Supplementary Online Content

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eMethods. Cohort Characteristics

eTable 1. Study Population ICD-9-CM/ ICD-10-CM Diagnosis Codes

eTable 2. Multivariable Analyses of Non-Invasive and Invasive Mechanical Ventilation, by Diagnosis and Year

This supplementary material has been provided by the authors to give readers additional information about their work.

eMethods. Cohort Characteristics

Medicare fee-for-service beneficiaries ResDAC research identifiable files were used from 2000-2010 and MedPAR files were used after 2011. The cohort was restricted to one hospitalization per beneficiary and for the small percentage of decedents with more than one hospitalization in the last 30 days of life, the hospitalization closet to death was used. Overall, 7,685 unique hospitals were represented by this sample with a mean 321.5 (standard deviation=547.4, [intraquartile range=9-386]) hospitalizations per hospital for all years. In 2016, there were 2,872 unique hospitals with a mean 77.0 (standard deviation=53.3, [intraquartile range=37-104]) hospitalizations per hospital. The following ICD-9/10-CM diagnosis codes were used to identify sub-cohorts based on admitting diagnosis. (eTable 1)

eTable 1. Study Population ICD-9-CM/ ICD-10-CM Diagnosis Codes

Diagnosis	ICD-9-CM	ICD-10-CM
Congestive Heart Failure (CHF)	398.91, 402.01, 402.11, 402.91, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, 428.9	I09.81, I11.0, I13.0, I13.2, I50.1, I50.20, I50.21, I50.22, I50.23, I50.30, I50.31, I50.32, I50.33, I50.40, I50.41, I50.42, I50.43, I50.810, I50.811, I50.812, I50.813, I50.814, I50.82, I50.83, I50.84, I50.89, I50.9
Chronic Obstructive Pulmonary Disease (COPD)	490, 491.0, 491.1, 491.8, 491.9, 491.20, 491.21, 491.22, 492.0, 492.8, 493, 494.0, 494.1, 496	J40, J41.0, J41.1, J41.8, J42, J43.0, J43.1, J43.2, J43.8, J43.9, J44.0, J44.1, J44.9, J45, J47.0, J47.1, J47.9
Cancer	140-209, 235-239, 338.8	C00-C96, D37-D48, D49, D3A, G89.3
Dementia		
Alzheimer's Disease	331.0, 331.11, 331.19, 331.2, 331.82	G30.9, G31.01, G31.09, G31.1, G31.83
Alzheimer's Disease and Related Disorders or Senile Dementia	331.7, 290.0, 290.10, 290.11, 290.12, 290.13, 290.20, 290.21, 290.3, 290.40, 290.41, 290.42, 290.43, 294.10, 294.11, 294.20, 294.21, 797	F01.50, F01.51, F02.80, F02.81, F03.90, F03.91, F05, G94, R41.81

eTable 2. Multivariable Analyses of Non-Invasive and Invasive Mechanical Ventilation, by Diagnosis and Year

Compared to 2000, the percent receipt and adjusted odds ratios (AOR) increase in NIV and IMV are depicted in eTable 2 clustered by hospital, adjusting for age, gender, race, admitting diagnosis, and Charlson comorbidity index. Based on the intra-class correlation, 28.0% and 20.8% of the variance in NIV and IMV, beyond that explained by individual characteristics, can be attributed to hospitals.

Non-invasive mechanical ventilation, % receipt, AOR (95% CI)				
Year	All (n=2,043,327)	CHF (n=140,266)	COPD (n=43,411)	Cancer (n=230,539)	Dementia (n=269,434)
2000	0.8, Reference	1.4, Reference	2.7, Reference	0.4, Reference	0.6, Reference
2001	0.9, 1.15 (1.06-1.25)	1.6, 1.21 (0.97-1.52)	2.3, 0.85 (0.63-1.15)	0.4, 1.25 (0.88-1.77)	0.5, 0.86 (0.63-1.20)
2002	1.0, 1.35 (1.25-1.46)	1.6, 1.22 (0.98-1.53)	3.6, 1.40 (1.07-1.83)	0.4, 1.22 (0.86-1.72)	0.6, 1.09 (0.80-1.49)
2003	1.4, 1.77 (1.65-1.91)	2.2, 1.66 (1.34-2.05)	5.0, 1.95 (1.51-2.52)	0.6, 1.83 (1.33-2.52)	0.8, 1.34 (0.99-1.79)
2004	1.6, 2.14 (1.99-2.30)	2.8, 2.27 (1.86-2.78)	4.6, 1.79 (1.37-2.34)	0.8, 2.42 (1.78-3.29)	1.1, 1.89 (1.43-2.50)
2005	2.0, 2.63 (2.46-2.82)	3.1, 2.40 (1.97-2.94)	5.6, 2.29 (1.77-2.97)	0.9, 2.51 (1.85-3.41)	1.1, 1.88 (1.42-2.48)
2006	2.4, 3.28 (3.07-3.51)	3.6, 2.75 (2.25-3.36)	6.6, 2.62 (2.03-3.39)	1.0, 3.04 (2.25-4.11)	1.2, 2.19 (1.66-2.90)
2007	3.0, 4.20 (3.93-4.49)	4.6, 3.66 (3.01-4.44)	7.6, 3.12 (2.42-4.03)	1.5, 4.43 (3.32-5.91)	2.0, 3.61 (2.78-4.69)
2008	3.6, 5.29 (4.95-5.65)	6.0, 4.96 (4.09-6.02)	8.6, 3.74 (2.91-4.79)	1.7, 5.08 (3.81-6.79)	2.2, 4.16 (3.20-5.40)
2009	4.1, 5.82 (5.46-6.21)	7.4, 6.23 (5.17-7.51)	10.2, 4.50 (3.53-5.73)	2.0, 5.92 (4.44-7.88)	2.5, 4.66 (3.60-6.02)
2010	4.6, 6.70 (6.28-7.14)	8.9, 7.56 (6.30-9.08)	11.9, 5.43 (4.27-6.89)	2.1, 6.34 (4.77-8.43)	3.1, 5.85 (4.56-7.52)
2011	5.2, 7.87 (7.38-8.39)	10.0, 9.03 (7.51-10.86)	12.2, 5.96 (4.68-7.60)	2.5, 7.61 (5.74-10.10)	3.3, 6.21 (4.86-7.94)
2012	5.7, 9.18 (8.61-9.78)	11.1, 10.22 (8.49-12.31)	12.6, 6.34 (4.95-8.12)	2.9, 8.89 (6.71-11.78)	3.8, 7.30 (5.77-9.25)
2013	6.3, 10.35 (9.72-11.02)	12.8, 11.92 (9.93-14.31)	14.4, 7.60 (5.97-9.68)	3.2, 9.94 (7.52-13.14)	4.4, 8.43 (6.67-10.64)
2014	6.5, 10.87 (10.20-11.58)	13.3, 13.09 (10.89-15.75)	15.8, 8.83 (6.87-11.35)	3.1, 9.34 (7.05-12.40)	4.7, 9.04 (7.15-11.43)
2015[A]	7.1, 11.80 (11.07-12.58)	13.8, 13.50 (11.20-16.27)	15.3, 7.90 (6.11-10.20)	3.0, 9.29 (6.94-12.42)	5.0, 9.74 (7.70-12.32)
2016	6.6, 11.10 (10.42-11.83)	14.2, 13.70 (11.41-16.46)	15.7, 8.82 (6.82-11.42)	2.9, 8.92 (6.70-11.87)	4.9, 9.05 (7.16-11.43)
2017	7.1, 11.84 (11.11-12.61)	14.2, 14.14 (11.77-16.98)	14.5, 8.22 (6.42-10.52)	3.5, 10.82 (8.16-14.34)	5.2, 9.62 (7.61-12.15)
Invasive mechanical ventilation, % receipt, AOR (95% CI)				

Year	All (n=2,354,046)	CHF (n=143,938)	COPD (n=45,177)	Cancer (n=233,118)	Dementia (n=277,639)
2000	15.0, Reference	11.1, Reference	17.4, Reference	6.2, Reference	5.7, Reference
2001	14.7, 0.99 (0.97-1.01)	12.0, 1.12 (1.02-1.22)	16.4, 0.93 (0.82-1.05)	6.2, 1.01 (0.92-1.11)	5.6, 0.98 (0.88-1.09)
2002	15.0, 1.03 (1.00-1.05)	11.4, 1.06 (0.97-1.16)	17.1, 1.01 (0.89-1.15)	6.5, 1.08 (0.99-1.18)	5.6, 0.98 (0.88-1.09)
2003	15.2, 1.05 (1.02-1.07)	11.7, 1.11 (1.02-1.21)	16.4, 0.99 (0.87-1.13)	6.3, 1.06 (0.97-1.15)	5.3, 0.93 (0.84-1.04)
2004	15.2, 1.03 (1.01-1.05)	11.6, 1.14 (1.05-1.25)	15.1, 0.89 (0.78-1.02)	6.2, 1.03 (10.94-1.13)	5.3, 0.93 (0.83-1.03)
2005	15.2, 1.04 (1.02-1.06)	9.4, 0.92 (0.83-1.00)	15.1, 0.91 (0.79-1.04)	6.4, 1.07 (0.98-1.17)	5.0, 0.88 (0.79-0.98)
2006	15.3, 1.06 (1.04-1.08)	7.6, 0.76 (0.69-0.84)	13.1, 0.79 (0.69-0.91)	6.2, 1.06 (0.97-1.16)	4.9, 0.88 (0.78-0.98)
2007	15.9, 1.09 (1.07-1.12)	7.6, 0.76 (0.69-0.84)	14.5, 0.92 (0.80-1.06)	6.2, 1.05 (0.96-1.15)	5.3, 0.95 (0.85-1.07)
2008	17.1, 1.20 (1.18-1.23)	8.0, 0.83 (0.74-0.92)	13.1, 0.84 (0.73-0.97)	6.6, 1.11 (1.01-1.22)	6.8, 1.26 (1.13-1.40)
2009	16.6, 1.14 (1.11-1.16)	6.9, 0.74 (0.66-0.82)	12.6, 0.80 (0.70-0.93)	6.5, 1.11 (1.01-1.22)	6.0, 1.09 (0.97-1.22)
2010	16.6, 1.15 (1.13-1.18)	6.5, 0.72 (0.65-0.80)	12.6, 0.84 (0.73-0.97)	6.5, 1.10 (1.00-1.21)	5.7, 1.05 (0.94-1.17)
2011	17.1, 1.39 (1.36-1.42)	7.0, 0.87 (0.78-0.97)	12.5, 0.86 (0.74-1.00)	7.6, 1.39 (1.27-1.53)	6.4, 1.26 (1.13-1.39)
2012	17.2, 1.50 (1.47-1.53)	7.6, 0.96 (0.86-1.08)	11.8, 0.82 (0.70-0.96)	7.5, 1.37 (1.24-1.51)	6.3, 1.25 (1.14-1.37)
2013	17.1, 1.54 (1.51-1.57)	6.1, 0.81 (0.72-0.91)	12.5, 0.92 (0.79-1.07)	7.3, 1.36 (1.23-1.50)	6.0, 1.21 (1.10-1.32)
2014	17.4, 1.52 (1.49-1.56)	6.8, 0.87 (0.77-0.99)	12.4, 0.92 (0.77-1.09)	7.3, 1.33 (1.20-1.47)	5.9, 1.17 (1.06-1.28)
2015[A]	16.2, 1.44 (1.40-1.47)	7.1, 0.98 (0.86-1.11)	11.2, 0.83 (0.69-1.00)	6.9, 1.28 (1.15-1.43)	5.2, 1.06 (0.96-1.17)
2016	18.8, 1.66 (1.62-1.69)	7.3, 0.92 (0.82-1.03)	14.1, 1.09 (0.91-1.30)	7.8, 1.41 (1.28-1.56)	6.9, 1.43 (1.30-1.57)
2017	18.2, 1.63 (1.59-1.66)	7.8, 1.07 (0.95-1.19)	13.2, 1.03 (0.88-1.21)	7.6, 1.40 (1.26-1.55)	6.2, 1.28 (1.17-1.41)

Abbreviations: AOR, adjusted odds ratio; CHF, congestive heart failure; CI, Confidence interval; and COPD, chronic obstructive lung disease.

Notes: [A]2015 only includes data from January 1, 2015- September 30, 2015 due to the ICD-9-CM to ICD-10-CM conversion. (1) Outcome measure was a binary variable indicating patients with NIV or IMV versus patients with no ventilatory support, (2) Subgroups of CHF, COPD, and cancer without dementia listed as the secondary diagnosis were identified based on primary diagnosis codes, while decedents with dementia are identified based on the primary or the first 9 secondary diagnosis codes, (3) Odds ratios were obtained from logistic regressions with random intercepts by hospitals; analyses on overall sample were adjusted for age, sex, race/ethnicity, primary admitting diagnosis, dementia as a secondary or primary diagnosis, and Charlson Comorbidity Index, (4) Subgroup analyses on specific diagnostic groups adjusted for age, sex, race/ethnicity, and Charlson comorbidity index, and (5) year dummies for the years 2001-2017 were included and adjusted odds ratio are presented.