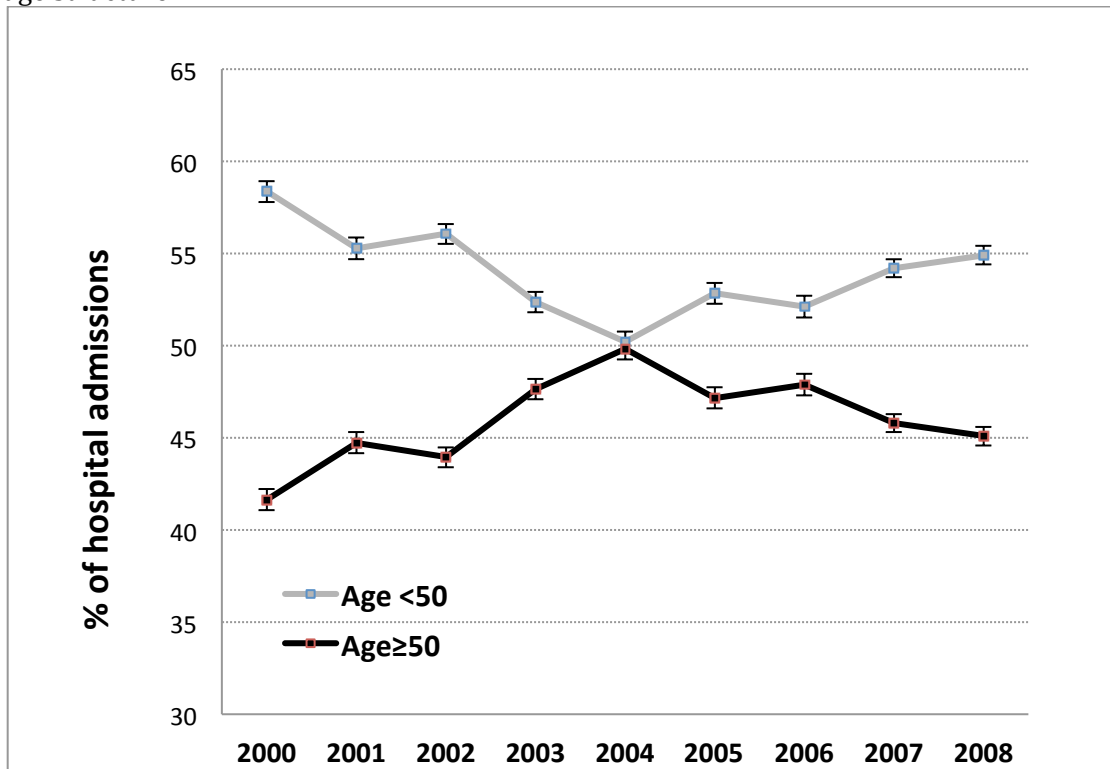
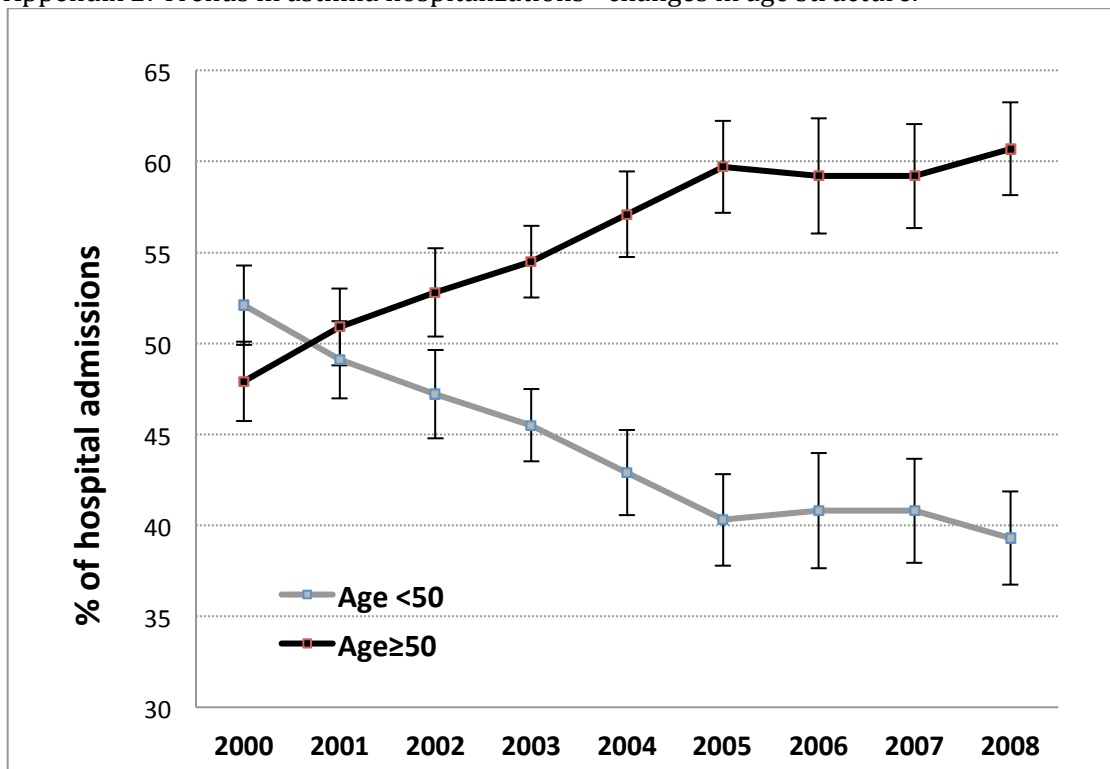


Appendix 1: Trends in asthma hospitalizations with invasive mechanical ventilation - changes in age structure.



Appendix 2: Trends in asthma hospitalizations - changes in age structure.



Appendix 3: Predictors of any mechanical ventilation in asthma using multivariate logistic model.

Predictors	Odds ratio (95% Confidence Interval)
Age category	
18-34	Reference
35-49*	1.03(0.66-1.61)
50-64*	1.18(0.75-1.85)
65-79	1.03(0.57-1.86)
80 or more	1.08(0.53-2.20)
Gender (%)	
Male	Reference
Female*	0.84(0.62-1.14)
Race(%)	
White	Reference
African American*	1.57(1.11-2.22)
Hispanic	0.95(0.57-1.57)
Asian*	2.78(1.32-5.81)
Others*	2.41(1.31-4.43)
Unknown*	0.37(0.21-0.63)
Primary Payer (%)	
Medicare	Reference
Medicaid	1.37(0.88-2.15)
Private*	0.88(0.55-1.38)
Self*	1.71(1.00-2.93)
Other*	0.65(0.25-1.69)
Chalrson-Deyo's co-morbidity index (%)	
1-2	Reference
3-4	1.19(0.71-2.00)
5-6	2.10(0.66-6.68)
7 or more	0.99(0.36-2.71)
Hospital Characteristics (%)	
Non teaching hospital	Reference
Teaching hospital*	2.30(1.70-3.10)
Obstructive sleep apnea*	2.11(1.39-3.18)
Year	
2000	Reference
2001	0.71(0.27-1.88)
2002*	2.22(1.06-4.65)
2003*	1.85(0.88-3.85)
2004*	2.19(1.05-4.55)
2005*	1.35(0.61-2.99)
2006*	2.46(1.21-5.02)
2007*	2.11(1.01-4.40)
2008*	2.43(1.19-4.94)

* Significant at p<0.05

Appendix 4: Predictors of invasive mechanical ventilation in asthma using multivariate logistic model.

Predictors	Odds ratio (95% Confidence Interval)
Age category	
18-34	Reference
35-49*	0.76(0.70-0.82)
50-64*	0.72(0.65-0.78)
65-79*	0.64(0.57-0.72)
80 or more*	0.55(0.46-0.63)
Gender (%)	
Male	Reference
Female*	0.71(0.67-0.75)
Race(%)	
White	Reference
African American*	1.37(1.27-1.48)
Hispanic	1.01(0.92-1.12)
Asian*	2.78(2.39-3.25)
Others*	1.68(1.11-2.52)
Unknown*	0.49(0.45-0.54)
Primary Payer (%)	
Medicare	Reference
Medicaid*	1.23(1.11-1.36)
Private*	1.11(1.01-1.22)
Self*	1.55(1.38-1.74)
Other*	1.26(1.08-1.47)
Chalrson-Deyo's co-morbidity index (%)	
1-2	Reference
3-4	1.14(1.00-1.29)
5-6	1.37(0.92-2.05)
7 or more	0.74(0.57-0.96)
Hospital Characteristics (%)	
Non teaching hospital	Reference
Teaching hospital*	1.62(0.52-1.72)
Year	
2000	Reference
2001	1.02(0.91-1.14)
2002	0.96(0.86-1.08)
2003*	0.88(0.78-0.97)
2004*	0.75(0.67-0.84)
2005*	0.61(0.53-0.69)
2006*	0.50(0.44-0.57)
2007*	0.53(0.47-0.61)
2008*	0.52(0.46-0.59)

* Significant at p<0.05

Appendix 5: Predictors of NIV in asthma using multivariate logistic model.

Predictors	Odds ratio (95% Confidence Interval)
Age category	
18-34	Reference
35-49*	1.20 (1.08-1.32)
50-64*	1.26 (1.13-1.39)
65-79	1.03 (0.91-1.17)
80 or more	0.99 (0.85-1.16)
Gender (%)	
Male	Reference
Female*	0.74 (0.70-0.79)
Race(%)	
White	Reference
African American*	1.30 (1.22-1.40)
Hispanic	1.08 (0.99-1.19)
Asian*	2.08 (1.75-2.48)
Others*	1.30 (1.09-1.54)
Unknown*	0.31 (0.28-0.34)
Primary Payer (%)	
Medicare	Reference
Medicaid	1.00 (0.92-1.09)
Private*	0.74 (0.68-0.80)
Self*	0.82 (0.72-0.93)
Other*	0.82 (0.70-0.97)
Chalrson-Deyo's co-morbidity index (%)	
1-2	Reference
3-4	1.07 (0.97-1.18)
5-6	1.20 (0.92-1.56)
7 or more	0.77 (0.60-1.00)
Hospital Characteristics (%)	
Non teaching hospital	Reference
Teaching hospital*	1.64 (1.54-1.73)
Obstructive sleep apnea*	8.50 (7.99-9.03)
Year	
2000	Reference
2001	1.10 (0.89-1.35)
2002*	1.50 (1.23-1.82)
2003*	1.84 (1.54-2.21)
2004*	2.73 (2.30-3.25)
2005*	2.14 (1.79-2.55)
2006*	3.36 (2.84-3.97)
2007*	3.52 (2.98-4.17)
2008*	3.47 (2.94-4.10)

* Significant at p<0.05

Appendix 6: Demographic and clinical characteristics of patients discharged with AAE - 2000 to 2008.

Patient characteristics	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	226,385	230,991	244,388	284,828	252,639	270,719	266,551	253,398	262,190
Age in years, mean ± SD	50.6± 18.1	52.0± 18.3	52.6± 18.1	53.0± 18.1	54.2± 17.9	55.1± 18	54.7± 17.8	54.5± 17.6	55.2± 17.8
Gender (%)									
Female*	73.8	74	73.1	72.6	72.9	73.1	72.4	71.9	72.4
Race(%)									
White	43.8	42.2	40.5	40.2	40.7	45.2	40.7	40.6	46.9
African American	18.4	17.8	18.6	18.7	19.9	15.1	19.5	19.8	19.9
Hispanic	9.5	9.8	8.3	10.9	9.0	8.4	11.3	9.5	10
Asian or Pacific Islander	1.6	1.8	1.5	1.6	1.5	1.2	1.6	1.4	1.5
Other	2.7	1.5	2.7	3.1	1.9	2.6	1.8	2.1	3.0
Unknown*	23.9	26.8	28.2	25.4	26.7	27.3	24.6	26	18.6
Payer (%)									
Medicare*	30.5	33.2	34.9	36.6	38.3	40.8	40.2	39.1	40
Medicaid	20.2	20.3	19.5	21.3	19.7	18.4	20.5	18.9	19.2
Private*	36.9	34.8	33.5	30.6	29.2	28.7	27	27.9	28.3
Self	8.3	8.5	8.4	8.0	9.2	8.3	8.3	9.6	8.4
Other	4.2	3.3	3.7	3.6	3.6	3.7	4.1	4.5	4.2
Charlson-Deyo's co-morbidity index* (%)									
1-2*	94.9	94.4	94.2	93.5	92.7	91.7	89.6	87.9	86.2
3-4*	3.8	4.2	4.5	5.1	5.7	6.7	8.1	9.2	10.6
5-6*	0.1	0.1	0.1	0.2	0.2	0.4	0.8	1.3	1.7
7 or more	1.2	1.3	1.2	1.2	1.4	1.3	1.5	1.6	1.5
Co-morbidities (%)									
Diabetes mellitus*	16.5	18.5	19.7	21.8	22.7	24.8	25.7	26.3	26.7
Congestive heart failure*	6.7	7.9	8.7	9.7	11.2	11.5	12	11.7	11.9
Morbid obesity*	3.2	2.9	4.0	4.9	5.6	6.4	6.8	7.9	9.4
Cancer*	4.0	4.3	4.9	4.8	5.3	5.6	5.6	5.8	6.2
Alcoholism*	1.6	1.6	1.7	1.6	1.8	1.8	2.2	2.2	2.1
Smoking*	15	16.9	20.9	22.6	25.3	28.8	29.5	31.9	33.2
Obstructive sleep apnea*	2.7	3.3	4.1	5.4	6.1	7.4	8.2	9.8	10.3
Hospital Characteristics (%)									
Teaching status									
Teaching	41.6	41.1	39	39.6	37.6	34.3	45.1	40.9	42.2
Hospital size									
Small	12.5	13.1	12.9	12.8	13.4	14.2	16.8	13.8	14.2
Medium	31.9	28.3	27.9	29.1	27.3	26.1	26.5	28.1	26.1
Large	55.6	58.6	59.2	58	59.4	59.7	56.7	58.1	59.7
Hospital ownership									
Government-Non federal	14.7	13.8	16.2	15.7	14.5	15.1	14.1	13.5	13.5
Private - non profit	73.3	73	70.7	70.5	72	70.5	72.6	71.3	72.3
Private - investor owned	12.0	13.2	13.1	13.8	13.5	14.4	13.3	15.3	14.2
Mechanical Ventilation, N									
Total NIV*	796	899	1336	2177	2849	2534	4336	4448	4908
NIV in patients without OSA*	486	575	819	1239	1685	1315	2682	2532	2987
Started on NIV but went on to invasive ventilation	37	30	72	95	80	59	134	95	133
Total invasive MV*	3095	3132	3081	3408	2530	2045	1870	1820	1931
Any mechanical ventilation (invasive + NIV)	3891	4031	4417	5585	5379	4579	6206	6268	6839

Appendix 7: Characteristics of patients requiring NIV for AAE (2000-2008)

Patient characteristics	Non invasive mechanical ventilation in first 2 days								
	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	796	899	1336	2177	2849	2534	4336	4448	4908
Age in years, mean ± SD	50.2±14.7	51.5±15.5	51.6±15.2	53.4±15.4	53.3±16.0	53.9±15.6	54.7±16.2	53.7±15.2	54.6±15.8
Sex (%)									
Female	73	65.8	65.1	66	66.5	64.1	64.5	66.4	65.9
Race(%)									
White	42.3	44.7	41.4	39.6	42	49.5	40.3	46	45.7
African American	36.7	29.3	27.1	29	30.3	22.9	33.9	32.8	30.3
Hispanic	8.0	8.6	10.5	19	14.8	10.7	10.2	8.9	11.1
Asian	-	3.5	0.8	4.0	3.9	1.9	4.7	1.5	1.6
Others	7.9	1.9	6.4	3.5	1.0	4.2	3.0	3.0	2.9
Unknown	5.0	11.9	13.8	4.8	8.0	10.5	7.9	7.8	8.5
Payer (%)									
Medicare	33.3	36.2	33.2	40.4	36.5	45.8	42.8	38.8	43.8
Medicaid	28.8	27.3	25.9	26.3	27.1	22.9	25.5	22.5	21.6
Private	30.4	26.1	33.3	24.7	27.1	21.9	20.5	26.2	24.2
Self	6.4	6.4	5.5	4.7	5.7	6.2	7.6	8.3	6.3
Other	1.2	4.0	2.1	3.9	3.5	3.2	3.6	4.2	4.2
Charlson-Deyo's co-morbidity index (%)									
1-2	94.9	91.9	91.3	90.7	89.2	89.8	87.1	86.6	82.5
3-4	3.2	6.4	7.9	7.6	9.0	8.2	10.4	9.9	14.5
5-6	-	-	-	-	-	0.6	0.9	2.3	2.3
7 or more	1.8	1.7	-	1.2	1.4	1.4	1.6	1.2	0.8
Co-morbidities (%)									
Diabetes mellitus	27.4	32.6	29.4	35.8	32.6	38.1	37	36.4	34.9
Congestive heart failure	19.7	16.8	19.3	17.7	22.9	24	23.3	22	22.4
Morbid obesity	17.5	21.9	16.4	20.6	16.5	22.4	21.6	23.4	24.9
Cancer	2.5	2.3	4.4	3.5	4.2	4.1	4.6	3.6	5.2
Alcoholism	-	-	2.3	4.1	1.2	1.9	2.6	2.5	2.5
Smoking	20.4	14.2	30.2	25.7	25.2	29.1	35.1	37	36.8
Hospital Characteristics (%)									
Teaching status									
Teaching hospital	56.8	58.6	51.2	61.7	56.3	48.9	57.8	52.2	56.6
Hospital size									
Small	10.1	12.7	8.5	11.8	7.5	13.5	13	8.8	14.3
Medium	26.0	17.7	34.3	30.4	25.1	29.1	29	33.6	23.0
Large	63.9	69.6	57.2	57.8	67.4	57.4	58	57.6	62.7
Hospital ownership									
Government-Non federal	12.6	12.5	14.4	12.8	8.2	15.8	13.5	13.8	14.6
Private - non profit	78.9	77.6	76.7	80.8	84	73.4	75.3	78.2	75.5
Private - investor owned	8.4	9.9	8.9	6.3	7.8	10.8	11.2	7.9	9.8

Appendix 8: Characteristics of patients requiring invasive mechanical ventilation for AAE (2000-2008)

Patient characteristics	Invasive mechanical ventilation in first 2 days								
	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	3095	3132	3081	3408	2530	2045	1870	1820	1931
Age in years, mean ± SD	47.5±17.3	48.4±17.7	48.8±17.5	48.9±17.3	50.7±17.4	49.0±16.8	50.2±17.1	49.6±18.0	48.1±17.2
Sex (%)									
Female	64.4	62	65	63.3	63.7	63.4	63.2	66.2	67.5
Race(%)									
White	38.5	41.6	31.7	33.4	36.5	43.9	35.3	41	44.9
African American	26.6	24.8	35.7	30.5	34.5	25.1	34.8	29.3	29.3
Hispanic	14.5	11.9	8.0	12.7	12.4	8.5	11.8	10.7	9.0
Asian	5.7	4.8	4.9	4.1	2.6	2.5	4.2	3.9	2.5*
Others	4.4	2.6	4.4	6.9	2.6	6.2	1.5	3.1	5.9
Unknown	10.3	14.3	15.1	12.4	11.4	13.7	11.4	11.8	8.4
Payer (%)									
Medicare	21.7	24.3	28.3	26.9	30.7	27	30.9	28.3	27.3
Medicaid	26.6	24.5	22.5	25.8	25	26.3	25.4	22.2	23
Private	36.3	35.4	28.6	30.5	28.8	25.2	26.2	27.6	28.3*
Self	10.8	11.5	16.7	11.8	12.6	15.1	12.1	17	14.2
Other	4.6	4.3	3.8	5.0	2.9	6.4	5.5	4.8	7.2
Charlson-Deyo's co-morbidity index (%)									
1-2	95.4	95.5	95.3	94.1	91.3	88.4	90	87.9	85.9*
3-4	3.8	3.2	4.0	4.6	6.9	7.9	7.0	8.5	10.7*
5-6	-	-	-	-	-	0.8	-	1.7	2.5*
7 or more	0.7	1.2	0.7	1.1	1.4	2.9	2.8	1.9	0.8
Co-morbidities (%)									
Diabetes mellitus	12.3	15.3	14.9	18.7	21.2	20.5	22.3	17.4	23.8*
Congestive heart failure	7.9	7.3	10.8	11.8	13.2	13.5	15.6	15.6	13.5*
Morbid obesity	2.5	2.4	3.6	3.4	4.2	5.6	5.2	8.3	8.9*
Cancer	2.3	3.3	2.5	2.9	4.2	2.8	4.0	3.1	4.1
Alcoholism	2.5	3.5	3.6	3.4	4.1	3.4	5.5	4.7	5.7*
Smoking	12.4	17.5	17.1	20.3	23.9	30.2	24.7	29.4	34.7*
Hospital Characteristics (%)									
Teaching status									
Teaching hospital	56.7	53.9	53	57.4	54.4	54.1	64.2	58	55.3
Hospital size									
Small	12.9	11.9	9.5	9.7	10.4	11.2	13.6	9.7	7.6*
Medium	34.5	31	32.6	29	25.2	24.3	25.3	30.1	30.5
Large	52.5	57.1	58	61.2	64.4	64.6	61.1	60.2	61.9*
Hospital ownership									
Government-Non federal	19.1	16.2	21.2	24.3	17.5	26	21.5	19.1	18.1
Private - non profit	69.8	73.1	66	66.4	70.3	66.5	69	73.1	69.3
Private - investor owned	11.1	10.7	12.8	9.3	12.2	7.5	9.5	7.9	12.6

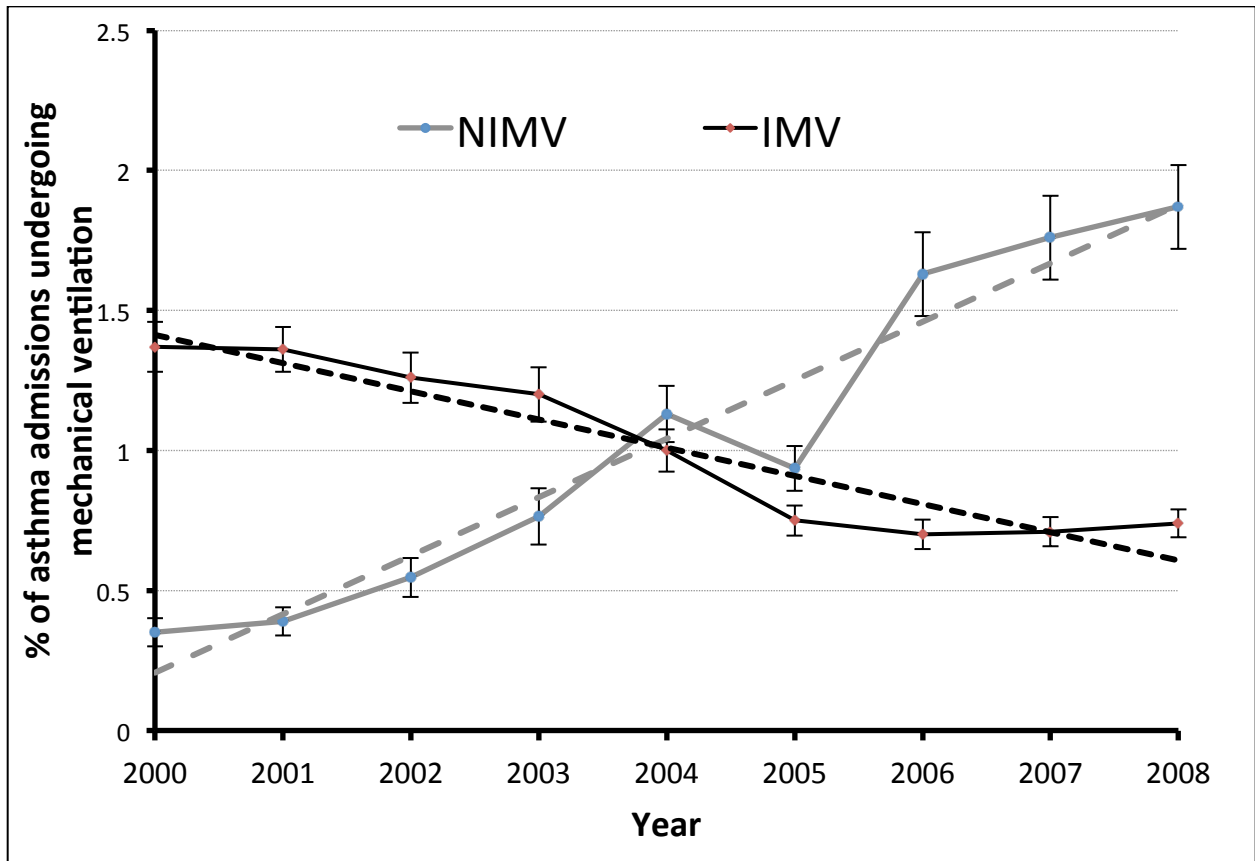
Appendix 9: Outcomes of patients with acute asthma exacerbation –2000 to2008.

	2000			2001			2002		
	No MV	NIV	invasive MV	No MV	NIV	IMV	No MV	NIV	Invasive MV
All cause in-hospital mortality, (%)	0.2	1.2	6.4	0.3	1.5	6.8	0.3	1.1	5.1
3 day mortality, (%)	0.08	-	2.3	0.10	-	3.4	0.07	-	2.1
Prolonged mechanical ventilation (>96hrs)	-	-	23.1	-	-	19.1	-	-	18.1
Tracheostomy (%)	-	-	0.8	-	-	1.3	-	-	1.3
Pneumothorax (%)	-	-	0.9	-	-	1.8	-	-	2.1
Disposition in survivors, (%)									
Home	89.3	76.9	75.6	88	73	79	88	84	80
Inter hospital transfer	0.7	-	5.6	0.7	-	3.3	0.7	-	3.3
Skilled nursing facility^	3.5	5.1	7.0	4.2	5.1	7.5	4.3	5.2	7.5
Home with home care	4.3	15.5	7.0	4.7	15	5.7	4.7	9	5.2
AMA/unknown	2.3	1.9	5.1	2.3	1.9	4.2	2.3	1.5	3.6
Median LOS in days, Inter quartile range.	3(2-5)	4(2-7)	5(3-8)						
	2003			2004			2005		
	No MV	NIV	Invasive MV	No MV	NIV	Invasive MV	No MV	NIV	Invasive MV
All cause in-hospital mortality, (%)	0.3	1.8	5.7	0.3	0.7	6.7	0.2	1.7	5.7
3 day mortality, (%)	0.09	0.7	2.8	0.09	-	4	0.05	0.6	3.6
Prolonged mechanical ventilation (>96hrs)	-	-	21.8	-	-	19.7	-	-	21.8
Tracheostomy (%)	-	-	1.4	-	-	1.3	-	-	1.2
Pneumothorax (%)	-	-	1.6	-	-	1.3	-	-	0.9
Disposition in survivors, (%)									
Home	88	79	78	85	75	72	85	74	72
Inter hospital transfer	0.6	1.1	5.3	0.7	-	3.9	0.7	1.1	3.1
Skilled nursing facility^	4.2	6.6	6.9	5.2	8.6	12	5.4	9.3	11
Home with home care	5.1	12	5.9	7	14	8.7	7	15	9.9
AMA/unknown	2.3	2	4	2.2	2.5	3.2	2	1	3.9
Median length of hospital stay in days, Inter quartile range.									
	2006			2007			2008		
	No MV	NIV	Invasive MV	No MV	NIV	Invasive MV	No MV	NIV	Invasive MV
All cause in-hospital mortality, (%)	0.2	1	5.4	0.2	0.4	8.7	0.2	0.8	6.9
3 day mortality, (%)	0.08	0.4	3.7	0.06	0.3	5.5	0.05*	0.6	4.5
Prolonged mechanical ventilation (>96hrs)	-	-	21.3	-	-	17	-	-	18.2
Tracheostomy (%)	-	-	0.7	-	-	0.4	-	-	1.5
Pneumothorax (%)	-	-	0.7	-	-	0.8	-	-	1.2
Disposition in survivors, (%)									
Home	84	72	71	85	75	69	84.5*	76.2	70.9
Inter hospital transfer	0.6	1	3.3	0.7	1.0	4.5	0.7	1.0	4.6
Skilled nursing facility^	5	9.3	10	5.1	9.6	12	4.7*	6.3	9.0
Home with home care	7.5	15	10	7	12	9.3	7.7*	13.2	11.8*
AMA/unknown	2.4	2.4	5.3	2.5	2.7	4.8	2.4	3.4	3.6
Median length of hospital stay in days, Inter quartile range.							3(2-5)	4(2-6)	5(3-8)

* Significant difference between 2000 and 2008 at p<0.05

^ Also includes intermediate care

Appendix 10: Trend lines, represented by dashed lines, are added to figure 2. We also provide the slope from a simple regression equation.



Slope of IMV: -0.10
Slope for NIMV: +0.21