

# THE LANCET

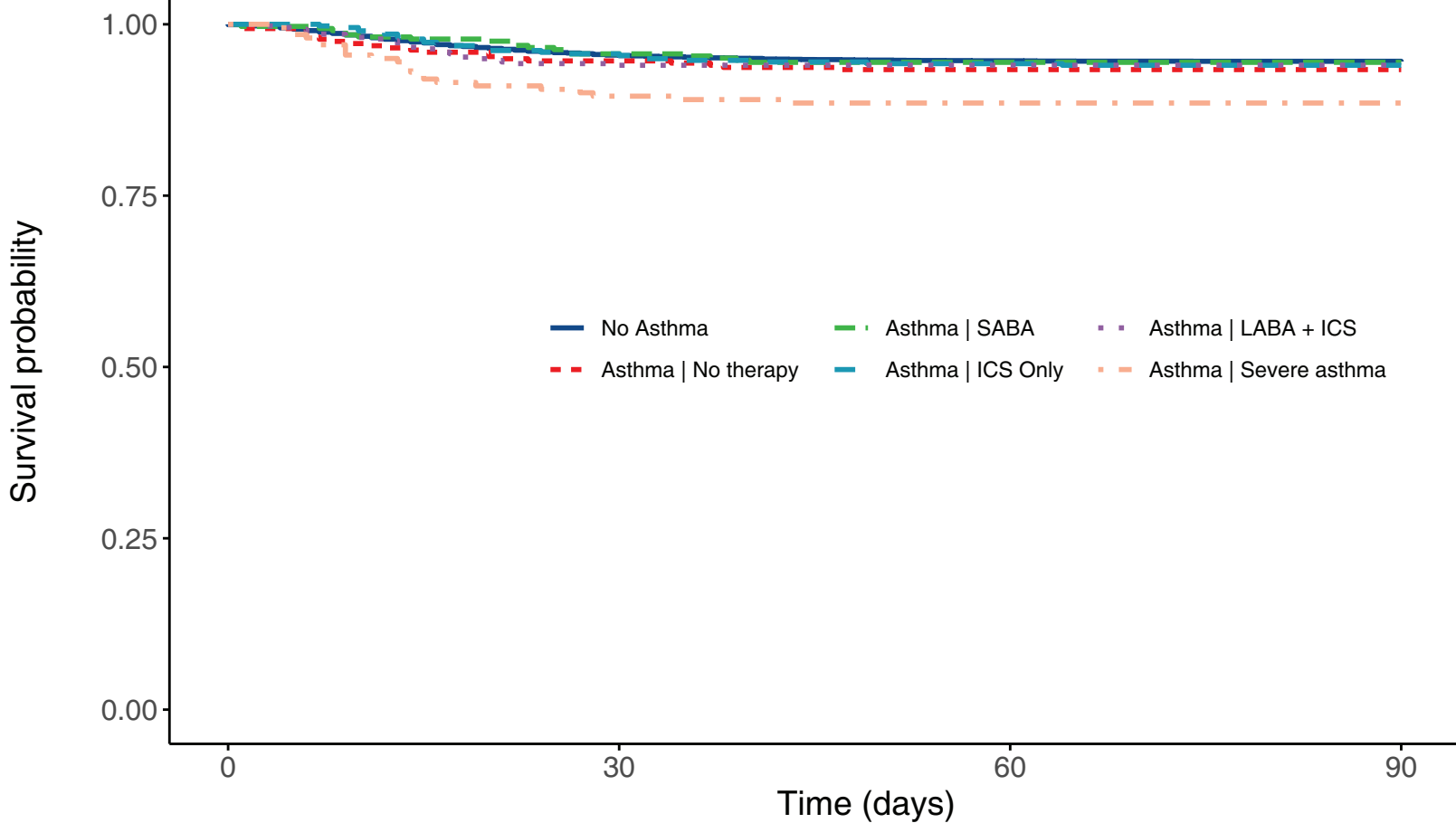
## Respiratory Medicine

### Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Bloom CI, Drake TM, Docherty AB, et al. Risk of adverse outcomes in patients with underlying respiratory conditions admitted to hospital with COVID-19: a national, multicentre prospective cohort study using the ISARIC WHO Clinical Characterisation Protocol UK. *Lancet Respir Med* 2021; published online March 4. [http://dx.doi.org/10.1016/S2213-2600\(21\)00013-8](http://dx.doi.org/10.1016/S2213-2600(21)00013-8).

**Supplementary Figure 1.**  
**Survival plot for 16-49 years**

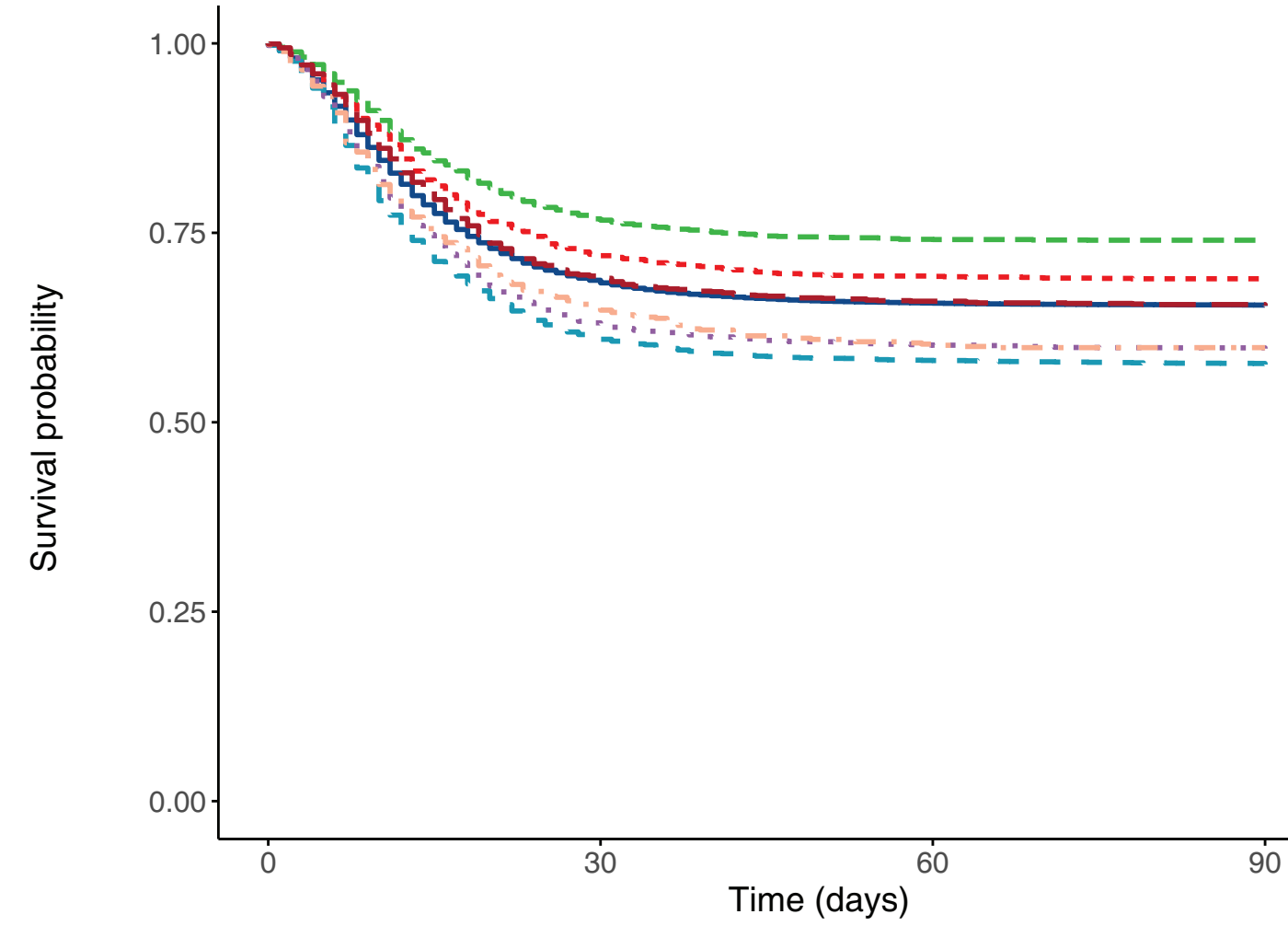


**Number at risk**

No Asthma	7079	6667	6604	6597
Asthma No therapy	326	299	295	295
Asthma SABA	326	310	306	306
Asthma ICS only	424	400	394	391
Asthma LABA + ICS	423	393	393	393
Asthma Most severe asthma	201	179	177	177

— No respiratory disease|No inhaled steroids    
 - - Asthma only|Yes – on inhaled steroid    
 - - Chronic pulmonary disease only|Yes - on inhaled steroid    
 - - Asthma and Chronic pulmonary disease|Yes - on inhaled steroid  
— Asthma only|No Inhaled Steroids    
 - - Chronic pulmonary disease only|No Inhaled Steroids    
 - - Asthma and Chronic pulmonary disease|No Inhaled Steroids

**Supplementary Figure 2.**  
**Survival plot for ≥50 years**

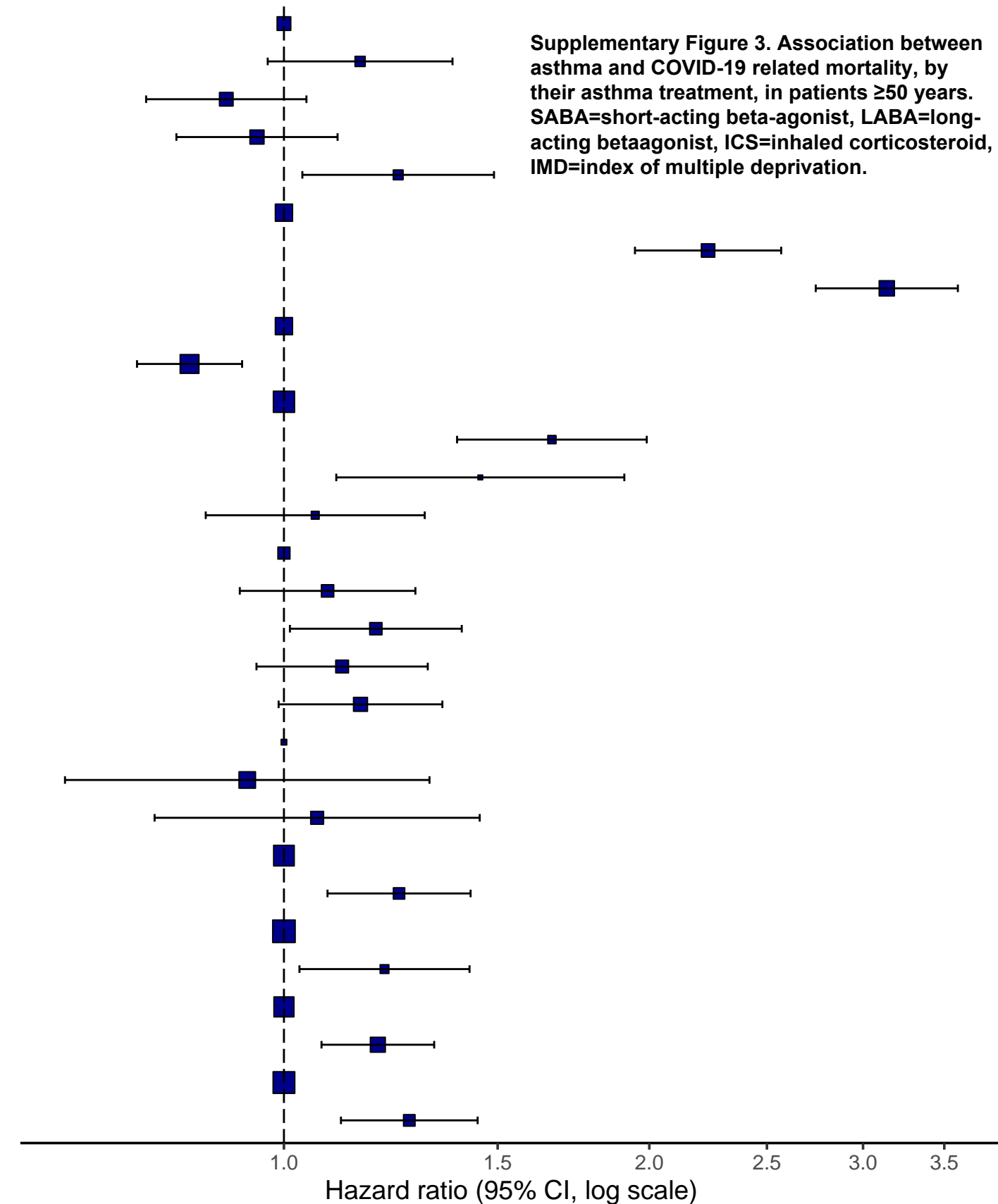


Number at risk

No respiratory disease No inhaled steroids	42727	29059	27758	27641
Asthma only No Inhaled Steroids	2258	1614	1548	1539
Asthma only Yes – on inhaled steroid	3473	2644	2549	2545
Chronic pulmonary disease only No Inhaled Steroids	6008	3624	3440	3414
Chronic pulmonary disease only Yes – on inhaled steroid	4003	2505	2386	2371
Asthma and Chronic pulmonary disease  No Inhaled Steroids	658	424	387	384
Asthma and Chronic pulmonary disease  Yes – on inhaled steroid	1370	940	895	889

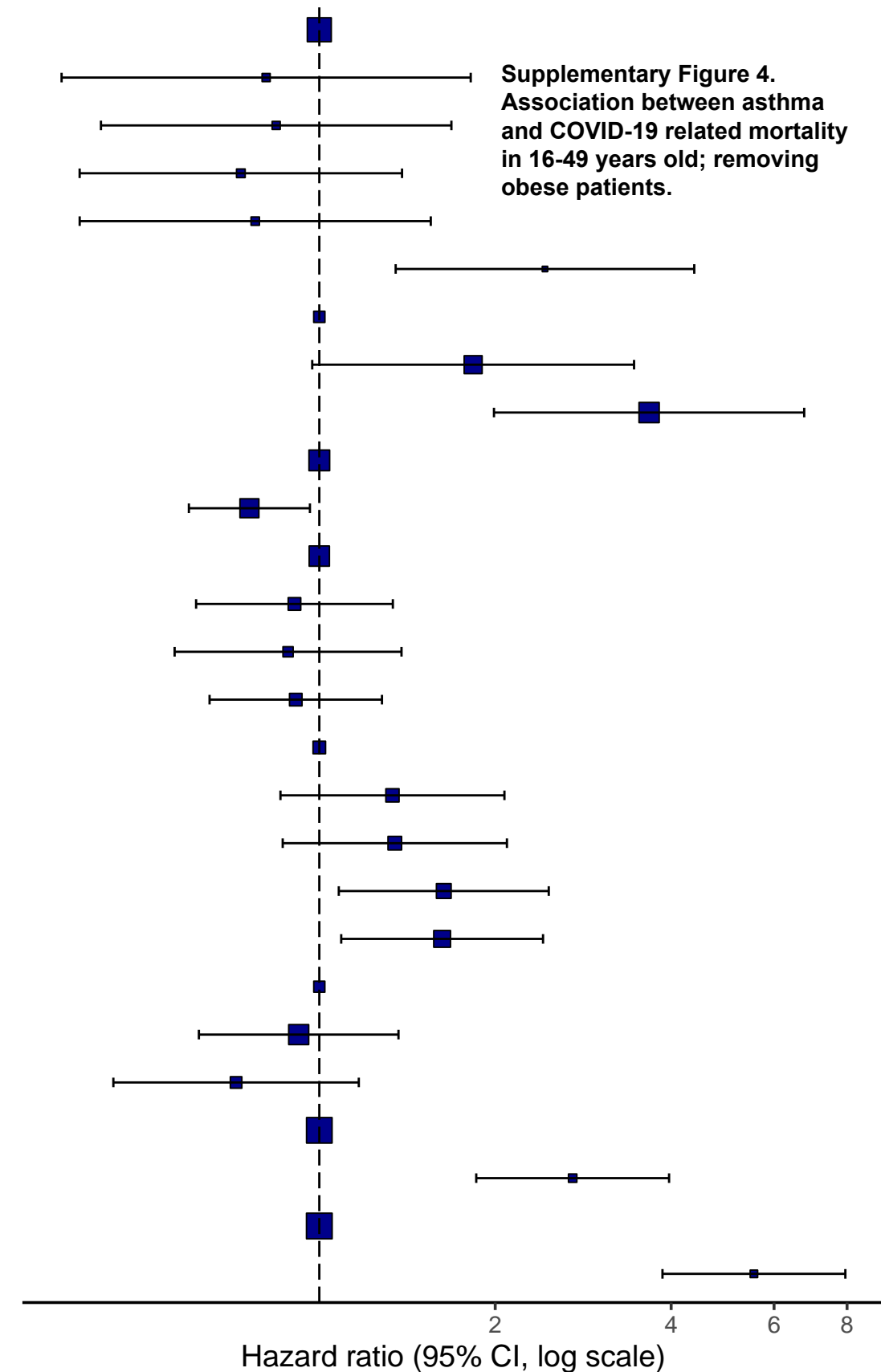
Survival: HR (95% CI, p-value)

Asthma ICS:Asthma therapy	Asthma only No therapy	–
	Asthma only SABA	1.16 (0.97–1.38, p=0.106)
	Asthma only ICS only	0.90 (0.77–1.04, p=0.157)
	Asthma only LABA + ICS	0.95 (0.82–1.11, p=0.508)
Age	Asthma only Most severe asthma	1.24 (1.04–1.49, p=0.020)
	50 to 70 Years	–
	70 to 80 Years	2.24 (1.95–2.57, p<0.001)
Sex	Over 80 Years	3.14 (2.74–3.59, p<0.001)
	Male	–
	Female	0.84 (0.76–0.92, p<0.001)
Ethnicity	White	–
	Asian	1.66 (1.39–1.99, p<0.001)
	Black	1.45 (1.10–1.91, p=0.008)
	Other	1.06 (0.86–1.31, p=0.575)
IMD quintile	1	–
	2	1.09 (0.92–1.28, p=0.330)
	3	1.19 (1.01–1.40, p=0.036)
	4	1.12 (0.95–1.31, p=0.183)
	5	1.16 (0.99–1.35, p=0.067)
Smoking	Yes	–
	Never Smoked	0.93 (0.66–1.32, p=0.677)
	Former Smoker	1.07 (0.78–1.45, p=0.680)
Obesity	No	–
	Yes	1.24 (1.09–1.42, p=0.002)
Malignant Neoplasm	No	–
	Yes	1.21 (1.03–1.42, p=0.020)
Chronic Cardiac Disease	No	–
	Yes	1.20 (1.07–1.33, p=0.001)
Chronic Kidney Disease	No	–
	Yes	1.27 (1.11–1.44, p<0.001)



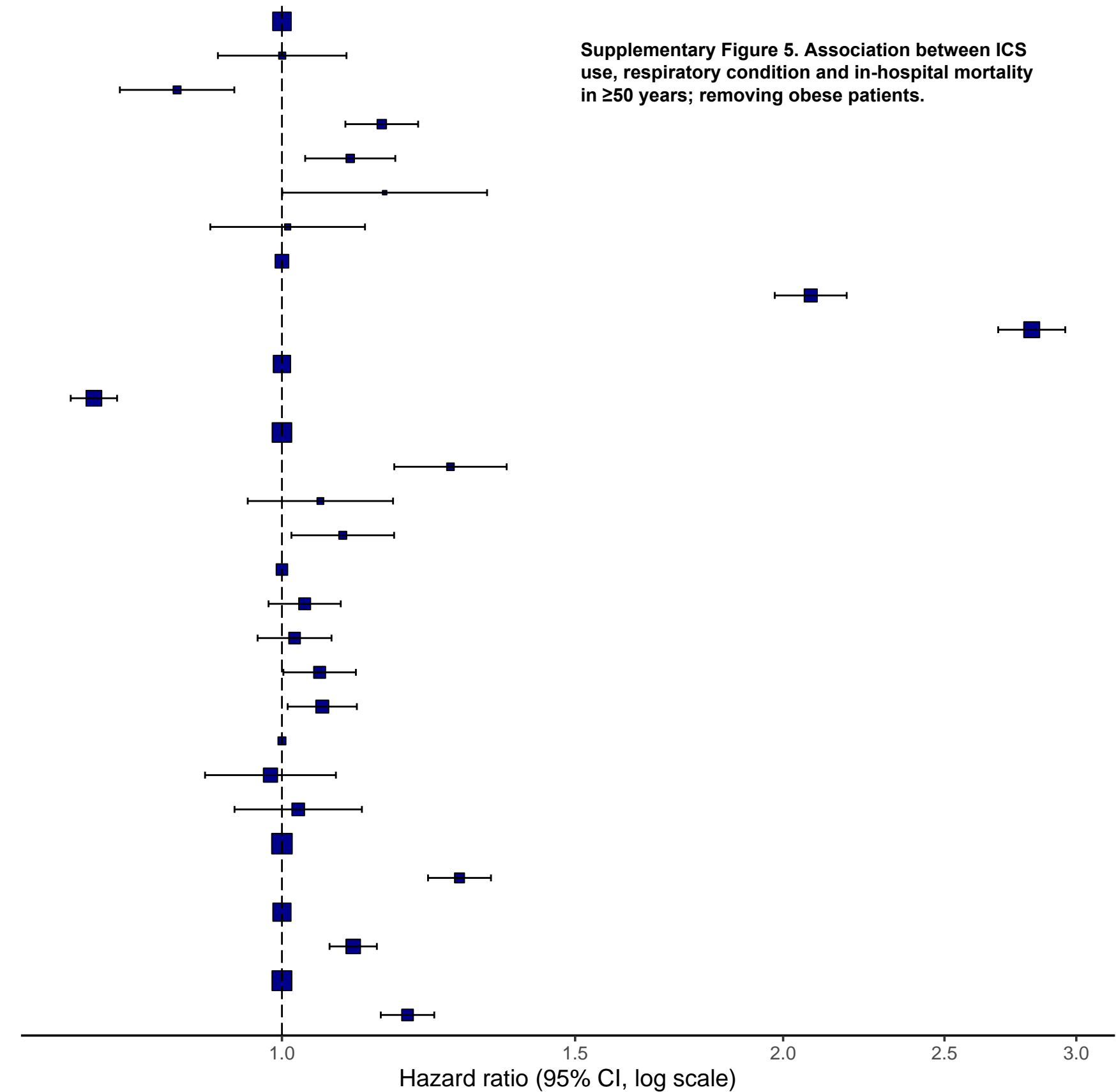
Survival: HR (95% CI, p-value)

Asthma and therapy	No Asthma	–
	Asthma No therapy	0.81 (0.36–1.82, p=0.602)
	Asthma SABA	0.84 (0.42–1.68, p=0.627)
	Asthma ICS only	0.73 (0.39–1.39, p=0.339)
	Asthma LABA + ICS	0.78 (0.39–1.55, p=0.472)
Age	Asthma Most severe asthma	2.43 (1.35–4.38, p=0.003)
	16 to 25 Years	–
	25 to 40 Years	1.83 (0.97–3.46, p=0.061)
	40 to 50 Years	3.67 (1.99–6.76, p<0.001)
Sex	Male	–
	Female	0.76 (0.60–0.96, p=0.024)
Ethnicity	White	–
	Asian	0.91 (0.62–1.34, p=0.613)
	Black	0.88 (0.57–1.38, p=0.588)
	Other	0.91 (0.65–1.28, p=0.590)
IMD quintile	1	–
	2	1.33 (0.86–2.07, p=0.200)
	3	1.35 (0.87–2.09, p=0.186)
	4	1.63 (1.08–2.47, p=0.020)
	5	1.62 (1.09–2.41, p=0.017)
Smoking	Yes	–
	Never Smoked	0.92 (0.62–1.37, p=0.679)
	Former Smoker	0.72 (0.44–1.17, p=0.180)
Chronic Cardiac Disease	No	–
	Yes	2.71 (1.86–3.97, p<0.001)
Malignant Neoplasm	No	–
	Yes	5.54 (3.87–7.95, p<0.001)



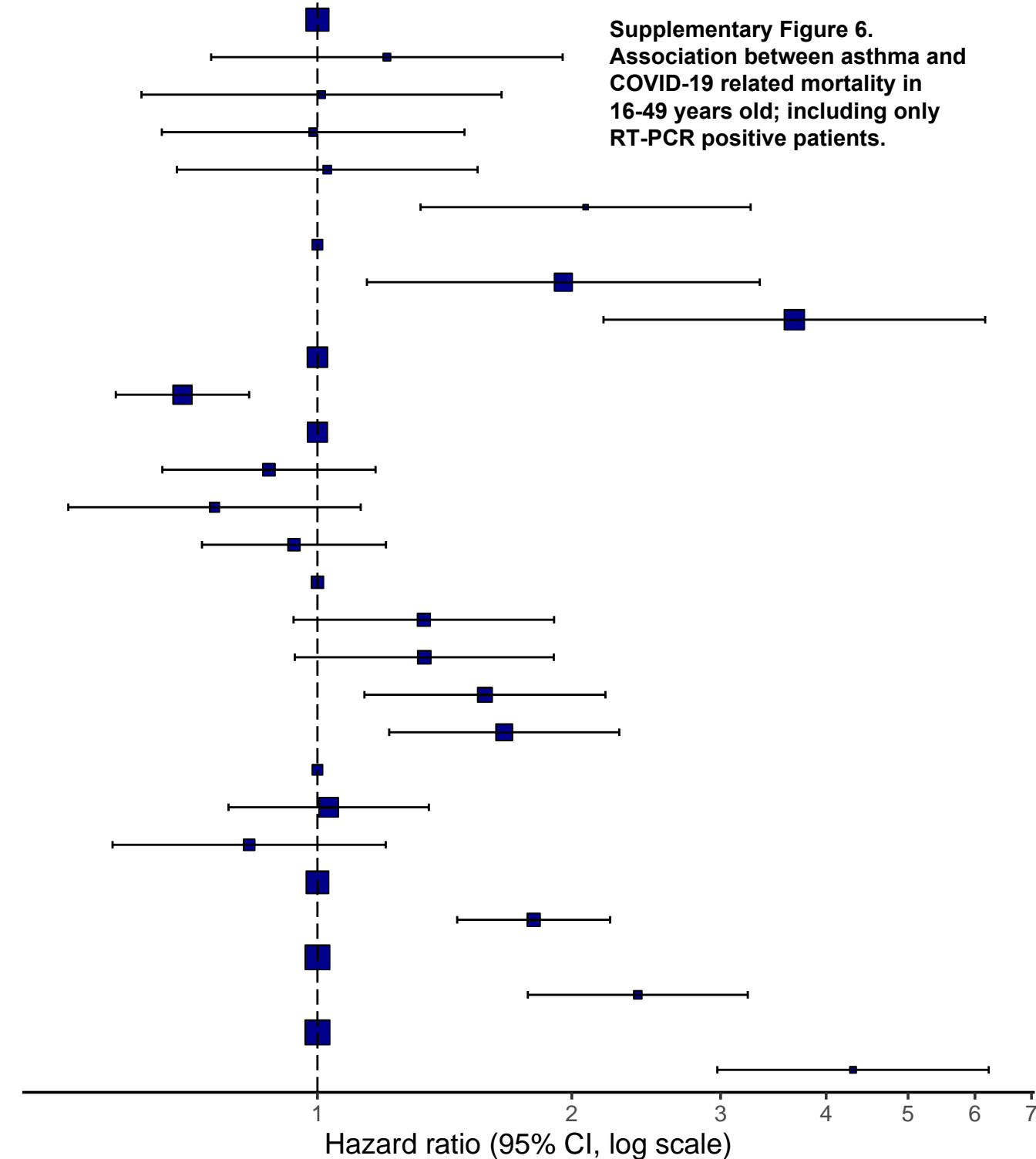
Survival: HR (95% CI, p-value)

Respiratory disease	No respiratory disease No inhaled steroids	–
	Asthma only No Inhaled Steroids	1.00 (0.92–1.09, p=0.994)
	Asthma only Yes – on inhaled steroid	0.87 (0.80–0.94, p<0.001)
	Chronic pulmonary disease only No Inhaled Steroids	1.15 (1.09–1.21, p<0.001)
	Chronic pulmonary disease only Yes – on inhaled steroid	1.10 (1.03–1.17, p=0.003)
	Asthma and Chronic pulmonary disease  No Inhaled Steroids	1.15 (1.00–1.33, p=0.049)
	Asthma and Chronic pulmonary disease  Yes – on inhaled steroid	1.01 (0.91–1.12, p=0.885)
Age	50 to 70 Years	–
	70 to 80 Years	2.08 (1.98–2.18, p<0.001)
	Over 80 Years	2.82 (2.69–2.95, p<0.001)
Sex	Male	–
	Female	0.77 (0.75–0.80, p<0.001)
Ethnicity	White	–
	Asian	1.26 (1.17–1.36, p<0.001)
	Black	1.05 (0.95–1.17, p=0.299)
	Other	1.09 (1.01–1.17, p=0.020)
IMD quintile	1	–
	2	1.03 (0.98–1.08, p=0.217)
	3	1.02 (0.97–1.07, p=0.503)
	4	1.05 (1.00–1.11, p=0.042)
	5	1.06 (1.01–1.11, p=0.022)
Smoking	Yes	–
	Never Smoked	0.98 (0.90–1.08, p=0.718)
	Former Smoker	1.02 (0.94–1.12, p=0.600)
Malignant Neoplasm	No	–
	Yes	1.28 (1.22–1.34, p<0.001)
Chronic Cardiac Disease	No	–
	Yes	1.10 (1.07–1.14, p<0.001)
Chronic Kidney Disease	No	–
	Yes	1.19 (1.15–1.23, p<0.001)



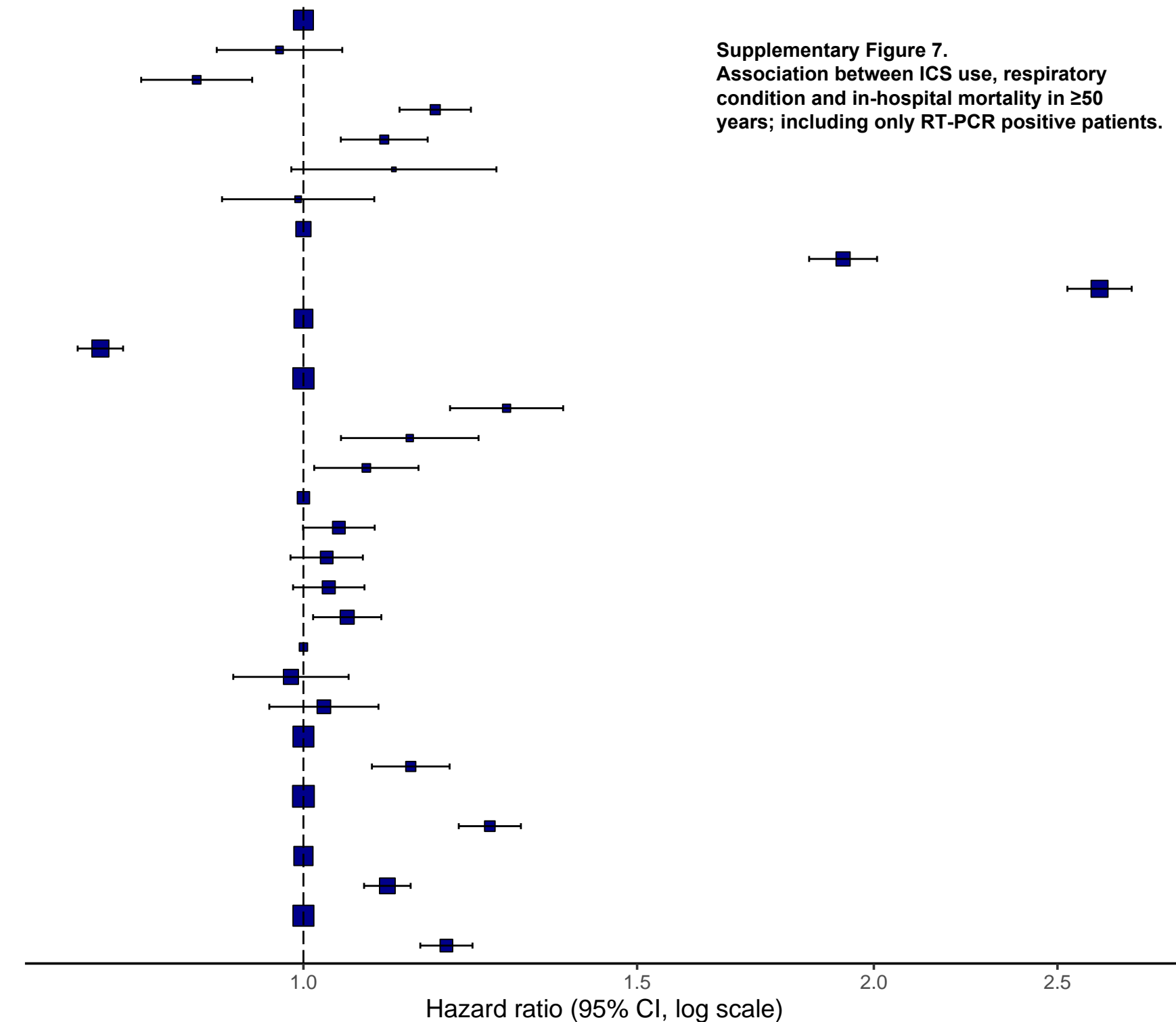
Survival: HR (95% CI, p-value)

Asthma and therapy	No Asthma	–
	Asthma No therapy	1.21 (0.75–1.95, p=0.435)
	Asthma SABA	1.01 (0.62–1.65, p=0.964)
	Asthma ICS only	0.99 (0.65–1.49, p=0.956)
	Asthma LABA + ICS	1.03 (0.68–1.55, p=0.898)
	Asthma Most severe asthma	2.08 (1.32–3.26, p=0.002)
Age	16 to 25 Years	–
	25 to 40 Years	1.95 (1.14–3.34, p=0.014)
	40 to 50 Years	3.67 (2.18–6.17, p<0.001)
Sex	Male	–
	Female	0.69 (0.58–0.83, p<0.001)
Ethnicity	White	–
	Asian	0.88 (0.66–1.17, p=0.366)
	Black	0.76 (0.51–1.13, p=0.166)
	Other	0.94 (0.73–1.21, p=0.616)
IMD quintile	1	–
	2	1.34 (0.94–1.91, p=0.109)
	3	1.34 (0.94–1.90, p=0.106)
	4	1.58 (1.14–2.19, p=0.007)
	5	1.66 (1.22–2.28, p=0.002)
Smoking	Yes	–
	Never Smoked	1.03 (0.78–1.35, p=0.825)
	Former Smoker	0.83 (0.57–1.20, p=0.321)
Obesity	No	–
	Yes	1.80 (1.46–2.22, p<0.001)
Chronic Cardiac Disease	No	–
	Yes	2.39 (1.77–3.23, p<0.001)
Malignant Neoplasm	No	–
	Yes	4.30 (2.97–6.23, p<0.001)



Survival: HR (95% CI, p-value)

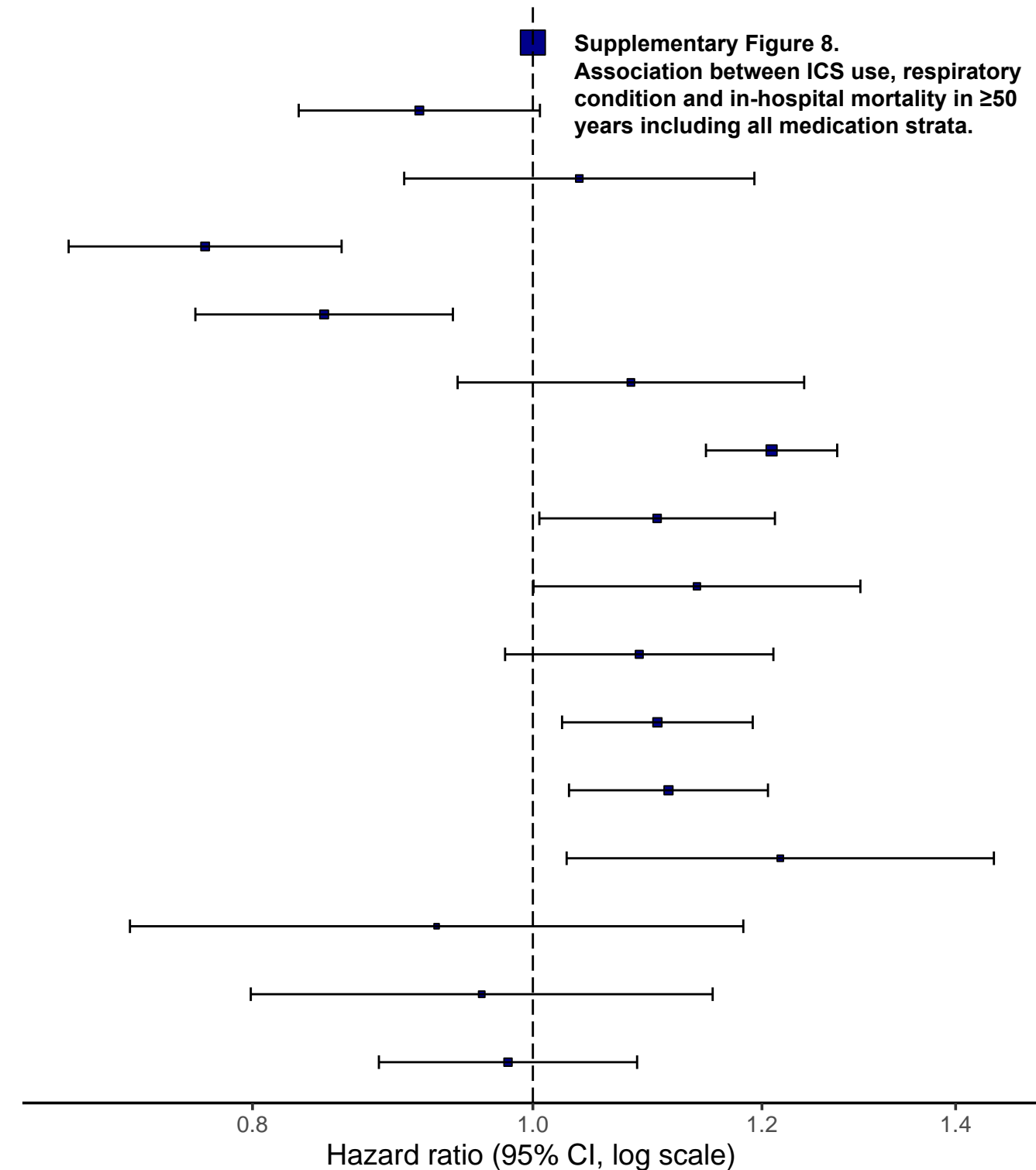
Respiratory disease	No respiratory disease No inhaled steroids	–
	Asthma only No Inhaled Steroids	0.97 (0.90–1.05, p=0.455)
	Asthma only Yes – on inhaled steroid	0.88 (0.82–0.94, p<0.001)
	Chronic pulmonary disease only No Inhaled Steroids	1.17 (1.12–1.23, p<0.001)
	Chronic pulmonary disease only Yes – on inhaled steroid	1.10 (1.05–1.16, p<0.001)
	Asthma and Chronic pulmonary disease  No Inhaled Steroids	1.12 (0.99–1.26, p=0.084)
Age	Asthma and Chronic pulmonary disease  Yes – on inhaled steroid	0.99 (0.91–1.09, p=0.892)
	50 to 70 Years	–
	70 to 80 Years	1.93 (1.85–2.01, p<0.001)
Sex	Over 80 Years	2.63 (2.53–2.74, p<0.001)
	Male	–
Ethnicity	Female	0.78 (0.76–0.80, p<0.001)
	White	–
	Asian	1.28 (1.19–1.37, p<0.001)
IMD quintile	Black	1.14 (1.05–1.24, p=0.003)
	Other	1.08 (1.01–1.15, p=0.018)
	1	–
	2	1.04 (1.00–1.09, p=0.053)
Smoking	3	1.03 (0.98–1.07, p=0.208)
	4	1.03 (0.99–1.08, p=0.164)
	5	1.05 (1.01–1.10, p=0.012)
	Yes	–
	Never Smoked	0.98 (0.92–1.06, p=0.662)
Obesity	Former Smoker	1.03 (0.96–1.10, p=0.453)
	No	–
Malignant Neoplasm	Yes	1.14 (1.09–1.19, p<0.001)
	No	–
Chronic Cardiac Disease	Yes	1.25 (1.21–1.30, p<0.001)
	No	–
Chronic Kidney Disease	Yes	1.11 (1.08–1.14, p<0.001)
	No	–
	Yes	1.19 (1.15–1.23, p<0.001)





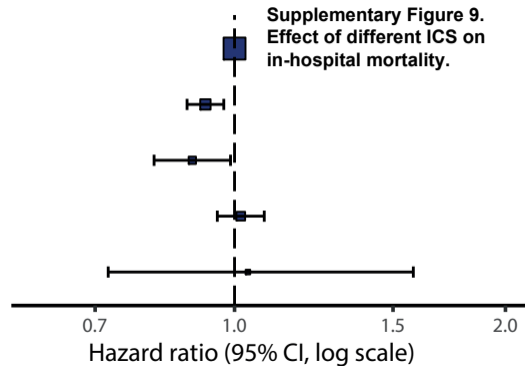
Survival: HR (95% CI, p-value)

Therapy	No or missing No therapy	HR (95% CI, p-value)
	No or missing No therapy	–
	Asthma No therapy	0.91 (0.83–1.01, p=0.065)
	Asthma SABA	1.04 (0.90–1.19, p=0.603)
	Asthma ICS	0.77 (0.69–0.86, p<0.001)
	Asthma ICS + LABA	0.85 (0.76–0.94, p=0.001)
	Asthma Most severe asthma	1.08 (0.94–1.24, p=0.268)
	Chronic pulmonary disease only No therapy	1.21 (1.15–1.27, p<0.001)
	Chronic pulmonary disease only SABA	1.10 (1.01–1.21, p=0.039)
	Chronic pulmonary disease only LAMA or LABA only	1.14 (1.00–1.30, p=0.049)
	Chronic pulmonary disease only ICS	1.09 (0.98–1.21, p=0.120)
	Chronic pulmonary disease only Dual therapy	1.10 (1.02–1.19, p=0.010)
	Chronic pulmonary disease only Triple therapy	1.11 (1.03–1.21, p=0.008)
	Asthma and Chronic pulmonary disease No therapy	1.22 (1.03–1.44, p=0.023)
	Asthma and Chronic pulmonary disease SABA	0.93 (0.73–1.18, p=0.538)
	Asthma and Chronic pulmonary disease ICS	0.96 (0.80–1.15, p=0.664)
	Asthma and Chronic pulmonary disease ICS + Other	0.98 (0.88–1.09, p=0.706)



# Survival: HR (95% CI, p-value)

Inhaled Steroid	No steroid	—
Beclometasone	0.93 (0.89–0.98, p=0.003)	
Budesonide	0.90 (0.82–1.00, p=0.040)	
Fluticasone	1.01 (0.95–1.08, p=0.659)	
Ciclesonide	1.10 (0.76–1.60, p=0.613)	



**Supplementary Table 1 – Using case report form and therapy use to label the patients**

Label	How defined (case report form and therapy)	Patients (N)	% of label
No respiratory condition (47,398)	No asthma/CPD + no/missing therapy	41039	86.58
	No asthma/CPD + therapy	2501	5.28
	Missing asthma/CPD + no/missing therapy	3643	7.69
	Missing asthma/CPD + therapy	215	0.45
Asthma (5,918)	Asthma + therapy	4269	72.14
	Asthma + no/missing therapy	1649	27.86
CPD (10,266)	CPD (no asthma) + therapy	5789	56.39
	CPD (no asthma) + no/missing therapy	4477	43.61
Asthma and CPD (2,071)	Asthma + CPD + therapy	1662	80.25
	Asthma + CPD + no/missing therapy	409	19.75

**Supplementary Table 2 – Characteristics of patients aged under 16 years**

Characteristic	Total N	Strata	No Asthma	Asthma
Total N (%)			786 (91.4)	74 (8.6)
<b>Demographic characteristics</b>				
Age (continuous, years)	860	Mean (SD)	4.1 (4.7)	6.9 (4.4)
Sex at Birth	858	Female	315 (40.1)	29 (39.2)
		Male	470 (59.8)	44 (59.5)
		(Missing)	1 (0.1)	1 (1.4)
Ethnicity	770	Asian	116 (14.8)	6 (8.1)
		Black	71 (9.0)	5 (6.8)
		White	402 (51.1)	50 (67.6)
		Other	113 (14.4)	7 (9.5)
		(Missing)	84 (10.7)	6 (8.1)
Deprivation (IMD quintile)	860	1	116 (14.8)	10 (13.5)
		2	102 (13.0)	10 (13.5)
		3	102 (13.0)	14 (18.9)
		4	244 (31.0)	25 (33.8)
		5	222 (28.2)	15 (20.3)
Smoking	794	Never Smoked	725 (92.2)	65 (87.8)
		Former Smoker	1 (0.1)	1 (1.4)
		Current Smoker	1 (0.1)	1 (1.4)
		(Missing)	59 (7.5)	7 (9.5)
<b>Clinical characteristics</b>				
Obesity (as defined by clinical staff)	847	No	764 (97.2)	69 (93.2)
		Yes	12 (1.5)	2 (2.7)
		(Missing)	10 (1.3)	3 (4.1)
CPD (not asthma)	859	No	753 (95.8)	73 (98.6)
		Yes	33 (4.2)	0 (0.0)
		(Missing)	0 (0.0)	1 (1.4)
Chronic Cardiac Disease	854	No	737 (93.8)	68 (91.9)
		Yes	43 (5.5)	6 (8.1)
		(Missing)	6 (0.8)	0 (0.0)
Malignancy	859	No	765 (97.3)	74 (100.0)
		Yes	20 (2.5)	0 (0.0)
		(Missing)	1 (0.1)	0 (0.0)
Chronic Kidney Disease	859	No	768 (97.7)	72 (97.3)
		Yes	18 (2.3)	1 (1.4)
		(Missing)	0 (0.0)	1 (1.4)
Diabetes without complications	858	No	777 (98.9)	74 (100.0)
		Yes	7 (0.9)	0 (0.0)
		(Missing)	2 (0.3)	0 (0.0)
Diabetes with complications	858	No	778 (99.0)	74 (100.0)
		Yes	6 (0.8)	0 (0.0)
		(Missing)	2 (0.3)	0 (0.0)
Mild liver disease	858	No	780 (99.2)	74 (100.0)
		Yes	4 (0.5)	0 (0.0)
		(Missing)	2 (0.3)	0 (0.0)
Moderate or severe liver disease	860	No	778 (99.0)	74 (100.0)
		Yes	8 (1.0)	0 (0.0)

		(Missing)	0 (0.0)	0 (0.0)
Chronic neurological disorder	855	No	726 (92.4)	70 (94.6)
		Yes	55 (7.0)	4 (5.4)
		(Missing)	5 (0.6)	0 (0.0)
Chronic haematologic disease	860	No	766 (97.5)	72 (97.3)
		Yes	20 (2.5)	2 (2.7)
		(Missing)	0 (0.0)	0 (0.0)
Rheumatologic disease	858	No	776 (98.7)	74 (100.0)
		Yes	8 (1.0)	0 (0.0)
		(Missing)	2 (0.3)	0 (0.0)
<b>Medication</b>				
Medication	860	Reported	746 (100.0)	69 (93.2)
		Missing	0 (0.0)	5 (6.8)
Type of inhaler therapy	855	No therapy	776 (98.7)	11 (14.9)
		B2 agonist only	2 (0.3)	29 (39.2)
		ICS only	7 (0.9)	17 (23.0)
		ICS + other	1 (0.1)	11 (16.3)
ICS components	855	No steroid	779 (99.1)	43 (58.1)
		Beclometasone	2 (0.3)	21 (28.4)
		Budesonide	3 (0.4)	1 (1.4)
		Fluticasone	2 (0.3)	4 (5.4)
		(Missing)	0 (0.0)	5 (6.8)
Oral corticosteroids	846	No oral steroids	764 (97.2)	68 (91.9)
		Oral steroids	9 (1.1)	5 (6.8)
		(Missing)	13 (1.7)	1 (1.4)

**Supplementary Table 3 – Characteristics of patients aged 16-50 years, by ICS**

label	levels	No Inhaled Steroids	Yes - on inhaled steroid	p
Total N (%)		7728 (86.3)	1076 (12.0)	
Age on admission (years)	Mean (SD)	38.8 (8.6)	39.8 (8.3)	0.00020
Age on admission	16 to 25 Years	680 (8.8)	70 (6.5)	0.0019
	25 to 40 Years	2970 (38.4)	383 (35.6)	
	40 to 50 Years	4078 (52.8)	623 (57.9)	
	50 to 70 Years	0 (0.0)	0 (0.0)	
	70 to 80 Years	0 (0.0)	0 (0.0)	
	Over 80 Years	0 (0.0)	0 (0.0)	
Sex at Birth	Female	3401 (44.0)	613 (57.0)	<0.0001
	Male	4312 (55.8)	460 (42.8)	
	(Missing)	15 (0.2)	3 (0.3)	
Ethnicity	White	3996 (51.7)	720 (66.9)	<0.0001
	Asian	1063 (13.8)	126 (11.7)	
	Black	584 (7.6)	26 (2.4)	
	Other	1035 (13.4)	87 (8.1)	
	(Missing)	1050 (13.6)	117 (10.9)	
IMD quintile	1	979 (12.7)	167 (15.5)	0.033
	2	1207 (15.6)	169 (15.7)	
	3	1315 (17.0)	179 (16.6)	
	4	1740 (22.5)	208 (19.3)	
	5	2479 (32.1)	353 (32.8)	
	(Missing)	8 (0.1)	0 (0.0)	
Smoking	Current Smoker	679 (8.8)	104 (9.7)	0.00011
	Never Smoked	3922 (50.8)	518 (48.1)	
	Former Smoker	822 (10.6)	164 (15.2)	
	(Missing)	2305 (29.8)	290 (27.0)	
Obesity (as defined by clinical staff)	No	6021 (77.9)	677 (62.9)	<0.0001
	Yes	1157 (15.0)	299 (27.8)	
	(Missing)	550 (7.1)	100 (9.3)	
Probable Asthma Classification	No Asthma	7022 (90.9)	61 (5.7)	<0.0001
	Asthma	706 (9.1)	1015 (94.3)	
Chronic Cardiac Disease	No	7353 (95.1)	978 (90.9)	0.0017
	Yes	324 (4.2)	67 (6.2)	
	(Missing)	51 (0.7)	31 (2.9)	
Malignant neoplasm	No	7443 (96.3)	1022 (95.0)	0.019
	Yes	209 (2.7)	15 (1.4)	
	(Missing)	76 (1.0)	39 (3.6)	
Chronic kidney disease	No	7349 (95.1)	1001 (93.0)	0.77
	Yes	321 (4.2)	41 (3.8)	
	(Missing)	58 (0.8)	34 (3.2)	
Diabetes without complications	No	6801 (88.0)	888 (82.5)	0.00072
	Yes	682 (8.8)	127 (11.8)	
	(Missing)	245 (3.2)	61 (5.7)	
Diabetes with complications	No	7193 (93.1)	976 (90.7)	0.99
	Yes	300 (3.9)	40 (3.7)	
	(Missing)	235 (3.0)	60 (5.6)	

label	levels	No Inhaled Steroids	Yes - on inhaled steroid	p
Mild Liver disease	No	7523 (97.3)	1019 (94.7)	0.92
	Yes	118 (1.5)	17 (1.6)	
	(Missing)	87 (1.1)	40 (3.7)	
Moderate or severe liver disease	No	7495 (97.0)	1021 (94.9)	0.64
	Yes	153 (2.0)	18 (1.7)	
	(Missing)	80 (1.0)	37 (3.4)	
Chronic neurological disorder	No	7149 (92.5)	963 (89.5)	0.41
	Yes	510 (6.6)	77 (7.2)	
	(Missing)	69 (0.9)	36 (3.3)	
Chronic hematologic disease	No	7450 (96.4)	1010 (93.9)	0.81
	Yes	207 (2.7)	30 (2.8)	
	(Missing)	71 (0.9)	36 (3.3)	
Rheumatologic disorder	No	7423 (96.1)	968 (90.0)	<0.0001
	Yes	221 (2.9)	70 (6.5)	
	(Missing)	84 (1.1)	38 (3.5)	

**Supplementary Table 4 – Characteristics of patients aged ≥50 years, by ICS**

label	levels	No Inhaled Steroids	On inhaled steroid	p
Total N (%)		55131 (84.5)	10079 (15.5)	
Age on admission (years)	Mean (SD)	75.8 (12.3)	75.1 (11.2)	<0.0001
Age on admission	16 to 25 Years	0 (0.0)	0 (0.0)	<0.0001
	25 to 40 Years	0 (0.0)	0 (0.0)	
	40 to 50 Years	0 (0.0)	0 (0.0)	
	50 to 70 Years	17494 (31.7)	3056 (30.3)	
	70 to 80 Years	13696 (24.8)	3205 (31.8)	
	Over 80 Years	23941 (43.4)	3818 (37.9)	
Sex at Birth	Female	23366 (42.4)	4994 (49.5)	<0.0001
	Male	31619 (57.4)	5068 (50.3)	
	(Missing)	146 (0.3)	17 (0.2)	
Ethnicity	White	41836 (75.9)	8206 (81.4)	<0.0001
	Asian	2468 (4.5)	396 (3.9)	
	Black	1691 (3.1)	177 (1.8)	
	Other	2960 (5.4)	398 (3.9)	
	(Missing)	6176 (11.2)	902 (8.9)	
IMD quintile	1	9753 (17.7)	1547 (15.3)	<0.0001
	2	10546 (19.1)	1819 (18.0)	
	3	10236 (18.6)	1776 (17.6)	
	4	11022 (20.0)	2079 (20.6)	
	5	13553 (24.6)	2856 (28.3)	
	(Missing)	21 (0.0)	2 (0.0)	
Smoking	Current Smoker	2494 (4.5)	686 (6.8)	<0.0001
	Never Smoked	17388 (31.5)	2595 (25.7)	
	Former Smoker	11736 (21.3)	3381 (33.5)	
	(Missing)	23513 (42.6)	3417 (33.9)	
Obesity (as defined by clinical staff)	No	40742 (73.9)	7201 (71.4)	<0.0001
	Yes	4738 (8.6)	1231 (12.2)	
	(Missing)	9651 (17.5)	1647 (16.3)	
Respiratory Disease	No or missing	46182 (83.8)	1216 (12.1)	<0.0001
	Asthma only	2264 (4.1)	3481 (34.5)	
	CPD only	6024 (10.9)	4009 (39.8)	
	Asthma and CPD	661 (1.2)	1373 (13.6)	
Chronic Cardiac Disease	No	32703 (59.3)	5614 (55.7)	<0.0001
	Yes	18723 (34.0)	4026 (39.9)	
	(Missing)	3705 (6.7)	439 (4.4)	
Malignant neoplasm	No	44624 (80.9)	8432 (83.7)	0.033
	Yes	5971 (10.8)	1045 (10.4)	
	(Missing)	4536 (8.2)	602 (6.0)	
Chronic kidney disease	No	40777 (74.0)	7671 (76.1)	0.24
	Yes	10253 (18.6)	1866 (18.5)	
	(Missing)	4101 (7.4)	542 (5.4)	
Diabetes without complications	No	40360 (73.2)	7549 (74.9)	0.99
	Yes	8768 (15.9)	1641 (16.3)	
	(Missing)	6003 (10.9)	889 (8.8)	
Diabetes with complications	No	44867 (81.4)	8481 (84.1)	0.0056
	Yes	4141 (7.5)	695 (6.9)	
	(Missing)	6123 (11.1)	903 (9.0)	
Mild Liver disease	No	49525 (89.8)	9282 (92.1)	0.14
	Yes	781 (1.4)	167 (1.7)	
	(Missing)	4825 (8.8)	630 (6.3)	
Moderate or severe liver disease	No	49445 (89.7)	9268 (92.0)	0.31
	Yes	993 (1.8)	202 (2.0)	
	(Missing)	4693 (8.5)	609 (6.0)	
Chronic neurological disorder	No	43414 (78.7)	8385 (83.2)	<0.0001
	Yes	7330 (13.3)	1109 (11.0)	
	(Missing)	4387 (8.0)	585 (5.8)	
Chronic hematologic disease	No	48162 (87.4)	9030 (89.6)	0.96
	Yes	2363 (4.3)	445 (4.4)	
	(Missing)	4606 (8.4)	604 (6.0)	
Rheumatologic disorder	No	44062 (79.9)	8082 (80.2)	<0.0001
	Yes	6302 (11.4)	1387 (13.8)	
	(Missing)	4767 (8.6)	610 (6.1)	

**Supplementary Table 5 – Symptoms and severity on admission, and maximal level of care received during admission, by age and respiratory condition in patients under 16 years old**

		Aged 0 to 16 years		
		No Asthma	Asthma	<i>p-value</i>
Total N (%)		786 (91.4)	74 (8.6)	
<b>Symptoms on admission</b>				
Fever		557 (70.9)	44 (59.5)	0.051
Dyspnoea		225 (28.6)	46 (62.2)	<0.0001
Wheeze		52 (6.6)	30 (40.5)	<0.0001
Cough		261 (33.2)	47 (63.5)	<0.0001
<b>Severity on admission</b>				
Days of symptoms pre-admission	Median (IQR)	1.0 (4.0)	3.0 (6.0)	0.0021
NEWS2	Median (IQR)	7.0 (4.0)	6.0 (5.5)	0.045
NEWS2	0 to 4	76 (9.7)	14 (18.9)	0.045
	5 to 6	84 (10.7)	10 (13.5)	
	7+	263 (33.5)	18 (24.3)	
	(Missing)	363 (46.2)	32 (43.2)	
<b>Outcomes</b>				
Death	Alive	770 (98.0)	73 (98.6)	0.89
	Died	7 (0.9)	0 (0.0)	
	(Missing)	9 (1.1)	1 (1.4)	
Critical Care	Yes	159 (20.5)	10 (13.5)	0.20
IMV	Yes	63 (8.2)	2 (2.7)	0.15
NIV	Yes	55 (7.1)	3 (4.1)	0.46
Oxygen therapy	Yes	192 (24.9)	31 (42.5)	0.0018
Length of Stay	Median (IQR)	2.0 (19.8)	1.0 (5.2)	0.0025
Length of Stay (survivors only)	Median (IQR)	2.0 (19.0)	1.0 (5.5)	0.0040



**Supplementary Table 6 – Univariable and multivariable hazard ratios for survival in in asthma (16-49 years) by asthma therapy**

label	levels	HR (univariable)	HR (multivariable)	HR (multiple imputation)
Asthma and therapy	No Asthma	-	-	-
	Asthma – no therapy	1.24 (0.80-1.93, p=0.34)	1.38 (0.77-2.49, p=0.28)	1.17 (0.73-1.86, p=0.51)
	Asthma - SABA	1.03 (0.64-1.64, p=0.92)	0.58 (0.24-1.42, p=0.23)	0.99 (0.61-1.58, p=0.95)
	Asthma - ICS only	1.10 (0.74-1.66, p=0.63)	0.95 (0.54-1.65, p=0.84)	0.94 (0.62-1.43, p=0.77)
	Asthma - LABA + ICS	1.12 (0.75-1.68, p=0.5890)	1.15 (0.72-1.85, p=0.55)	1.02 (0.67-1.54, p=0.93)
Asthma - Severe asthma	2.27 (1.50-3.44, p=0.00012)	2.17 (1.25-3.75, p=0.0057)	1.96 (1.25-3.08, p=0.0037)	
Age	16 to 24 Years	-	-	-
	25 to 40 Years	1.96 (1.17-3.28, p=0.011)	1.40 (0.65-2.99, p=0.39)	1.91 (1.14-3.21, p=0.015)
	40 to 50 Years	3.98 (2.42-6.57, p<0.0001)	2.91 (1.33-6.37, p=0.0074)	3.55 (2.15-5.88, p<0.0001)
Sex	Male	-	-	-
	Female	0.67 (0.56-0.79, p<0.0001)	0.68 (0.54-0.87, p=0.0021)	0.67 (0.56-0.81, p<0.0001)
Ethnicity	White	-	-	-
	Asian	0.90 (0.70-1.17, p=0.44)	1.25 (0.86-1.83, p=0.24)	0.92 (0.72-1.19, p=0.53)
	Black	0.79 (0.54-1.13, p=0.20)	0.65 (0.33-1.29, p=0.22)	0.79 (0.54-1.17, p=0.24)
	Other	0.90 (0.69-1.18, p=0.46)	1.13 (0.76-1.67, p=0.55)	0.92 (0.72-1.18, p=0.52)
IMD quintile	1	-	-	-
	2	1.20 (0.85-1.69, p=0.31)	1.47 (0.81-2.68, p=0.21)	1.27 (0.90-1.79, p=0.18)
	3	1.16 (0.83-1.64, p=0.39)	1.63 (0.89-2.97, p=0.11)	1.24 (0.88-1.76, p=0.22)
	4	1.42 (1.04-1.95, p=0.028)	1.88 (1.14-3.11, p=0.014)	1.50 (1.09-2.06, p=0.013)
	5	1.50 (1.11-2.02, p=0.0076)	1.77 (1.05-2.98, p=0.032)	1.59 (1.17-2.15, p=0.0030)
Smoking	Yes	-	-	-
	Never Smoked	0.99 (0.72-1.37, p=0.9598)	1.28 (0.80-2.03, p=0.31)	1.05 (0.79-1.39, p=0.75)
	Former Smoker	0.98 (0.65-1.47, p=0.93)	0.87 (0.49-1.55, p=0.64)	0.83 (0.55-1.23, p=0.34)
Obesity	No	-	-	-
	Yes	1.83 (1.49-2.24, p<0.0001)	1.86 (1.41-2.46, p<0.0001)	1.91 (1.56-2.34, p<0.0001)
Chronic Cardiac Disease	No	-	-	-
	Yes	2.92 (2.23-3.84, p<0.0001)	3.29 (2.28-4.74, p<0.0001)	2.35 (1.77-3.12, p<0.0001)
Malignant Neoplasm	No	-	-	-
	Yes	3.94 (2.88-5.38, p<0.0001)	4.87 (2.87-8.27, p<0.0001)	4.39 (3.24-5.95, p<0.0001)

Concordance = 0.705 (SE = 0.018), Likelihood ratio test = 145.737 (df = 20, p = 0.000)

**Supplementary Table 7 – Univariable and multivariable hazard ratios for survival in respiratory conditions (≥50 years) by ICS use only**

label	levels	HR (univariable)	HR (multivariable)	HR (multiple imputation)
Respiratory disease	No respiratory disease	-	-	-
	Asthma only – no ICS	0.87 (0.81-0.94, p=0.00030)	1.00 (0.89-1.13, p=0.94)	0.97 (0.89-1.05, p=0.39)
	Asthma only + ICS	0.70 (0.66-0.75, p<0.0001)	0.86 (0.78-0.95, p=0.0042)	0.86 (0.80-0.92, p<0.0001)
	CPD – no ICS	1.30 (1.25-1.36, p<0.0001)	1.21 (1.13-1.29, p<0.0001)	1.16 (1.12-1.22, p<0.0001)
	CPD + ICS	1.21 (1.15-1.27, p<0.0001)	1.13 (1.04-1.23, p=0.0027)	1.10 (1.04-1.16, p=0.00040)
	Asthma and CPD- no ICS	1.20 (1.06-1.36, p=0.0033)	1.25 (1.05-1.49, p=0.013)	1.13 (1.01-1.28, p=0.041)
	Asthma and CPD + ICS	0.98 (0.90-1.08, p=0.71)	0.95 (0.83-1.07, p=0.39)	0.97 (0.89-1.06, p=0.51)
	Age	50 to 69 Years	-	-
	70 to 80 Years	2.00 (1.92-2.08, p<0.0001)	1.86 (1.75-1.97, p<0.0001)	1.93 (1.85-2.01, p<0.0001)
	Over 80 Years	2.68 (2.58-2.77, p<0.0001)	2.53 (2.38-2.69, p<0.0001)	2.63 (2.53-2.74, p<0.0001)
Sex	Male	-	-	-
	Female	0.82 (0.80-0.84, p<0.0001)	0.77 (0.74-0.81, p<0.0001)	0.78 (0.76-0.80, p<0.0001)
Ethnicity	White	-	-	-
	Asian	0.97 (0.91-1.03, p=0.35)	1.24 (1.11-1.39, p=0.00020)	1.27 (1.19-1.36, p<0.0001)
	Black	0.84 (0.77-0.91, p<0.0001)	1.17 (1.00-1.38, p=0.0565)	1.11 (1.03-1.21, p=0.0085)
	Other	0.87 (0.82-0.93, p<0.0001)	0.98 (0.87-1.11, p=0.77)	1.08 (1.02-1.15, p=0.014)
IMD quintile	1	-	-	-
	2	1.03 (0.99-1.07, p=0.1867)	1.02 (0.95-1.08, p=0.62)	1.05 (1.00-1.10, p=0.030)
	3	1.01 (0.97-1.05, p=0.69)	1.01 (0.94-1.09, p=0.74)	1.04 (0.99-1.08, p=0.10)
	4	1.00 (0.96-1.04, p=0.93)	1.05 (0.97-1.13, p=0.24)	1.04 (1.00-1.09, p=0.045)
	5	1.00 (0.96-1.04, p=0.83)	1.03 (0.96-1.11, p=0.42)	1.07 (1.02-1.11, p=0.0022)
Smoking	Yes	-	-	-
	Never Smoked	1.01 (0.95-1.08, p=0.70)	0.99 (0.91-1.08, p=0.84)	1.00 (0.93-1.07, p=0.95)
	Former Smoker	1.20 (1.12-1.28, p<0.0001)	1.01 (0.93-1.09, p=0.89)	1.03 (0.97-1.10, p=0.34)
Obesity	No	-	-	-
	Yes	0.89 (0.85-0.94, p<0.0001)	1.10 (1.02-1.18, p=0.0089)	1.14 (1.09-1.19, p<0.0001)
Malignant Neoplasm	No	-	-	-
	Yes	1.42 (1.36-1.47, p<0.0001)	1.25 (1.18-1.32, p<0.0001)	1.26 (1.21-1.31, p<0.0001)
Chronic Cardiac Disease	No	-	-	-
	Yes	1.45 (1.41-1.49, p<0.0001)	1.13 (1.08-1.19, p<0.0001)	1.11 (1.07-1.14, p<0.0001)
Chronic Kidney Disease	No	-	-	-
	Yes	1.47 (1.43-1.52, p<0.0001)	1.20 (1.14-1.26, p<0.0001)	1.19 (1.15-1.23, p<0.0001)

Concordance = 0.632 (SE = 0.003), Likelihood ratio test = 1924.554 (df = 22, p = 0.000)

**Supplementary Table 8 – Univariable and multivariable hazard ratios for survival in asthma by therapy (≥50 years)**

label	levels	HR (univariable)	HR (multivariable)	HR (multiple imputation)
Asthma ICS:Asthma therapy	Asthma - No therapy	-	-	-
	Asthma – SABA only	1.04 (0.88-1.22, p=0.67)	1.35 (1.04-1.76, p=0.024)	1.16 (0.97-1.38, p=0.11)
	Asthma - ICS only	0.79 (0.69-0.91, p=0.0010)	0.91 (0.74-1.10, p=0.32)	0.90 (0.77-1.04, p=0.16)
	Asthma - LABA + ICS	0.82 (0.71-0.94, p=0.0040)	1.02 (0.84-1.23, p=0.87)	0.95 (0.82-1.11, p=0.51)
	Asthma - Most severe asthma	0.99 (0.83-1.18, p=0.92)	1.65 (1.28-2.13, p=0.00010)	1.24 (1.04-1.49, p=0.020)
Age	50 to 69 Years	-	-	-
	70 to 80 Years	2.27 (1.99-2.60, p<0.0001)	2.38 (2.00-2.83, p<0.0001)	2.24 (1.95-2.57, p<0.0001)
	Over 80 Years	3.20 (2.84-3.60, p<0.0001)	3.44 (2.88-4.10, p<0.0001)	3.14 (2.74-3.59, p<0.0001)
Sex	Male	-	-	-
	Female	0.89 (0.81-0.98, p=0.019)	0.80 (0.69-0.93, p=0.0030)	0.84 (0.76-0.92, p=0.0004)
Ethnicity	White	-	-	-
	Asian	1.37 (1.15-1.64, p=0.0010)	1.53 (1.13-2.07, p=0.0056)	1.66 (1.39-1.99, p<0.0001)
	Black	1.13 (0.87-1.48, p=0.36)	1.47 (1.03-2.09, p=0.034)	1.45 (1.10-1.91, p=0.0077)
	Other	0.94 (0.76-1.17, p=0.58)	0.91 (0.66-1.27, p=0.60)	1.06 (0.86-1.31, p=0.58)
IMD quintile	1	-	-	-
	2	1.02 (0.86-1.20, p=0.84)	1.02 (0.76-1.37, p=0.91)	1.09 (0.92-1.28, p=0.33)
	3	1.16 (0.99-1.36, p=0.073)	1.31 (1.03-1.66, p=0.026)	1.19 (1.01-1.40, p=0.036)
	4	1.08 (0.92-1.27, p=0.32)	1.26 (0.97-1.64, p=0.087)	1.12 (0.95-1.31, p=0.18)
	5	1.09 (0.93-1.27, p=0.28)	1.27 (1.00-1.61, p=0.051)	1.16 (0.99-1.35, p=0.067)
Smoking	Yes	-	-	-
	Never Smoked	1.19 (0.87-1.63, p=0.28)	0.94 (0.65-1.37, p=0.75)	0.93 (0.66-1.32, p=0.68)
	Former Smoker	1.44 (1.05-1.99, p=0.024)	1.12 (0.76-1.65, p=0.57)	1.07 (0.78-1.45, p=0.68)
Obesity	No	-	-	-
	Yes	0.94 (0.81-1.08, p=0.35)	1.17 (0.95-1.43, p=0.13)	1.24 (1.09-1.42, p=0.0016)
Malignant Neoplasm	No	-	-	-
	Yes	1.52 (1.29-1.78, p<0.0001)	1.29 (0.97-1.72, p=0.076)	1.21 (1.03-1.42, p=0.021)
Chronic Cardiac Disease	No	-	-	-
	Yes	1.76 (1.59-1.94, p<0.0001)	1.20 (1.02-1.41, p=0.024)	1.20 (1.07-1.33, p=0.0011)
Chronic Kidney Disease	No	-	-	-
	Yes	1.80 (1.60-2.02, p<0.0001)	1.43 (1.18-1.72, p=0.00030)	1.27 (1.11-1.44, p=0.00043)

Concordance = 0.692 (SE = 0.009), Likelihood ratio test = 329.487 (df = 20, p < 0.01)

**Supplementary Table 9. Association between ICS use, respiratory condition and in-hospital mortality in ≥50 years old, stratified by admission NEWS2 score**

NEWS 0 to 4		N	HR (univariable)	HR (multivariable)
Respiratory disease	No respiratory disease	22532	-	-
	Asthma only - No ICS	1123	0.79 (0.69-0.89, p=0.0002)	0.93 (0.77-1.14, p=0.4931)
	Asthma only - ICS	1832	0.74 (0.67-0.82, p<0.0001)	0.91 (0.78-1.05, p=0.1983)
	CPD (no asthma) - No ICS	2658	1.32 (1.23-1.41, p<0.0001)	1.14 (1.03-1.26, p=0.0118)
	CPD (no asthma) - ICS	1530	1.17 (1.06-1.28, p=0.0014)	1.02 (0.87-1.20, p=0.7828)
	Asthma & CPD - No ICS	272	1.26 (1.02-1.55, p=0.0316)	1.58 (1.19-2.08, p=0.0014)
	Asthma & CPD - ICS	636	1.01 (0.87-1.18, p=0.8622)	0.94 (0.76-1.16, p=0.5383)
NEWS 5 to 6		N	HR (univariable)	HR (multivariable)
Respiratory disease	No respiratory disease	6699	-	-
	Asthma only - No ICS	381	0.90 (0.76-1.07, p=0.2189)	1.02 (0.81-1.30, p=0.8477)
	Asthma only - ICS	623	0.59 (0.50-0.69, p<0.0001)	0.79 (0.62-1.00, p=0.0495)
	CPD (no asthma) - No ICS	1078	1.08 (0.97-1.19, p=0.1521)	0.93 (0.81-1.08, p=0.3542)
	CPD (no asthma) - ICS	872	1.09 (0.98-1.21, p=0.1284)	0.97 (0.85-1.10, p=0.6221)
	Asthma & CPD - No ICS	155	0.94 (0.72-1.22, p=0.6181)	0.76 (0.51-1.13, p=0.1766)
	Asthma & CPD - ICS	263	0.83 (0.67-1.02, p=0.0735)	0.69 (0.51-0.93, p=0.0138)
NEWS 7+		N	HR (univariable)	HR (multivariable)
Respiratory disease	No respiratory disease	7831	-	-
	Asthma only - No ICS	425	0.89 (0.77-1.02, p=0.0932)	0.98 (0.77-1.23, p=0.8352)
	Asthma only - ICS	603	0.70 (0.61-0.79, p<0.0001)	0.82 (0.68-0.98, p=0.0327)
	CPD (no asthma) - No ICS	1499	1.20 (1.12-1.29, p<0.0001)	1.18 (1.06-1.31, p=0.0026)
	CPD (no asthma) - ICS	1186	0.96 (0.88-1.04, p=0.3280)	0.91 (0.79-1.04, p=0.1641)
	Asthma & CPD - No ICS	135	1.06 (0.84-1.33, p=0.6289)	0.93 (0.70-1.25, p=0.6454)
	Asthma & CPD - ICS	323	0.90 (0.77-1.05, p=0.1890)	0.90 (0.74-1.11, p=0.3283)

**Supplementary Table 10. Association between ICS use, respiratory condition and in-hospital mortality in 16-50 years old, including age as a continuous transformed variable**

			HR (univariable)	HR (multivariable)
Asthma and therapy	No respiratory disease	7079 (100.0)	-	-
	Asthma only - No ICS	326 (100.0)	1.24 (0.80-1.93, p=0.34)	1.40 (0.77-2.52, p=0.27)
	Asthma only - ICS	326 (100.0)	1.03 (0.64-1.64, p=0.9179)	0.58 (0.24-1.42, p=0.24)
	CPD (no asthma) – No ICS	424 (100.0)	1.10 (0.74-1.66, p=0.63)	0.95 (0.54-1.65, p=0.85)
	CPD (no asthma) - ICS	423 (100.0)	1.12 (0.75-1.68, p=0.59)	1.15 (0.71-1.84, p=0.57)
	Asthma & CPD - No ICS	201 (100.0)	2.27 (1.50-3.44, p=0.00010)	2.22 (1.28-3.84, p=0.0043)
Age	Mean (SD)	38.8 (8.6)	-	-
Sex	Male	5250 (100.0)	-	-
	Female	4436 (100.0)	0.67 (0.56-0.79, p<0.0001)	0.69 (0.54-0.88, p=0.0030)
Ethnicity	White	5080 (100.0)	-	-
	Asian	1321 (100.0)	0.90 (0.70-1.17, p=0.44)	1.26 (0.86-1.85, p=0.23)
	Black	666 (100.0)	0.79 (0.54-1.13, p=0.20)	0.66 (0.33-1.29, p=0.22)
	Other	1260 (100.0)	0.90 (0.69-1.18, p=0.46)	1.13 (0.76-1.67, p=0.55)
IMD quintile	1	1278 (100.0)	-	-
	2	1512 (100.0)	1.20 (0.85-1.69, p=0.31)	1.49 (0.82-2.71, p=0.19)
	3	1662 (100.0)	1.16 (0.83-1.64, p=0.39)	1.63 (0.89-2.96, p=0.11)
	4	2178 (100.0)	1.42 (1.04-1.95, p=0.028)	1.88 (1.14-3.12, p=0.014)
	5	3076 (100.0)	1.50 (1.11-2.02, p=0.0076)	1.76 (1.05-2.95, p=0.032)
Smoking	Yes	829 (100.0)	-	-
	Never Smoked	4641 (100.0)	0.99 (0.72-1.37, p=0.96)	1.28 (0.80-2.04, p=0.30)
	Former Smoker	1032 (100.0)	0.98 (0.65-1.47, p=0.93)	0.87 (0.49-1.55, p=0.64)
Obesity	No	6858 (100.0)	-	-
	Yes	1533 (100.0)	1.83 (1.49-2.24, p<0.0001)	1.84 (1.40-2.42, p<0.0001)
Chronic Cardiac Disease	No	8503 (100.0)	-	-
	Yes	414 (100.0)	2.92 (2.23-3.84, p<0.0001)	3.25 (2.24-4.70, p<0.0001)
Malignant Neoplasm	No	8632 (100.0)	-	-
	Yes	236 (100.0)	3.94 (2.88-5.38, p<0.0001)	4.83 (2.84-8.22, p<0.0001)
<b>Spline terms for age</b>				
	First knot term		1.08 (1.02-1.14, p=0.0075)	1.04 (0.95-1.13, p=0.43)
	Second knot term		0.98 (0.90-1.06, p=0.56)	1.05 (0.91-1.21, p=0.50)

	HR (univariable)	HR (multivariable)
Third knot term	1.12 (0.70-1.80, p=0.63)	0.68 (0.32-1.48, p=0.33)

**Supplementary Table 11. Association between ICS use, respiratory condition and in-hospital mortality in ≥50 years old, including age as a continuous transformed variable**

			HR (univariable)	HR (multivariable)
Respiratory disease	No respiratory disease	42727 (100.0)	-	-
	Asthma only - No ICS	2258 (100.0)	0.87 (0.81-0.94, p=0.00030)	1.02 (0.91-1.15, p=0.73)
	Asthma only - ICS	3473 (100.0)	0.70 (0.66-0.75, p<0.0001)	0.89 (0.81-0.99, p=0.026)
	CPD (no asthma) – No ICS	6008 (100.0)	1.30 (1.25-1.36, p<0.0001)	1.20 (1.13-1.28, p<0.0001)
	CPD (no asthma) - ICS	4003 (100.0)	1.21 (1.15-1.27, p<0.0001)	1.13 (1.04-1.23, p=0.0032)
	Asthma & CPD - No ICS	658 (100.0)	1.20 (1.06-1.36, p=0.0033)	1.26 (1.06-1.51, p=0.0096)
	Asthma & CPD - ICS	1370 (100.0)	0.98 (0.90-1.08, p=0.71)	0.95 (0.84-1.07, p=0.40)
	Age	Mean (SD)	75.8 (14.9)	-
Sex	Male	36846 (100.0)	-	-
	Female	28485 (100.0)	0.82 (0.80-0.84, p<0.0001)	0.76 (0.72-0.79, p<0.0001)
Ethnicity	White	50242 (100.0)	-	-
	Asian	2880 (100.0)	0.97 (0.91-1.03, p=0.35)	1.29 (1.15-1.44, p<0.0001)
	Black	1885 (100.0)	0.84 (0.77-0.91, p<0.0001)	1.23 (1.04-1.44, p=0.015)
	Other	3379 (100.0)	0.87 (0.82-0.93, p<0.0001)	1.01 (0.90-1.15, p=0.81)
IMD quintile	1	11331 (100.0)	-	-
	2	12412 (100.0)	1.03 (0.99-1.07, p=0.19)	1.02 (0.96-1.09, p=0.50)
	3	12078 (100.0)	1.01 (0.97-1.05, p=0.69)	1.02 (0.95-1.09, p=0.65)
	4	13160 (100.0)	1.00 (0.96-1.04, p=0.93)	1.06 (0.98-1.14, p=0.14)
	5	16488 (100.0)	1.00 (0.96-1.04, p=0.83)	1.04 (0.97-1.13, p=0.26)
Smoking	Yes	3205 (100.0)	-	-
	Never Smoked	20062 (100.0)	1.01 (0.95-1.08, p=0.70)	0.97 (0.89-1.06, p=0.54)
	Former Smoker	15195 (100.0)	1.20 (1.12-1.28, p<0.0001)	0.98 (0.90-1.07, p=0.69)
Obesity	No	48172 (100.0)	-	-
	Yes	5997 (100.0)	0.89 (0.85-0.94, p<0.0001)	1.14 (1.07-1.23, p=0.00020)
Malignant Neoplasm	No	53326 (100.0)	-	-
	Yes	7017 (100.0)	1.42 (1.36-1.47, p<0.0001)	1.24 (1.17-1.32, p<0.0001)
Chronic Cardiac Disease	No	38510 (100.0)	-	-
	Yes	22825 (100.0)	1.45 (1.41-1.49, p<0.0001)	1.10 (1.05-1.15, p<0.0001)
Chronic Kidney Disease	No	48692 (100.0)	-	-
	Yes	12151 (100.0)	1.47 (1.43-1.52, p<0.0001)	1.17 (1.11-1.24, p<0.0001)
<b>Spline terms for age</b>				
	First knot term		1.06 (1.06-1.07, p<0.0001)	1.07 (1.06-1.08, p<0.0001)
	Second knot term		0.98 (0.97-0.99, p<0.0001)	0.96 (0.94-0.97, p<0.0001)
	Third knot term		0.97 (0.93-1.00, p=0.049)	1.13 (1.04-1.24, p=0.0048)

**Supplementary Table 12. Univariable and multivariable hazard ratios for the effect of different ICS on survival**

label	levels	HR (univariable)	HR (multivariable)	HR (multiple imputation)
Inhaled Steroid	No steroid	-	-	-
	Beclometasone	0.90 (0.86-0.95, p<0.0001)	0.92 (0.85-0.98, p=0.016)	0.93 (0.89-0.97, p=0.0019)
	Budesonide	0.85 (0.77-0.94, p=0.0011)	0.91 (0.80-1.05, p=0.19)	0.90 (0.81-0.99, p=0.031)
	Fluticasone	1.07 (1.01-1.14, p=0.028)	1.01 (0.93-1.11, p=0.78)	1.02 (0.96-1.08, p=0.60)
	Ciclesonide	1.14 (0.78-1.67, p=0.49)	1.06 (0.64-1.76, p=0.83)	1.03 (0.71-1.51, p=0.86)
Age	16 to 25 Years	-	-	-
	25 to 40 Years	2.68 (1.75-4.10, p<0.0001)	2.05 (1.02-4.14, p=0.045)	2.63 (1.72-4.02, p<0.0001)
	40 to 50 Years	5.38 (3.59-8.06, p<0.0001)	4.21 (2.13-8.34, p<0.0001)	5.09 (3.39-7.62, p<0.0001)
	50 to 70 Years	15.21 (10.27-22.54, p<0.0001)	12.12 (6.21-23.63, p<0.0001)	14.08 (9.50-20.86, p<0.0001)
	70 to 80 Years	30.42 (20.54-45.06, p<0.0001)	23.02 (11.84-44.75, p<0.0001)	27.50 (18.55-40.76, p<0.0001)
	Over 80 Years	40.74 (27.52-60.31, p<0.0001)	31.18 (16.04-60.61, p<0.0001)	37.53 (25.33-55.60, p<0.0001)
Sex	Male	-	-	-
	Female	0.81 (0.79-0.84, p<0.0001)	0.77 (0.74-0.81, p<0.0001)	0.78 (0.76-0.80, p<0.0001)
Ethnicity	Asian	-	-	-
	Black	0.94 (0.85-1.03, p=0.20)	0.92 (0.76-1.11, p=0.37)	0.88 (0.80-0.98, p=0.019)
	White	1.38 (1.30-1.47, p<0.0001)	0.81 (0.73-0.91, p=0.00031)	0.80 (0.76-0.85, p<0.0001)
	Other	0.97 (0.89-1.05, p=0.45)	0.80 (0.71-0.90, p=0.00033)	0.86 (0.79-0.94, p=0.00060)
Deprivation	1	-	-	-
	2	1.02 (0.98-1.07, p=0.29)	1.02 (0.96-1.09, p=0.52)	1.05 (1.01-1.10, p=0.019)
	3	0.99 (0.95-1.03, p=0.56)	1.02 (0.95-1.10, p=0.58)	1.04 (0.99-1.08, p=0.096)
	4	0.94 (0.90-0.98, p=0.0077)	1.06 (0.98-1.15, p=0.13)	1.05 (1.00-1.09, p=0.030)
	5	0.94 (0.90-0.98, p=0.0018)	1.05 (0.98-1.13, p=0.18)	1.08 (1.03-1.12, p=0.00042)
Smoking	Never Smoked	-	-	-
	Current Smoker	1.00 (0.94-1.07, p=0.95)	1.06 (0.97-1.15, p=0.19)	1.06 (0.98-1.15, p=0.13)
	Former Smoker	1.40 (1.35-1.45, p<0.0001)	1.05 (1.00-1.10, p=0.057)	1.06 (1.03-1.10, p=0.0013)
Obesity	No	-	-	-
	Yes	0.86 (0.82-0.90, p<0.0001)	1.12 (1.05-1.20, p=0.0014)	1.16 (1.10-1.21, p<0.0001)
Malignant Neoplasm	No	-	-	-
	Yes	1.62 (1.56-1.69, p<0.0001)	1.26 (1.19-1.34, p<0.0001)	1.28 (1.23-1.33, p<0.0001)
Chronic cardiac disease	No	-	-	-
	Yes	1.75 (1.71-1.80, p<0.0001)	1.15 (1.10-1.21, p<0.0001)	1.12 (1.09-1.15, p<0.0001)
Chronic kidney disease	No	-	-	-
	Yes	1.70 (1.65-1.75, p<0.0001)	1.20 (1.14-1.26, p<0.0001)	1.20 (1.16-1.24, p<0.0001)

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