Report Summary: Impact of Non-Invasive Ventilator at Home (NIVH billed under HCPCS E0466) on Select Outcomes for Medicare Fee-for-Service (FFS) Beneficiaries

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Presentation Overview

- Purpose
- Study Flow Chart
- Key Findings and Methodology
- Detailed Results for NIVH Treatment billed under HCPCS E0466 for the Fee for Service (FFS) Population



Purpose

 To determine the impact of NIVH billed under HCPCS E0466 on utilization, clinical outcomes, and Medicare expenditures for FFS beneficiaries with COPD-CRF.



Study Flowchart





Key Findings

- Across all FFS beneficiaries in our study, regression results showed that patients receiving NIVH treatment had better outcomes than patients with no NIVH treatment.
- Our results showed that the sooner a patient received NIVH treatment, 1) the lower the risk of death, 2) the less likely they are to be admitted to any inpatient setting, 3) the less likely they are to visit ED, and 4) the lower the total Medicare spending.
- The results are generally consistent across the 3 study populations:
 1) Hypercapnic, 2) Hypoxia, and 3)Unspecified patients.
- Finally, analytic results of MA beneficiaries were consistent with FFS study population results, further strengthening our findings that initiating early NIVH treatment results in better outcomes.



Methodology

- We identified FFS beneficiaries with COPD-CRF using Medicare FFS claims data from January 1, 2021, to December 31, 2023.
 - We compared utilization and outcomes for beneficiaries who received NIVH to a comparison group of beneficiaries with no NIVH using a series of econometric methods.
- We conducted this analysis based on four treatment initiation windows defined as the time elapsed between the COPD-CRF diagnosis and NIVH initiation:
 - 0 to 7 days, 0 to 15 days, 0 to 30 days, and 0 to 60 days.
- All study outcomes used the treatment windows described above. Select outcomes explored included:
 - 1. all-cause mortality (time-to-death),
 - 2. time to first inpatient admission after the index date¹,
 - 3. time to first emergency department (ED) visit after the index date, and
 - 4. monthly Medicare expenditures prior to death.²
- We conducted the analyses for the overall FFS study population and for: 1) Hypercapnic, 2) Hypoxia, and 3)Unspecified patients.
 - 1. The index date is the first occurrence of both COPD and CRF on the claim.
 - 2. For beneficiaries that died,, we calculated monthly Medicare expenditures before death to ensure zero payments in the months after death were excluded.



Time to death after index date

- Our results indicate that the sooner a FFS patient received NIVH treatment, the less likely they are to die.
 - Patients receiving NIVH within the 1st week of a CODP-CRF diagnosis had a 33% reduction in mortality (compared to patients without NIVH)
 - The percent reduction in mortality decreased to 32% for patients receiving NIVH within 2 weeks, 32% for patients receiving NIVH within 30 days and 31% for patients receiving NIVH within 60 days
 - These results were consistent across hypoxic and unspecified COPD-CRF patients.
 - All shown results are statistically significant



Time-to-first inpatient admission after index date

- Our results indicate that the sooner a patient received NIVH treatment, the less likely they are to be admitted to an inpatient setting
 - Patients receiving NIVH within the 1st week of a CODP-CRF diagnosis had a 44% reduction in inpatient admissions (compared to patients without NIVH)
 - The percent reduction in inpatient admissions decreased to 41% for patients receiving NIVH within 2 weeks, 40% for patients receiving NIVH within 30 days and 38% for patients receiving NIVH within 60 days.
 - These results are consistent across hypoxic and unspecified COPD-CRF patients.
 - All shown results are statistically significant



Time to first ED visit after index date

- Our results indicate that the sooner a patient received NIVH treatment, the less likely they are to visit the ED
 - Patients receiving NIVH within the 1st week of a CODP-CRF diagnosis had a 15% reduction in ED visits (compared to patients without NIVH)
 - The percent reduction in ED visits decreased to 14% for patients receiving NIVH within 2 weeks, 12% for patients receiving NIVH within 30 days and 10% for patients receiving NIVH within 60 days
 - These results are consistent across hypoxic and unspecified COPD-CRF patients.
 - All shown results are statistically significant



Medicare FFS per member per month (PMPM) expenditures prior to death

- The sooner FFS patients initiated NIVH treatment, the lower their monthly Medicare spending (prior to death) compared to beneficiaries without NIVH treatment.
 - Specifically, patients receiving NIVH within the 1st week of a CODP-CRF diagnosis had \$2,182 less in monthly spending (compared to patients without NIVH)
 - The spending difference reduced to \$1,901 for Patients receiving NIVH within 2 weeks, \$1,666 for patients receiving NIVH within 30 days and \$1,396 for patients receiving NIVH within 60 days.
 - These results are consistent across hypercapnic, hypoxic and unspecified COPD-CRF patients.
 - All shown results are statistically significant
- Note that the spending differences cannot be annualized, as they were calculated based on beneficiary spending in the months preceding death.



Medicare FFS per member per month (PMPM) expenditures prior to death

• For the Hypercapnia Group

- Specifically, patients receiving NIVH within the 1st week of a CODP-CRF diagnosis had \$5,619 less in monthly spending (compared to patients without NIVH)
- The spending difference reduced to \$5,456 for Patients receiving NIVH within 2 weeks, \$5,239 for patients receiving NIVH within 30 days and \$5,017 for patients receiving NIVH within 60 days.

• For the Hypoxia Group,

- Specifically, patients receiving NIVH within the 1st week of a CODP-CRF diagnosis had \$1,345 less in monthly spending (compared to patients without NIVH)
- The spending difference reduced to \$1,030 for Patients receiving NIVH within 2 weeks, \$893 for patients receiving NIVH within 30 days and \$561 for patients receiving NIVH within 60 days.

For the Unspecified Group

- Specifically, patients receiving NIVH within the 1st week of a CODP-CRF diagnosis had \$2,351 less in monthly spending (compared to patients without NIVH)
- The spending difference reduced to \$2,219 for Patients receiving NIVH within 2 weeks, \$2,035 for patients receiving NIVH within 30 days and \$1,865 for patients receiving NIVH within 60 days.
- All shown results are statistically significant
- Note that the spending differences cannot be annualized, as they were calculated based on beneficiary spending in the months preceding death.



Appendix A Detailed Data Tables



Time to death after regression results (Overall)

			FFS	
Overall	Treatment window	Percent Reduction in Mortality	P-value	
	0-7 days	-33%	<.0001	
	0-15 days	-32%	<.0001	
	0-30 days	-32%	<.0001	
	0-60 days	-31%	<.0001	
Hypercapnia				
	0-7 days	-55%	<.0001	
	0-15 days	-56%	<.0001	
	0-30 days	-56%	<.0001	
	0-60 days	-56%	<.0001	
Нурохіа				
	0-7 days	-23%	<.0001	
	0-15 days	-22%	<.0001	
	0-30 days	-22%	<.0001	
	0-60 days	-19%	<.0001	
Unspecified				
	0-7 days	-33%	<.0001	
	0-15 days	-32%	<.0001	
	0-30 days	-31%	<.0001	
	0-60 days	-30%	<.0001	



Time-to-first inpatient admission regression results (Overall)

		FF	FFS	
Overall	Treatment window	Percent Reduction in Inpatient Admissions	P-value	
	0-7 days	-44%	<.0001	
	0-15 days	-41%	<.0001	
	0-30 days	-40%	<.0001	
	0-60 days	-38%	<.0001	
Hypercapnia				
	0-7 days	-46%	<.0001	
	0-15 days	-44%	<.0001	
	0-30 days	-46%	<.0001	
	0-60 days	-46%	<.0001	
Hypoxia				
	0-7 days	-53%	<.0001	
	0-15 days	-47%	<.0001	
	0-30 days	-47%	<.0001	
	0-60 days	-41%	<.0001	
Unspecified				
	0-7 days	-50%	<.0001	
	0-15 days	-50%	<.0001	
	0-30 days	-48%	<.0001	
	0-60 days	-47%	<.0001	



Time-to-first ED visit Regression Results (Overall)

		FFS	
Overall	Treatment window	Percent Reduction in ED Visits	P-value
	0-7 days	-15.0%	<.0001
	0-15 days	-14.0%	<.0001
	0-30 days	-12.0%	<.0001
	0-60 days	-10.0%	<.0001
Hypercapnia			
	0-7 days	NA	0.986
	0-15 days	NA	0.965
	0-30 days	NA	0.278
	0-60 days	NA	0.074
Нурохіа			
	0-7 days	-20.0%	<.0001
	0-15 days	-16.0%	<.0001
	0-30 days	-12.0%	<.0001
	0-60 days	-9.0%	0.001
Unspecified			
	0-7 days	-16.0%	<.0001
	0-15 days	-15.0%	<.0001
	0-30 days	-15.0%	<.0001
	0-60 days	-14.0%	<.0001



PMPM Medicare expenditures before death(Overall)

		FF	FFS	
Overall	Treatment window	Reduction in Total Medicare Spending	P-value	
	0-7 days	-\$2,182	<.0001	
	0-15 days	-\$1,901	<.0001	
	0-30 days	-\$1,666	<.0001	
	0-60 days	-\$1,396	<.0001	
Hypercapnia	Treatment window			
	0-7 days	-\$5,619	<.0001	
	0-15 days	-\$5,456	<.0001	
	0-30 days	-\$5,239	<.0001	
	0-60 days	-\$5,017	<.0001	
Нурохіа	Treatment window			
	0-7 days	-\$1,345	<.0001	
	0-15 days	-\$1,030	<.0001	
	0-30 days	-\$893	<.0001	
	0-60 days	-\$561	<.0001	
Unspecified	Treatment window			
	0-7 days	-\$2,351	<.0001	
	0-15 days	-\$2,219	<.0001	
	0-30 days	-\$2,035	<.0001	
	0-60 days	-\$1,865	<.0001	



Appendix B Methodology



Econometric Methodology (Data)

Data Sources*

- 100% Research Identifiable File (RIF) containing Medicare Fee For Service (FFS) claims data
 - Payment and Utilization Data for all settings of care
 - From January 1, 2021 to December 31, 2023
- The Master Beneficiary Summary Files (MBSF)
 - Patient socioeconomic data and demographic data
 - Chronic conditions

Study Cohorts

- Beneficiaries who were concurrently diagnosed with COPD and CRF
- Index date is the first presentation of a diagnosis for COPD and CRF
- Data gathered for 12 months of pre-index and 12 months of post index
- Four treatment windows starting from the index date ending at 60 days



Econometric Methodology

- Selected outcome variables: all cause mortality, time to 1st inpatient admission, time to first ED visit, Medicare expenditures
- Statistical analysis
 - To balance our treatment and comparison covariates for each model¹, we estimated an Inverse Probability Treatment Weighting (IPTW) Propensitiy Score Model
 - To determine the impact of NIVH on each of the outcome (utilization and clinical outcomes) variables we estimated Cox Proportional Hazards Model separately for each time to treatment event
 - To determine the impact of NIVH on Medicare expenditures we estimated a generalized linear model with log link function and gamma distribution
- Using this approach our results are consistent with a randomized clinical trial approach

¹ For overall FFS and stratified by phenotypes (Hypercapnia, Hypoxia and Unspecified) **Dobson** | DaVanzo



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