by limiting our control group to North Carolina, Nebraska, and Wisconsin individually and again using each possible two-state combination of North Carolina, Nebraska, and Wisconsin. Fourth, we performed our analysis including only Iowa (expansion) and Nebraska (nonexpansion), given their close geographic proximity and resulting face validity as intervention and control states. Finally, to examine whether our findings were sensitive to our modeling approach, we collapsed the data into quarterly observations at the state level and performed a state-level analysis with *per capita* mechanical ventilation rate as the dependent variable (*see* online supplement for further methodological details).

All analyses were performed using SAS 9.4 (SAS Institute Inc.) and Stata 14.2 (StataCorp) software. All tests were two tailed, and $P < 0.05$ was considered statistically significant. Because this study used publicly available, deidentified data, the project was deemed exempt from full review by the institutional review board at the University of Michigan (HUM00134111).

Results

The study cohort included 62,346 patients admitted to 609 hospitals. Before Medicaid expansion, patients in expansion states tended to be slightly older, were more likely to be in a higher income quartile, and had

slightly fewer comorbidities (Table 1). Over the two years before expansion, baseline rates of mechanical ventilation were lower in nonexpansion states than in expansion states (7.2% vs. 8.8%). Baseline rates of respiratory failure were higher in nonexpansion states than in expansion states (29.4% vs. 26.4%). There were no differences in baseline rates of ICU admission (19.5% in nonexpansion states and 20.2% in expansion states) and in-hospital mortality (1.7% in both nonexpansion and expansion states). Hospitals in nonexpansion states were smaller than those in expansion states (58.5% vs. 50.2% with ≤ 100 beds, respectively) (Table E3). There were no differences between hospitals in nonexpansion and expansion states in median annual patient volume (8,233 and 8,647, respectively).

Inpatient Payer Composition

Rates of uninsurance among hospitalized patients with asthma, COPD, and CHF declined in expansion states, from 12.3% before expansion to 4.4% after expansion (Figure 1). Meanwhile, rates of Medicaid coverage in these states increased from 20.2% to 29.8% after expansion. In nonexpansion states, there were smaller changes in rates of uninsurance (10.6–8.8%) and Medicaid coverage (23.3–24.0%). Difference-in-differences analysis revealed an association between Medicaid expansion and increasing rates of insurance coverage among hospitalized adults by 1.6% per quarter (95% confidence interval [CI], 1.4% to 1.9%; $P < 0.001$) (Table 2).

Mechanical Ventilation, ICU Admission, Length of Stay, and Mortality

We did not observe differences in the preexpansion trend in mechanical ventilation between states that expanded Medicaid and states that did not expand Medicaid ($P = 0.62$) (*see* online supplement), thereby satisfying the parallel trends assumption during the preexpansion period. Unadjusted mechanical ventilation rates in expansion states declined from 8.8% in the first quarter of 2013 to 8.4% in the first quarter of 2015, though this decline was not statistically significant ($P = 0.19$). During the same interval, unadjusted mechanical ventilation rates increased by a small amount in nonexpansion states (from 7.8%

Table 1. Characteristics and outcomes among uninsured or Medicaid-covered patients in the preexpansion period

	Nonexpansion States (n = 28,820)	Expansion States (n = 33,526)
Age group, %		
19–34 yr	10.5	12.0
35–44 yr	15.4	14.6
45–54 yr	35.7	33.8
55–64 yr	38.4	39.6
Diagnosis, %		
Asthma or COPD	62.0	63.2
CHF	38.0	36.8
Female sex, %	56.5	52.8
Primary insurer, %		
Medicaid	68.7	62.2
Uninsured/self-pay	31.3	37.8
Zip code income quartile, %		
First quartile (lowest)	50.7	33.1
Second quartile	34.7	26.7
Third quartile	11.4	24.2
Fourth quartile (highest)	3.2	16.0
Elixhauser comorbidities, %		
0	5.6	8.9
1	12.2	13.8
2	17.5	17.0
3	18.7	17.2
≥6	46.1	43.1
Discharge disposition, %		
Home	79.1	79.6
Rehabilitation, nursing, or long-term acute care facility	4.2	5.7
Outcomes, %		
Mechanical ventilation	7.2	8.8
Intensive care unit admission*	19.5	20.2
Respiratory failure	29.4	26.4
In-hospital mortality	1.4	1.4

Definition of abbreviations: CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease.

Values are pooled across all quarters before expansion and across expansion status. Expansion states included Arizona, Iowa, New Jersey, and Washington. Nonexpansion states included Nebraska, North Carolina, and Wisconsin.

*Arizona did not report intensive care unit (ICU)-specific revenue center codes and so was excluded from analyses involving ICU admission.

to 8.5%; $P = 0.07$), though this increase was not statistically significant (Figure 2). In the fully adjusted difference-in-differences models, Medicaid expansion was associated with a decline in mechanical ventilation rates by -0.2% per quarter-year (95% CI, -0.3% to 0.0% ; $P = 0.010$) (Table 2). We also observed slightly shorter lengths of stay associated with Medicaid expansion (-0.05 days per quarter; 95% CI, -0.08 to -0.01 d; $P = 0.006$). We did not observe a significant association between Medicaid expansion and rates of ICU admission or in-hospital mortality (-0.4% per quarter; 95% CI, -0.8% to 0.1% ; $P = 0.10$; and 0.1% per quarter; 95% CI, 0.0% to 0.1% ; $P = 0.30$, respectively).

Discharge Destination

We did not observe differences in rates of discharge to home (0.0% per quarter; 95% CI, -0.3% to 0.3% ; $P = 0.89$) or discharge to nursing or other facilities (-0.1% per quarter; 95% CI, -0.2% to 0.0% ; $P = 0.15$) in expansion relative to nonexpansion states (Table E4).

Per Capita Hospital Admission Rates

Admission rates for asthma, COPD, and CHF decreased slightly in expansion states (56.3 per 100,000 to 54.3 per 100,000) between the first quarter of 2013 and the first quarter of 2015. In the same period, admission rates remained the same in nonexpansion states (65.4 per 100,000 to

65.3 per 100,000) (Figure 3). We did not observe a difference in these trends over time between expansion and nonexpansion states (P value for interaction = 0.49).

Sensitivity Analyses

In a falsification test among adults aged 65 years and older, the risk difference was in the same direction as our primary analysis among those aged 19–64, though it did not meet statistical significance, owing to a wider CI (annual risk difference, -0.1% ; 95% CI, -0.2% to 0.00% ; $P = 0.08$) (Table 2). After we included NIV in the definition of mechanical ventilation, difference-in-differences analysis revealed a similar association between Medicaid expansion and declining mechanical ventilation rates (-0.4% ; 95% CI, -0.7% to -0.1% ; $P = 0.016$).

When we varied our selection of control states, we found that Medicaid expansion was associated with lower rates of mechanical ventilation in each of the analyses (range, -0.04% to -0.20% per quarter after Medicaid expansion) (Table E5). Similarly, in comparing only Iowa (expansion) and Nebraska (nonexpansion), the two most geographically aligned pair of states in our study, we observed a -0.20% quarterly difference in mechanical ventilation in Iowa versus Nebraska associated with Medicaid expansion (95% CI, -0.22% to -0.18% ; $P < 0.001$) (Table E6).

We next performed a state-level analysis of *per capita* mechanical ventilation rates for asthma, COPD, and CHF. In our unadjusted analysis, we observed fewer cases of mechanical ventilation in expansion states after Medicaid expansion (-0.61 cases per 100,000 people; 95% CI, -1.06 to -0.16 ; $P = 0.008$). After adjusting for characteristics of admitted patients (comorbidities, age, zip code income quartiles, and sex) and area health resources (*per capita* income, rates of high school graduation, and *per capita* rates of primary care physician), we again found a -1.23 per 100,000 decline in cases of mechanical ventilation associated with Medicaid expansion (95% CI, -2.27 to -0.20 ; $P = 0.019$) (Table E7).

Discussion

We report results suggesting that Medicaid expansion may have been associated with a

Figure 1. Inpatient payer composition, by expansion status and time period. Uninsurance declined after Medicaid expansion in expansion states.

decline in mechanical ventilation rates among adults admitted with asthma, COPD, or CHF. Coincident with this trend, we observed an increase in insurance coverage among patients admitted in Medicaid expansion states versus nonexpansion states.

There are several potential explanations for our observed decline in mechanical ventilation rates associated with Medicaid expansion (Figure E1). By reducing rates of uninsurance and increasing rates of

Medicaid coverage in expansion states, Medicaid expansion in general led to an increase in the use of both primary care and preventive services (11, 12, 37), greater access to and use of prescription medications (38, 39), and fewer financial barriers to accessing ED and hospital care (18, 40). We speculate that this may have led to both earlier presentation to the hospital (18, 40, 41) and lower rates of severe illness owing to better disease control (42, 43).

Table 2. Changes in insurance coverage and health outcomes after the Affordable Care Act Medicaid expansion

	Net Change per Quarter after Medicaid Expansion (%; [95% CI])	P Value
Patients with any insurer		
Insurance coverage, %	1.6 (1.4 to 1.9)	<0.001
Mechanical ventilation rate, %	−0.2 (−0.3 to 0.0)	0.010
ICU admission, %	−0.4 (−0.8 to 0.1)	0.10
Length of stay, d	−0.05 (−0.08 to −0.01)	0.006
In-hospital mortality, %	0.00 (0.0 to 0.1)	0.30
Sensitivity analyses		
Mechanical ventilation rates among patients aged ≥65 yr, %	−0.1 (−0.2 to 0.0)	0.08
Mechanical ventilation and noninvasive ventilation rates, %	−0.4 (−0.7 to −0.1)	0.016

Definition of abbreviations: CI = confidence interval; ICU = intensive care unit.

All analyses are adjusted for baseline differences between expansion and nonexpansion rates, preexisting secular trends, patient-level factors (sex, age, comorbidities, zip code median income quartile), hospital-level factors (size, ICU capacity, nursing workforce, teaching status), state-level annual hospital admission rates, and area health resources (*per capita* income, rates of high school graduation, and *per capita* rates of primary care physicians). Expansion states included Arizona, Iowa, New Jersey, and Washington. Nonexpansion states included Nebraska, North Carolina, and Wisconsin. Arizona did not report ICU-specific revenue center codes and so was excluded from analyses involving ICU admission.

A second potential explanation for these observations is the differential enactment of other policy changes across states, either as a result of the ACA or otherwise coinciding with the ACA's Medicaid expansion. Though our falsification test was not statistically significant, the direction and magnitude of the result suggest that other state-level improvements in care may have occurred in expansion states simultaneously with Medicaid expansion. The absence of a statistically significant trend in postexpansion mechanical ventilation rates among patients in nonexpansion states, meanwhile, suggests that the effect may have been limited to those states adopting Medicaid expansion.

Our study did not identify significant changes in the underlying admission rates between expansion and nonexpansion states. Although this is in line with prior studies examining hospital use after Medicaid expansion, it is in contrast to our primary finding of declining mechanical ventilation rates (44–46). This may be because earlier presentation to the hospital was more important than improved disease control as a driver of decreased mechanical ventilation rates. Alternatively, increased coverage has led to decreased rates of uncompensated care (45, 46) and lower financial pressures among hospitals to avoid potentially discretionary services (47, 48). These factors may have combined to increase discretionary use of the hospital, leading to no net change in total hospitalizations despite the declining rate of mechanical ventilation (17, 46). Further work using detailed patient-level clinical and coverage data may be able to examine these methods in more detail.

The results of this study differ from those of a prior study that did not find differences in ICU use rates after Massachusetts health reform (49). One possible reason for these differing findings include the prior study's use of all-cause ICU admission as its primary outcome, which may have masked changes among patients admitted with ambulatory care-sensitive conditions such as the conditions studied in our analysis. Second, the differences between baseline rates of uninsurance in Massachusetts (which were far lower than the national average) and those of other states may have limited the potential benefit of insurance expansion in Massachusetts. Third, several prior studies have revealed

Figure 2. Unadjusted mechanical ventilation rates among admitted patients, by expansion status. Mechanical ventilation rates declined after Medicaid expansion in expansion states. Locally weighted scatterplot smoothing was applied to account for seasonal variation. The vertical line indicates the transition from the preexpansion period to the postexpansion period.

widespread variability in ICU use across hospitals, especially among patients with low expected mortality (50–52). This variability may have decreased our effective power to identify small differences in ICU admission rates (50, 53). Finally, ICU use

may be susceptible to changes in supply; as a result, declines in ICU admission for some preventable conditions may have led to an increase in discretionary use for other conditions (e.g., post-procedure observation) (54, 55).

Figure 3. Unadjusted *per capita* asthma, chronic obstructive pulmonary disease, and congestive heart failure admissions, by expansion status and admission quarter. Hospital admission rates did not differ between expansion and nonexpansion states after Medicaid expansion. Locally weighted scatterplot smoothing was applied to account for seasonal variation. The vertical line indicates the transition from the preexpansion period to the postexpansion period.

Notably, we did not observe a difference in mortality between expansion and nonexpansion states despite the decline in mechanical ventilation. One potential explanation for this finding is that a mortality difference exists between expansion and nonexpansion states, though our study was underpowered to identify this difference. Alternatively, the hospitalizations resulting in death may represent a clinical entity (e.g., more advanced disease) distinct from others that results in mechanical ventilation and may not be amenable to better access to ambulatory care or other changes that occurred under Medicaid expansion.

This study should be interpreted in the context of several limitations. First, it was limited to seven states, and so the significant declines in mechanical ventilation rates may not be generalizable to other states, particularly among states that differed in baseline rates of uninsurance. Nonetheless, the selected states included a large population of patients spanning multiple regions, and our analyses adjusted for differences in patient and hospital characteristics across states. Second, administrative data have inherent limitations, including incomplete risk adjustment and potential misclassification when using ICD-9-CM codes to identify diagnoses and procedures such as mechanical ventilation and NIV. In particular, studies validating administrative codes for mechanical ventilation against chart review have revealed good specificity but low sensitivity (56). Imperfect sensitivity may have led our study to underestimate the effects of Medicaid expansion on rates of administrative coding for mechanical ventilation or confound our observed relationships if rates of coding for mechanical ventilation changed differently between expansion and nonexpansion states over time. Meanwhile, there have been no published studies validating administrative codes for NIV in adults. Though we present the results of a sensitivity analysis that includes NIV in our definition of mechanical ventilation, variations in administrative coding for NIV across hospitals may reduce our ability to reject differential rates of NIV adoption as influencing our observed associations. Third, this study identified Medicaid expansion at the state level and could not differentiate patients who gained Medicaid coverage under Medicaid expansion from

those who previously held it or those who moved to Medicaid insurance from private insurance. As a result, this study is subject to the ecological fallacy when ascribing declines in mechanical ventilation to gains in insurance coverage (57). Despite this concern, the summed proportion of uninsured and Medicaid-covered patients admitted to the hospital remained consistent across the study period, and prior studies have revealed gains in Medicaid coverage among previously uninsured adults after Medicaid expansion (10). Finally, the present study was limited to three diagnoses (asthma, COPD, and CHF), which were selected because they were common indications for mechanical

ventilation and have been identified as conditions in which severe illness can be avoided with effective ambulatory care. Additional research is needed to clarify whether these trends apply to other diagnoses.

Despite these limitations, this study has several potential implications. First, this study is consistent with prior research suggesting that chronic disease care improved after Medicaid expansion. Second, though most work examining the effects of complex policies on healthcare use have used hospital admissions and ED visits as markers of ambulatory care access and quality, this work used mechanical ventilation as an alternative measure of

underlying health status that may be less susceptible to discretionary patient and provider decision making.

Taken together, this study suggests that states expanding Medicaid may have experienced a decline in mechanical ventilation rates among patients hospitalized with asthma, COPD, and CHF. Further work is needed to explore whether this effect is evident in other states and for other conditions, examine potential mechanisms for this decline, and confirm the persistence of these findings over time. ■

Author disclosures are available with the text of this article at www.atsjournals.org.

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