

Establishing Medicaid incentives for liberating nursing home patients from ventilators

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Funding information

This study was funded by Tennessee's Medicaid program (TennCare) through a Centers for Medicaid and Medicare Services State Innovations Model grant. Training grants from the National Institute on Aging (K01AG058700), the National Heart, Lung, and Blood Institute (T32HL087738, K23AG052603), and the Arthur and Lisa Wheeler Critical Care Research Grant have funded individual effort for Dr. Keohane, Dr. Makam, and Dr. Mart.

Abstract

Background: Chronic ventilator use in Tennessee nursing homes surged following 2010 increases in respiratory care payment rates. Tennessee's Medicaid program implemented multiple policies between 2014 and 2017 to promote ventilator liberation in 11 nursing homes, including quality reporting, on-site monitoring, and pay-for-performance incentives.

Methods: Using repeated cross-sectional analysis of Medicare and Medicaid nursing home claims (2011–2017), hospital discharge records (2010–2017), and nursing home quality reports (2015–2017), we examined how service use changed as Tennessee implemented policies designed to promote ventilator liberation in nursing homes. We measured the annual number of nursing home patients with ventilator-related service use; discharge destination of ventilated inpatients and percent of nursing home patients liberated from ventilators.

Results: Between 2011 and 2014, the number of Medicare SNF and Medicaid nursing home patients with ventilator use increased more than sixfold. Among inpatients with prolonged mechanical ventilation, discharges to home decreased as discharges to nursing homes increased.

As Tennessee implemented policy changes, ventilator-related service use moderately declined in nursing homes from a peak of 198 ventilated Medicare SNF patients in 2014 to 125 in 2017 and from 182 Medicaid patients with chronic ventilator use in 2014 to 145 patients in 2017. Nursing home weaning rates peaked at 49%–52% in 2015 and 2016, but declined to 26% by late 2017. Median number of days from admission to wean declined from 81 to 37 days.

Conclusions: This value-based approach demonstrates the importance of designing payment models that target key patient outcomes like ventilator liberation.

KEYWORDS

Medicaid, Medicare, nursing homes, prolonged mechanical ventilation, ventilator liberation

Patients with prolonged mechanical ventilation (PMV) face multiple care transitions once stable enough to be managed outside an intensive care unit (ICU).¹ Alternate care settings include nursing home ventilator units that provide skilled nursing facility (SNF), rehabilitative services, and long-term residential care.^{2–4} Inpatients with PMV are more likely to be discharged to long-term acute care hospitals (LTACs) than SNFs, but several regions have limited LTAC availability.⁵ Nursing homes in the United States averaged approximately 8200 patients with mechanical ventilation per quarter in 2019.⁶

Few studies examine ventilated nursing home patients.^{2,7} With Medicare and Medicaid as the primary funders of post-acute and long-term nursing home services, these facilities face mixed financial incentives to devote resources to ventilator weaning rather than chronic ventilator care. Nursing homes receive higher Medicare SNF payments and in 37 states higher Medicaid payments⁸ for ventilated patients, but further steps may be needed to promote quality of care.

Recent policy changes in Tennessee demonstrate the complexity of determining appropriate financial incentives for ventilated nursing home patients. Following 2010 changes that increased Medicare and Medicaid nursing home payment rates for respiratory care, the number of Tennessee Medicaid nursing home patients with chronic ventilator use surged.⁹ In addition to straining Tennessee's Medicaid budget, this trend prompted concerns about missed opportunities to liberate patients from ventilators. In response, Tennessee implemented several measures to improve the quality of ventilator-related services in nursing homes, including pay-for-performance incentives, technical assistance, and on-site monitoring.

Using patient-level data, we analyzed how Medicare and Medicaid ventilator-related service use in nursing homes, and associated spending, changed from 2011 to 2017 as Tennessee implemented changes. Among all inpatients with PMV, we examined whether the prevalence of discharges to nursing homes changed relative to other settings. Using provider-reported quality measures for 2015–2017, we analyzed nursing homes' ventilator liberation rates. This study provides rare insight into an innovative quality improvement approach for ventilated patients.

Key Points

- Medicaid and Medicare are the main funders of long-term and post-acute services, respectively, for ventilated nursing home patients.
- Chronic ventilator use in nursing homes declined as Tennessee's Medicaid program implemented quality reporting, on-site monitoring, and pay-for-performance incentives to promote ventilator liberation.
- Declines in ventilator service use were observed in both Medicare and Medicaid claims even though this initiative affected only Medicaid policies.

Why Does this Paper Matter?

- To prevent unnecessary delays in ventilator liberation, Medicaid and Medicare policies should be designed to promote better quality of respiratory services in nursing homes.

METHODS

Tennessee's Enhanced Respiratory Care program

In 2002, Tennessee's Medicaid program, TennCare, launched the Enhanced Respiratory Care (ERC) program in three nursing homes that directly negotiated payment rates with TennCare. When TennCare required managed care provision of long-term services and supports in 2010, TennCare established service-specific statewide per diem ERC payment rates.⁹ Ventilator weaning had the highest rates, followed by chronic ventilator care and tracheal suctioning for patients with tracheostomies (Table S1). This change coincided with increased SNF payments for traditional Medicare patients with ventilators or tracheostomies.¹⁰ Subsequently, eight additional nursing home ventilator units opened and chronic ventilator use in nursing homes

increased, prompting concerns about escalating Medicaid spending and missed opportunities for ventilator liberation.⁹

In response, TennCare reformed the ERC program with funding from the Centers for Medicare and Medicaid (CMS) State Innovations Model program. To design and implement changes, the state partnered with respiratory therapists from Eventa Inc, a consulting company specializing in post-acute respiratory care that was founded by clinicians who managed Tennessee's original nursing home ventilator units. In January 2014, TennCare implemented a moratorium on new ERC providers and notified existing ERC nursing homes that mandatory quality reporting would be implemented.⁹ In late 2014, nursing homes began reporting patient-level quality indicators for all ERC patients (regardless of payer), including use of weaning or chronic ventilator services, weaning rates, use of respiratory care technologies, and unanticipated hospitalizations and deaths.¹¹ To comply with a new state requirement for managed care plans to provide on-site quality monitoring by July 2015, Tennessee's Medicaid managed care plans contracted with Eventa to conduct approximately weekly visits that included reviewing treatment plans and providing advice. Eventa's clinical approach was modeled after best practices in the intensive care unit, including regular assessment for ventilator discontinuation, spontaneous breathing trials, and weaning protocols implemented by bedside respiratory therapists.

TennCare implemented a pay-for-performance system in July 2016 where ERC nursing homes received higher reimbursement rates for better performance, such as higher ventilator liberation rates (detailed in Table S2). TennCare previously paid higher rates for weaning services versus chronic ventilator care, and the new payment approach widened the difference in payment rates for these services (Table S1). Tracheal suctioning reimbursement is split into two categories: subacute (provided for up to a month post-weaning) and secretion management (provided to patients who met monthly authorization requirements). One new rule applied to out-of-state patients: Before admission, nursing homes had to arrange Medicaid coverage from a patient's state of residence. Effective January 2017, TennCare revised ERC standards of care and required facilities to provide medical direction by a physician with pulmonary or critical care medicine board certification, document a clinical evaluation of appropriate nursing home placement, provide continuous pulse oximetry and other routine monitoring, develop an emergency preparedness plan for ERC patients, and establish a written ERC staff training program.⁹

Study data

To measure ventilator-related service use in nursing homes from 2011 to 2017, we analyzed claims from TennCare's managed care plans and traditional Medicare SNF claims for Tennessee residents. A nursing home ventilator unit can provide services in both programs. For dual-eligible beneficiaries transferring from an acute care hospital or LTAC, the initial 100 days may be covered by Medicare SNF benefits. If a dual-eligible beneficiary remains as a long-stay resident, then Medicaid becomes the primary payer. For Medicaid-only beneficiaries, Medicaid covers rehabilitative and long-term residential services. We measured use in both programs to understand the full extent of services provided by nursing homes.

TennCare and Medicare enrollment data detailed patients' demographic characteristics. Tennessee vital statistics data linked to TennCare claims data provided mortality information for TennCare ERC service users. To assess changes in discharge patterns from 2010 to 2017 among inpatients receiving PMV, we analyzed Tennessee hospital discharge records for all payer sources. We also analyzed 2015–2017 patient-level data submitted monthly by ERC providers after the implementation of mandatory quality reporting for all patients receiving ventilator-related services, regardless of payer source.

Study population and measures

Analyses of ventilator-related Medicaid nursing home use included all TennCare members age 18 and above with any use of chronic ventilator care, ventilator weaning, or tracheal suctioning services in a year based on ERC billing and procedure codes. "Tracheal suctioning" refers to all forms of this service, including the subacute and secretion management categories established in 2016.

Medicare SNF analyses included traditional Medicare beneficiaries age 18 and above treated at Tennessee nursing homes and Tennessee residents treated at out-of-state nursing homes. Resource Utilization Group (RUG) codes identified patients with a ventilator and tracheostomy (ES3) or ventilator or tracheostomy (ES2). Because nursing homes generally do not admit ventilated patients without a tracheostomy, we assumed all ES2 beneficiaries had a tracheostomy only.

To examine inpatients most likely to be discharged on a ventilator, we identified all inpatients age 18 and over-discharged from Tennessee hospitals with at least a 4-day stay and a diagnosis code indicating continuous mechanical ventilator use for at least 96 h while hospitalized. We cannot determine whether patients were still ventilated when discharged. Provider identifiers categorized

hospitals as LTACs or general acute care hospitals. Discharge destination codes identified discharge status: death or discharge to SNF or nursing home, LTAC, home, or other. We annually summarized the mean length of inpatient stay by discharge destination.

Provider-reported quality measures included all patients receiving ERC-related services in ERC nursing homes, including non-TennCare patients. Ventilator users were identified based on having at least 1 day of chronic ventilator or weaning service use. TennCare reporting requirements stated that patients had to be liberated from a ventilator for at least 7 days before being counted as a successful wean. We measured the percentage of patients weaned within 180 days of admission date. Measurement is at a patient-nursing home level; a patient with admissions to distinct nursing homes counted towards each facility's denominator.

By linking Tennessee vital statistics data and TennCare records, we measured the percentage of TennCare ERC patients who died in any setting (including out of the nursing home) within 180 or 365 days of their first

ERC service claim. This measure is reported annually based on the initial ERC claim date.

Analysis approach

To describe how service use changed as ERC policies changed, we present annual trends from 2011 to 2017 on the number of Medicare and Medicaid beneficiaries with ventilator or tracheostomy-related services use in nursing homes and the associated spending.

For patients who used ventilator-related services in Medicare or Medicaid, we report and test for statistically significant differences in demographic characteristics in the year reforms began (2014) and the final study year (2017). For Medicare beneficiaries, we report any dual participation in Medicaid or, because residence affects Medicaid eligibility, any out-of-state residence during the year.

Trends in discharge destination and length of stay for Tennessee inpatients with PMV are reported annually

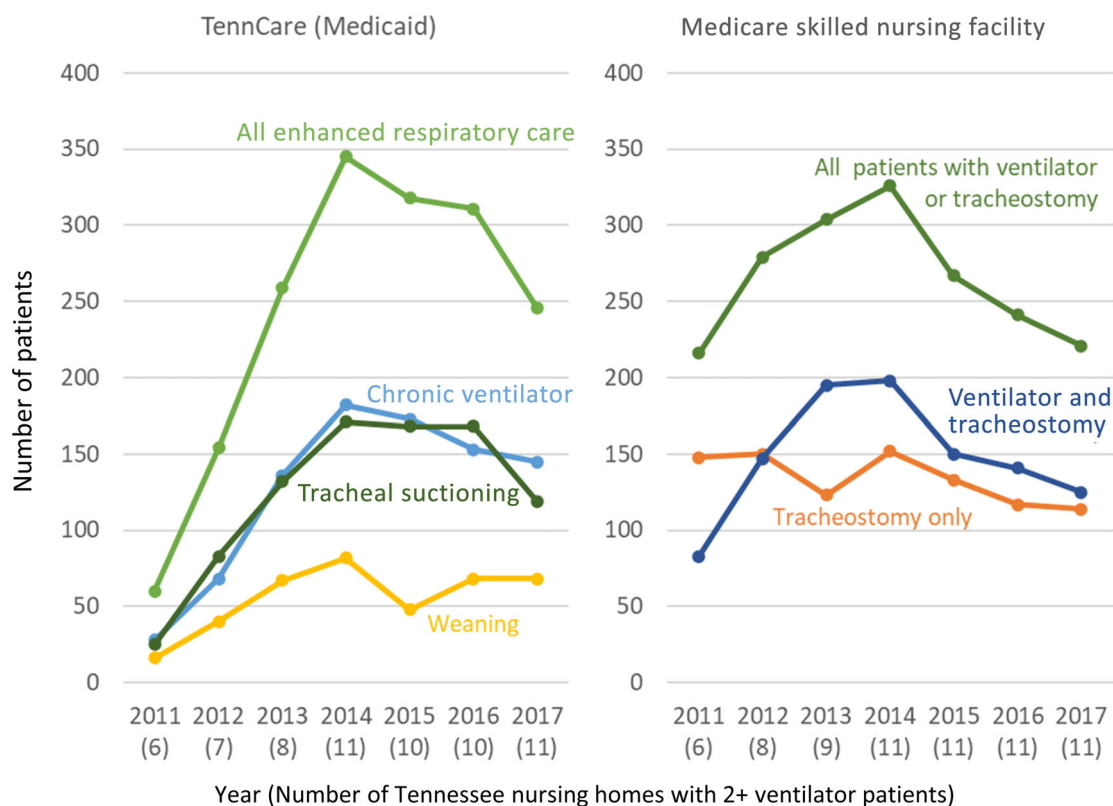


FIGURE 1 Number of Medicare and Medicaid members with ventilator or tracheostomy-related service use in Tennessee nursing homes, 2011–2017. Authors' analysis of TennCare Medicaid claims (Panel A) and traditional Medicare skilled nursing claims (Panel B). Because patients can receive more than one type of ventilator-related service per year, the number of patients with each type of service sums to more than the total number of unique patients with any services use. Number of nursing homes reports the number of Tennessee nursing homes that had at least two patients in a given year for TennCare chronic ventilator services (Panel A) or for Medicare ventilator and tracheostomy services (Panel B)

from 2010 to 2017, separately for acute care hospitals and LTACs. Using ordinary least squares regression, we tested whether changes in inpatient length stay between 2010 and 2017 were larger for patients discharged to nursing homes versus other destinations.

Finally, among patients admitted to ERC nursing homes in 2015–2017, we presented quarterly measures of the percentage of patients weaned within 180 days of admission and, among all patients liberated from ventilators, the median number of days from admission to weaning.

RESULTS

Service use in nursing homes

From 2011 to 2014, the number of TennCare members with any ERC use increased from 60 to 345 per year (Figure 1). After ERC policies began changing in 2014, annual ERC use decreased to 246 TennCare members by 2017. When stratified by type of service, chronic ventilator and tracheal suctioning services had the largest changes in use. The annual number of patients using each of these services increased more than sixfold

between 2011 and 2014 (28–182 patients with chronic ventilator use; 25–171 with tracheal suctioning use). By 2017, the number of patients with chronic ventilator or tracheal suctioning use declined to 145 and 119, respectively. Moderate changes occurred for ventilator weaning services. From 2011 to 2014, the annual number of TennCare members with ventilator weaning claims increased from 16 to 82 then declined to 68 in 2017.

The traditional Medicare SNF program also experienced a temporary peak in ventilator-related service use (Figure 1). The number of SNF users with a tracheostomy or ventilator plus tracheostomy increased from 216 in 2011 to 326 in 2014, and then declined to 221 in 2017. These changes were concentrated among patients with a ventilator and tracheostomy: This group more than doubled from 83 to 198 patients per year between 2011 and 2014 before decreasing to 125 patients in 2017.

As service use peaked and declined, so did spending on ventilator-related services (Figure S1). Medicare payments for ventilator-related services increased from \$3.4 million in 2011 to \$6.3 million in 2014 but declined to \$4.8 million in 2017. TennCare's total chronic ventilator care spending increased from \$2.2 million in 2011 to \$19.4 million in 2016 but declined slightly to \$19.0 million in 2017. Spending on tracheal suctioning services

TABLE 1 Characteristics of TennCare (Medicaid) and Medicare members with ventilator or tracheostomy-related service use in Tennessee nursing homes

	TennCare (Medicaid)		Medicare skilled nursing facilities	
	2014	2017	2014	2017
Number of beneficiaries	345	246	326	221
Age (%)				
Under 50	26.7	27.2	7.1	9.0
Age 50–64	42.3	35.8	24.8	18.1
Age 65–74	18.8	21.1	37.1	45.2
Age 75 plus	12.2	15.9	31.0	27.6
Sex (%)				
Male	42.6	48.8	49.7	53.8
Female	57.4	51.2	50.3	46.2
Race (%)				
White			73.3	73.3
Black and other races			26.7	26.7
Any partial Medicaid during year (%)				
Yes			8.9	7.2
Any full Medicaid during year (%)				
Yes			58.6	51.6
Out-of-state residence (%)				
Yes			30.1	23.1

Note: Authors' analysis of TennCare Medicaid claims plus enrollment data and traditional Medicare skilled nursing claims plus enrollment data for patients treated in Tennessee nursing homes. No statistically significant differences ($p < 0.05$) between 2014 and 2017.

increased from \$0.9 million in 2011 to a peak of \$9.6 million in 2015 before declining to \$6.7 million in 2017. Spending on weaning services ranged from \$0.5 to \$2.7 million over these years.

The characteristics of nursing home patients using ventilator-related services slightly shifted between the year when service use peaked, 2014, and the final study year, 2017 (Table 1). Compared to 2014, TennCare ERC service users in 2017 were older (37.0% age 65 plus vs. 31.0%) and more often male (48.8% vs. 42.6%). Traditional Medicare SNF users in 2017 versus 2014 were more often male (53.8% vs. 49.7%) and less likely to reside out of state (22.6% vs. 23.0%). The proportion of traditional Medicare SNF patients who were dual-eligible with full Medicaid benefits declined from 58.6% in 2014 to 51.6% in 2017.

Discharge destination among hospitalized patients with prolonged ventilator use

Analysis of discharge destination for inpatients with PMV also revealed increased nursing home use after 2010 (Figure 2). Among hospitalized patients with PMV, the percentage discharged to an SNF or nursing home

increased from 15.0% in 2010 to 20.3% in 2014. Between 2014 and 2017, this percentage ranged from 19.9% to 20.8% per year. These increases were even more pronounced among LTAC patients with PMV, with nursing home discharge rates increasing from 26.3% in 2010 to 43.8% in 2014. Between 2014 and 2017, between 39.3% and 44.4% of LTAC inpatients with PMV were discharged to SNFs or nursing homes.

As more inpatients with PMV were discharged to nursing homes, the percentage discharged home declined from 24.8% to 17.5% in acute care hospitals and from 21.9% to 14.1% in LTACs between 2010 and 2017. In 2016, new Medicare payment rules provided financial incentives for LTACs to treat more ventilated patients,¹² coinciding with noticeable shifts in discharge trends. After ranging from 11% to 12% for years 2010–2015, the percentage of acute care inpatients discharged to an LTAC increased to 14% in 2016 and 2017. In-hospital mortality findings were mixed, with slight increases among acute care hospital inpatients from 2010 to 2017 (28.5%–30.3%) and moderate decreases among LTAC inpatients (22.4%–20.0%).

Among patients with PMV in acute care hospitals, the average length of stay decreased from 26.4 days in 2010

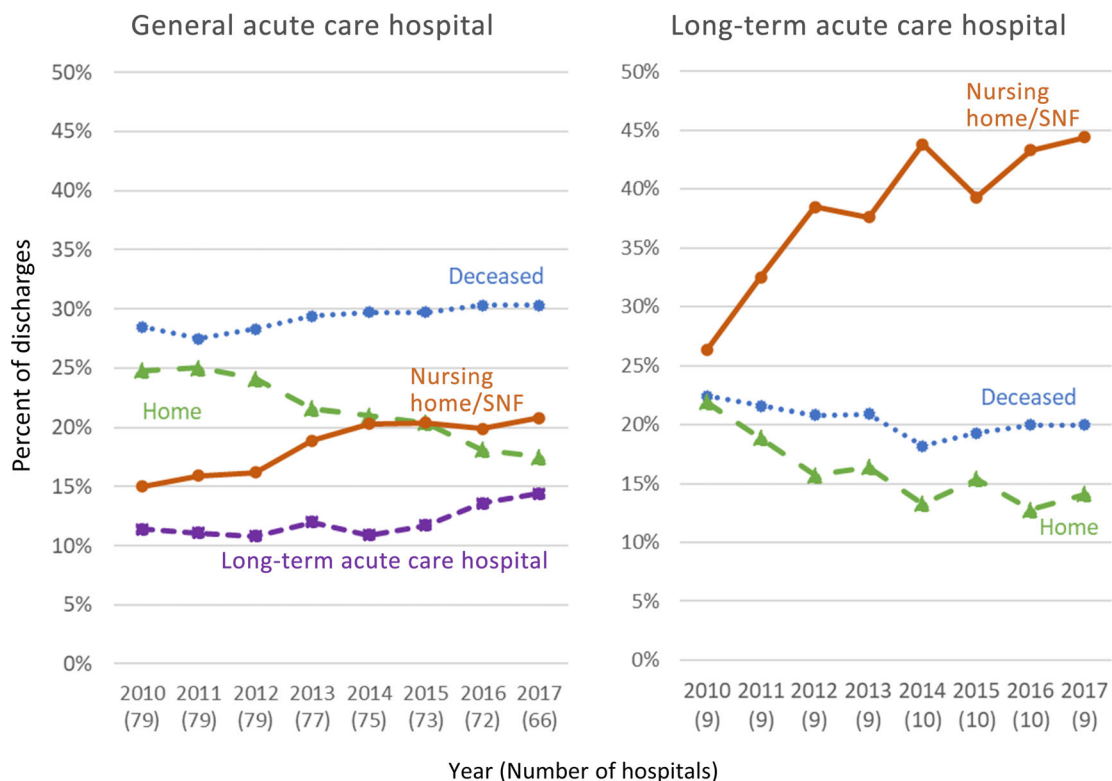


FIGURE 2 Distribution of discharge destination among Tennessee inpatients with prolonged mechanical ventilator use while hospitalized, 2010–2017. Authors' analysis of the Tennessee Hospital Discharge records database. Inpatient population included patients who had at least a 4-day inpatient stay and a diagnosis code indicating continuous mechanical ventilator use for at least 96 h while hospitalized. Hospitals counted according to number of unique National Provider Identifiers

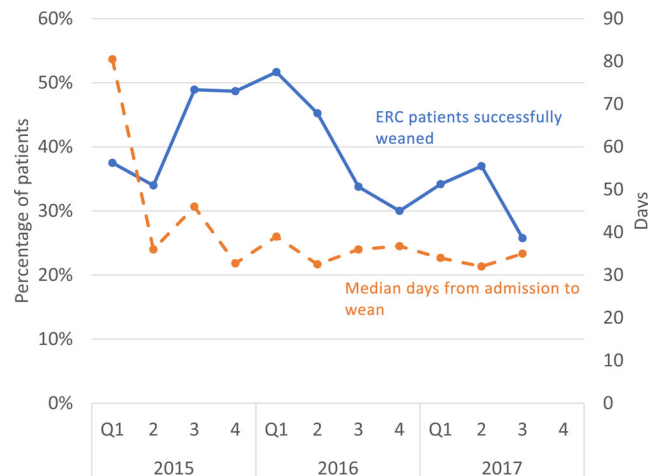


FIGURE 3 Percent of all enhanced respiratory care nursing facility patients successfully weaned from ventilator within 6 months of admission and median days from admission to wean, 2015–2017. Authors' analysis of the provider-reported quality data. Study population includes are patients treated for ventilator-related services at nursing homes participating in the ERC program. To be considered a successful wean, a patient must be liberated from a ventilator for at least 7 days. To be included in the numerator for the percentage of ERC patients successfully weaned within 6 months, patients must have a wean date within 6 months of nursing home admission. Median days from admission to wean includes all ventilator liberation outcomes regardless of timing since admission

to 23.8 days in 2017 for patients discharged to nursing homes and from 20.5 days to 19.1 days for patients who died or were discharged to other locations (Figure S2). The decrease in the length of stay for those discharged to nursing homes (−2.5 days) was marginally larger ($p = 0.06$) than the decrease in length of stay for those who died or were discharged to other locations (−1.4 days). Among patients with PMV in LTACs, the average length of stay decreased from 47.1 days in 2010 to 43.0 days in 2017 for patients discharged to nursing homes and remained relatively stable for patients who died or were discharged to other locations (34.6 days in 2010 vs. 35.5 days in 2017). Decreases in LTAC length of stay over this period were larger for patients discharged to nursing homes versus other locations (−4.1 decline vs. 0.9 increase), but not statistically significant ($p = 0.11$).

Quality performance in nursing homes

Across all payer types, a total of 935 ventilated patients were admitted to ERC nursing homes between the first quarter of 2015 and the third quarter of 2017. A total of 374 patients were liberated from mechanical ventilation

within 6 months of admission, and another 13 patients were liberated more than 6 months after admission for an overall wean rate of 41%.

On a quarterly basis, between 34 and 38% of patients admitted in the first two quarters of 2015 were weaned within 6 months (Figure 3). This percentage increased to 49%–52% of patients over the next three quarters. However, weaning rates then declined and only 26% of patients admitted in the third quarter of 2017 were liberated by the end of 2017. Among all patients liberated from a ventilator (including patients admitted before 2015), the median number of days from admission to successful wean declined from 81 days in early 2015 to 37 days by late 2016 and remained stable throughout 2017.

The proportion of TennCare members who died within 180 days of their first ERC claim gradually increased from a low of 22.5% in 2012 to a high of 31.3% in 2015, with slight drops in 2014 (25.6%) and 2016 (29.2%) (Figure S3). Mortality within 365 days of an initial ERC claim followed a similar pattern.

DISCUSSION

To address increased ventilator use in nursing homes, Tennessee's Medicaid program introduced mandatory quality reporting, on-site monitoring by external clinicians, and pay-for-performance incentives to improve ventilator liberation outcomes. As these changes were implemented, Medicaid and Medicare ventilator-related service use in nursing homes, and associated spending, moderately declined. Among all ventilated patients in nursing homes, facility-reported data demonstrated temporary increases in liberation rates and sustained decreases in time between admission and liberation.

Tennessee's focus on ventilated nursing home patients addresses an oversight gap that is especially concerning given the need for respiratory care during the coronavirus disease pandemic. Patients with PMV often experience poor clinical outcomes, including increased mortality, significant muscle weakness, and long-term dependency.^{1,13–16} Successful liberation is associated with reduced mortality and disability.¹⁷ To the best of our knowledge, Tennessee's program is unique among states and illustrates that Medicare and Medicaid payment incentives should be aligned to avoid delaying ventilator liberation, especially as in-hospital mortality declines among ventilated patients.¹⁸ During their best performance months, Tennessee nursing homes had ventilator liberation rates that were comparable to LTACs,¹⁹ suggesting that nursing homes can be accountable for ventilator liberation with proper clinical support.

Nationally, nursing homes have greater financial incentives to treat ventilated patients under increased

Medicare SNF payments rates for ventilator care in the new 2019 Patient-Driven Payment Model.^{20,21} By paying hospitals on a per-stay basis, Medicare's payment structure already encourages acute care hospitals to discharge patients as quickly as feasible. Medicare payment incentives target approximately a 32-day stay in LTACs for patients with PMV.²² Liberating a ventilated inpatient may shorten the length of stay by increasing the number of nursing homes willing to accept the patient or enabling the patient to be discharged home. However, if more nursing homes accept ventilated patients, then acute care hospitals and LTACs may face less pressure to pursue ventilator liberation or address end-of-life planning for patients with a poor prognosis, much like LTACs may alleviate this pressure for ICUs.^{23,24}

Three study findings raise concerns about quality and spending if nursing homes nationally begin accepting more ventilated patients. First, the percentage of inpatients with PMV discharged home declined as discharges to nursing home increased, possibly due to nursing homes substituting for in-home care instead of other facilities. Nursing homes may provide more support than patients would receive at home, but this trend should be balanced with patient and family preferences. Second, mortality rates slightly increased among TennCare members using ERC nursing home services as patient volume increased, possibly because nursing homes accepted more patients at the end of life or experienced challenges caring for these complex patients. Third, inpatient length of stay declined for patients discharged to nursing homes, which may have financially benefitted acute care hospitals and LTACs without improving quality of care. Unless Medicare and Medicaid payment incentives are aligned across inpatient and post-acute settings, expanding nursing homes' availability to treat ventilated patients may increase overall costs, delay ventilator liberation, and increase the prevalence of care transitions.

Clinicians and policymakers can learn from how Tennessee adapted pay-for-performance as part of a multifaceted quality initiative. Even just requiring nursing homes to report liberation rates is an important step: CMS requires LTACs to report ventilator liberation rates,²⁵ but no similar national measure exists for nursing homes. Tennessee combined pay-for-performance with on-site monitoring and technical assistance, an advantage over unsuccessful nursing home pay-for-performance models that provided little guidance about how to achieve improvements.^{26,27} Nationally, nursing homes have responded to quality initiatives by selectively admitting or discharging patients that may negatively influence performance scores.^{28,29} Tennessee addressed concerns that a pay-for-performance model may encourage nursing homes to avoid admitting patients who are less likely to

be liberated by modifying pay-for-performance measures in 2017 to avoid penalizing facilities for failing to liberate patients with diagnoses that may prevent liberation, such as progressive neuromuscular disorders. Exclusion criteria must be implemented with caution, as demonstrated by a pay-for-performance initiative that yielded an increase in daily spontaneous breathing trial performance in ventilated ICU patients. However, this was largely due to an increase in the documentation of patients excluded from the measure.³⁰ Better evidence on predicting the likelihood of successful liberation, especially outside of ICUs, could aid in the development of more robust quality measures that account for whether nursing homes accept sicker patients.

Our study has several limitations. Because Tennessee implemented concurrent policy changes, we cannot identify whether any particular policy led to changes in nursing home ventilator care use. Other factors, like changes in inpatient treatment for patients with PMV, may also influence these trends. Although claims and hospital discharge data established whether patients used ventilators while admitted to nursing homes and hospitals, these sources cannot identify whether patients were still ventilated when discharged. Only self-reported data from nursing homes provide information on ventilator liberation, and we cannot assess outcomes in other settings, like home. TennCare implemented additional auditing measures for nursing homes' self-reported data over time, so these measures may have been reported more accurately later in the study period. Data limitations also precluded measurement of Medicare Advantage SNF use, but Medicare Advantage members are included in Medicaid and hospital discharge measures.

Given the recent increases in Medicare SNF payments for respiratory care, other states may face a growing population of nursing home patients with PMV. Tennessee's effort to promote ventilator liberation through more rigorous quality oversight, better outcome measurement, and a new payment model is a significant improvement over national Medicare and Medicaid policies that currently fail to address ventilator liberation in nursing homes. Although the mixed results for quality performance suggest that future work could explore additional or alternative strategies to sustainably improve liberation outcomes, Tennessee's approach demonstrates the importance of designing payment models that target key patient outcomes like ventilator liberation.

ACKNOWLEDGMENTS

This work was presented at the 2021 AcademyHealth Annual Research Meeting (online) and the 2021 American Society of Health Economists Virtual Conference. The opinions and views expressed in this report are those

of the authors. They do not reflect the views of TennCare, the Tennessee Department of Health, or any other funding organization.

CONFLICT OF INTEREST

The authors disclose that Dr. Makam has received a research grant from the National Association of Long Term Hospitals, and Dr. Keohane has spousal income from TriStar Health. The authors report no other conflicts.

AUTHOR CONTRIBUTIONS

Laura M. Keohane, Matthew F. Mart, E. Wesley Ely, Pikki Lai, and David G. Stevenson conceived and designed the study. **Laura M. Keohane, Matthew F. Mart, E. Wesley Ely, Pikki Lai, Audrey Cheng, and David G. Stevenson** helped with the acquisition of data. All authors contributed to the analysis and interpretation of data. All authors drafted and critically revised the manuscript. All authors contributed to the final approval of the version to be published.

SPONSOR'S ROLE

The study's sponsor, TennCare, had the opportunity to review the manuscript to comment on accuracy and data confidentiality.


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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

Table S1. Daily payment rates for chronic ventilator care and ventilator weaning

Table S2. Enhanced Respiratory Care (ERC) performance tiers for nursing facilities

Figure S1. Total TennCare (Medicaid) and Medicare spending on ventilator or tracheostomy-related service use in nursing homes, 2011–2017

Figure S2. Length of stay by discharge destination for general acute hospitals and long-term acute care hospitals, 2010–2017

Figure S3. Percentage of TennCare Members who died within 180 or 365 days of first ERC claim

How to cite this article: Keohane LM, Mart MF, Ely EW, et al. Establishing Medicaid incentives for liberating nursing home patients from ventilators. *J Am Geriatr Soc.* 2022;70(1):259-268. doi:10.1111/jgs.17513