

Supplemental Online Content

Wang HE, Yu MI, Crowe RP, et al. Longitudinal changes in emergency medical services advanced airway management. *JAMA Netw Open*. 2024;7(8):e2427763. doi:10.1001/jamanetworkopen.2024.27763

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

eTABLE 1

Longitudinal characteristics of EMS events in the ESO Data Collaborative, 2011-2022.

Characteristic	YEAR												Total
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
EMS Agencies contributing to the data set - n	192	268	376	500	641	784	1,135	1,1230	1,265	1,975	1,934	2,670	N/A
EMS events – n	547,627	850,889	1,220,935	1,608,091	2,045,966	2,420,342	3,510,724	4,539,266	5,648,080	7,242,258	8,206,021	9,695,552	47,535,751
Age – Mean (SD)	51.9 (24.7)	52.4 (24.5)	53.5 (24.4)	54.1 (24.3)	54.5 (24.2)	54.5 (24.1)	54.3 (24.0)	54.1 (23.8)	55.1 (23.8)	55.5 (23.3)	55.4 (23.4)	56.0 (23.7)	55.0 (23.8)
Missing	9,557	24,646	41,524	52,368	65,335	81,918	119,919	104,156	189,667	202,362	234,175	297,332	1,422,959
Sex													
Male – n (%)	246,841 (45.1%)	376,616 (44.3%)	538,677 (44.1%)	711,253 (44.2%)	910,620 (44.5%)	1,079,999 (44.6%)	1,575,751 (44.9%)	2,067,112 (45.5%)	2,593,575 (45.9%)	3,422,387 (47.3%)	3,846,646 (46.9%)	4,501,619 (46.4%)	21,871,096 (46.0%)
Female – n (%)	288,670 (52.7%)	446,545 (52.5%)	637,440 (52.2%)	839,092 (52.2%)	1,064,195 (52.0%)	1,247,699 (51.5%)	1,792,530 (51.1%)	2,299,314 (50.6%)	2,850,587 (50.5%)	3,558,756 (49.1%)	4,079,514 (49.7%)	4,872,293 (50.2%)	23,976,635 (50.4%)
Unknown – n (%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (<0.1%)	79 (<0.1%)	89 (<0.1%)	1,717 (<0.1%)	2,238 (<0.1%)	2,658 (<0.1%)	3,388 (<0.1%)	10,173 (<0.1%)
Not reported (missing) – n (%)	12,116 (2.2%)	27,728 (3.3%)	44,818 (3.7%)	57,746 (3.6%)	71,151 (3.5%)	92,640 (3.8%)	142,364 (4.1%)	172,751 (3.8%)	202,201 (3.6%)	258,877 (3.6%)	277,203 (3.4%)	318,252 (3.3%)	1,677,847 (3.5%)
Urbanicity													
Rural – n (%)	105,420 (19.2%)	163,053 (19.2%)	218,874 (17.9%)	297,983 (18.5%)	396,235 (19.4%)	467,304 (19.3%)	614,075 (17.5%)	715,545 (15.8%)	875,024 (15.5%)	1,095,286 (15.1%)	1,200,820 (14.6%)	1,439,059 (14.8%)	7,588,678 (16.0%)
Urban – n (%)	435,730 (79.6%)	677,402 (79.6%)	984,703 (80.7%)	1,277,536 (79.4%)	1,609,470 (78.7%)	1,921,980 (79.4%)	2,868,159 (81.7%)	3,786,955 (83.4%)	4,731,922 (83.8%)	6,088,066 (84.1%)	6,957,755 (84.8%)	8,193,850 (84.5%)	39,533,528 (83.0%)
Missing – n (%)	6,477 (1.2%)	10,434 (1.2%)	17,358 (1.4%)	32,572 (2.0%)	40,261 (2.0%)	31,058 (1.3%)	28,490 (0.8%)	36,766 (0.8%)	41,134 (0.7%)	58,906 (0.8%)	47,446 (0.6%)	62,643 (0.7%)	413,545 (1.0%)
Medical vs. Trauma													
Medical – n (%)	265,389 (48.5%)	442,005 (52.0%)	653,877 (53.6%)	878,707 (54.6%)	1,148,695 (56.1%)	1,558,218 (64.4%)	2,478,773 (70.6%)	3,337,313 (73.5%)	4,160,406 (73.7%)	5,425,487 (74.9%)	6,164,291 (75.1%)	7,517,412 (77.5%)	34,030,573 (71.6%)
Trauma – n (%)	14,384 (2.6%)	21,999 (2.6%)	33,244 (2.7%)	44,506 (2.8%)	57,973 (2.8%)	66,305 (2.7%)	84,886 (2.4%)	109,342 (2.4%)	139,061 (2.5%)	182,327 (2.5%)	212,897 (2.6%)	260,410 (2.7%)	966,924 (2.0%)

Characteristic	YEAR												Total
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
Medical and Trauma	96,149	144,420	201,157	261,983	339,705	434,934	657,307	867,940	1,090,900	1,300,303	1,443,532	1,689,746	8,528,076
– n (%)	(17.6%)	(17.0%)	(16.5%)	(16.3%)	(16.6%)	(18.0%)	(18.7%)	(19.1%)	(19.3%)	(17.9%)	(17.6%)	(17.4%)	(17.9%)
Missing – n (%)	171,705 (31.4%)	242,465 (28.5%)	332,657 (27.2%)	422,895 (26.3%)	499,593 (24.4%)	360,885 (14.9%)	289,758 (8.2%)	224,671 (5.0%)	257,713 (4.6%)	334,141 (4.6%)	385,301 (4.7%)	488,394 (5.0%)	4,010,178 (8.4%)
Cardiac Arrest													
No – n (%)	542,863 (99.1%)	843,148 (99.1%)	1,208,883 (99.0%)	1,591,990 (99.0%)	2,026,222 (99.0%)	2,395,810 (99.0%)	3,469,454 (98.8%)	4,486,154 (98.8%)	5,580,052 (98.8%)	7,132,930 (98.5%)	8,091,224 (98.6%)	9,568,459 (98.7%)	46,937,189 (98.7%)
Yes – n (%)	4,764 (0.9%)	7,741 (0.9%)	12,052 (1.0%)	16,101 (1.0%)	19,744 (1.0%)	24,532 (1.0%)	41,270 (1.2%)	53,112 (1.2%)	68,028 (1.2%)	109,328 (1.5%)	114,797 (1.4%)	127,093 (1.3%)	598,562 (1.3%)
Census Region													
Midwest – n (%)	73,088 (13.3%)	125,993 (14.8%)	165,578 (13.6%)	294,851 (18.3%)	420,594 (20.6%)	511,649 (21.1%)	796,301 (22.7%)	1,004,859 (22.1%)	1,276,492 (22.6%)	1,779,476 (24.6%)	2,003,115 (24.4%)	2,336,692 (24.1%)	10,788,688 (22.7%)
Northeast – n (%)	31,301 (5.7%)	37,938 (4.5%)	59,945 (4.9%)	78,674 (4.9%)	113,900 (5.6%)	147,500 (6.1%)	147,466 (4.2%)	256,861 (5.7%)	270,721 (4.8%)	489,891 (6.8%)	542,795 (6.6%)	805,612 (8.3%)	2,982,604 (6.3%)
South – n (%)	350,095 (63.9%)	549,275 (64.5%)	808,251 (66.2%)	1,018,918 (63.4%)	1,240,680 (60.6%)	1,432,438 (59.2%)	2,080,570 (59.3%)	2,457,490 (54.1%)	3,129,953 (55.4%)	3,692,176 (51.0%)	4,155,268 (50.6%)	4,565,169 (47.1%)	25,480,283 (53.6%)
West – n (%)	92,950 (17.0%)	137,113 (16.1%)	185,728 (15.2%)	214,332 (13.3%)	268,523 (13.1%)	320,683 (13.2%)	476,416 (13.6%)	808,414 (17.8%)	933,089 (16.5%)	1,201,234 (16.6%)	1,409,516 (17.2%)	1,536,391 (15.8%)	7,584,389 (16.0%)
Missing – n (%)	193 (0.0%)	570 (0.1%)	1,433 (0.1%)	1,316 (0.1%)	2,269 (0.1%)	8,072 (0.3%)	9,971 (0.3%)	11,642 (0.3%)	37,825 (0.7%)	79,481 (1.1%)	95,327 (1.2%)	451,688 (4.7%)	699,787 (1.5%)

eTABLE 2

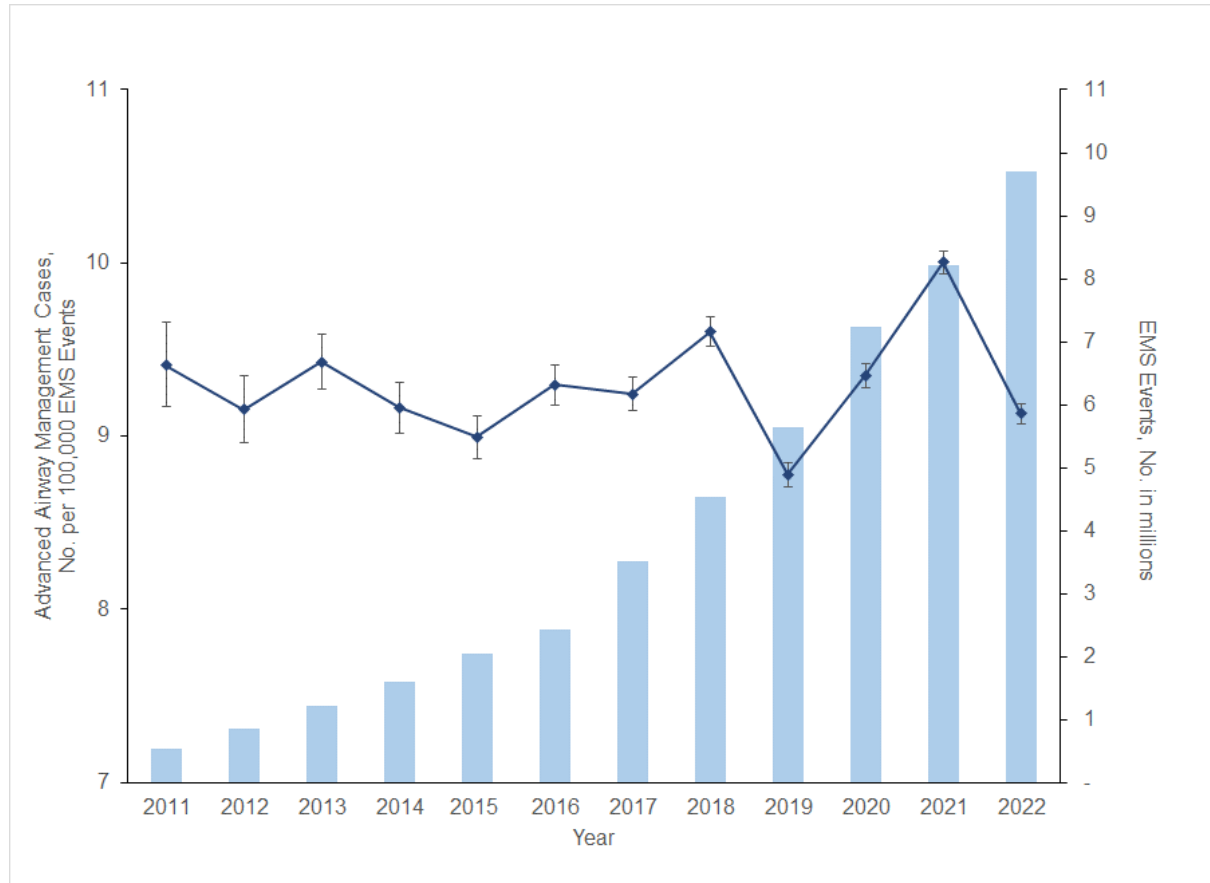
Longitudinal characteristics of EMS events with advanced airway management attempts, ESO Data Collaborative, 2011-2022.

Characteristic	YEAR												Total
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
EMS events – n	547,627	850,889	1,220,935	1,608,091	2,045,966	2,420,342	3,510,724	4,539,266	5,648,080	7,242,258	8,206,021	9,695,552	47,535,751
Advanced Airway Management Incidence (95% CI) - n per 1,000 EMS Events	5,153 9.4	7,790 9.2	11,513 9.4	14,736 9.2	18,404 9.0	22,504 9.3	32,449 9.2	43,586 9.6	49,589 8.8	67,710 9.3	82,098 10.0	88,509 9.1	444,041 9.3
Age – mean (SD)	59.4 (20.7)	59.6 (20.5)	60.5 (20.2)	60.5 (20.2)	60.5 (20.3)	60.0 (20.1)	60.2 (20.0)	60.8 (19.7)	61.1 (19.5)	60.8 (19.6)	60.6 (19.6)	60.5 (19.9)	60.6 (19.8)
Missing	158 (3.1%)	219 (2.8%)	358 (3.1%)	388 (2.6%)	457 (2.5%)	588 (2.6%)	1,078 (3.3%)	1,619 (3.7%)	1,986 (4.0%)	2,974 (4.4%)	3,693 (4.5%)	122 (0.1%)	13,640 (3.1%)
Sex													
Male – n (%)	3,142 (61.0%)	4,629 (59.4%)	6,888 (59.8%)	8,833 (59.9%)	11,186 (60.8%)	13,755 (61.1%)	19,756 (60.9%)	26,771 (61.4%)	30,424 (61.4%)	41,946 (62.0%)	50,EMS (62.0%)	55,055 (62.2%)	273,296 (61.5%)
Female – n (%)	1,977 (38.4%)	3,095 (39.7%)	4,536 (39.4%)	5,804 (39.4%)	7,121 (38.7%)	8,607 (38.2%)	12,451 (38.4%)	16,455 (37.8%)	18,781 (37.9%)	25,381 (37.5%)	30,856 (37.6%)	33,228 (37.5%)	168,292 (37.9%)
Not reported – n (%)	34 (0.7%)	66 (0.8%)	89 (0.8%)	99 (0.7%)	97 (0.5%)	142 (0.6%)	241 (0.7%)	360 (0.8%)	377 (0.8%)	376 (0.6%)	327 (0.4%)	211 (0.2%)	2,419 (0.5%)
Unknown – n (%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.0%)	0 (0.0%)	7 (0.0%)	7 (0.0%)	4 (0.0%)	15 (0.0%)	34 (0.0%)
Urbanicity													
Rural – n (%)	1,147 (22.3%)	1,704 (21.9%)	2,344 (20.4%)	3,040 (20.6%)	4,147 (22.5%)	5,160 (22.9%)	6,582 (20.3%)	7,960 (18.3%)	8,613 (17.4%)	11,644 (17.2%)	13,796 (16.8%)	14,924 (16.9%)	81,061 (18.3%)
Urban – n (%)	3,961 (76.9%)	6,006 (77.1%)	8,983 (78.0%)	11,333 (76.9%)	13,824 (75.1%)	17,037 (75.7%)	25,671 (79.1%)	35,308 (81.0%)	40,668 (82.0%)	55,635 (82.2%)	67,875 (82.7%)	73,096 (82.6%)	359,397 (80.9%)
Missing – n (%)	45 (0.9%)	80 (1.0%)	186 (1.6%)	363 (2.5%)	433 (2.4%)	307 (1.4%)	196 (0.6%)	318 (0.7%)	308 (0.6%)	431 (0.6%)	427 (0.5%)	489 (0.6%)	3,583 (0.8%)
Medical vs. Trauma													
Medical – n (%)	3,403 (66.0%)	5,471 (70.2%)	8,357 (72.6%)	10,811 (73.4%)	13,855 (75.3%)	18,968 (84.3%)	29,282 (90.2%)	39,794 (91.3%)	45,215 (91.2%)	61,861 (91.4%)	75,251 (91.7%)	81,041 (91.6%)	393,309 (88.6%)
Trauma – n (%)	419 (8.1%)	661 (8.5%)	864 (7.5%)	1,087 (7.4%)	1,466 (8.0%)	1,959 (8.7%)	2,893 (8.9%)	3,635 (8.3%)	4,245 (8.6%)	5,687 (8.4%)	6,651 (8.1%)	7,248 (8.2%)	36,815 (8.3%)
Missing – n (%)	1,331 (25.8%)	1,658 (21.3%)	2,292 (19.9%)	2,838 (19.3%)	3,083 (16.8%)	1,577 (7.0%)	274 (0.8%)	157 (0.4%)	129 (0.3%)	162 (0.2%)	196 (0.2%)	220 (0.2%)	13,917 (3.1%)

Characteristic	YEAR												Total
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
Cardiac Arrest													
Yes – n (%)	2,831 (54.9%)	4,785 (61.4%)	7,293 (63.4%)	9,510 (64.5%)	11,761 (63.9%)	14,582 (64.8%)	24,408 (75.2%)	34,125 (78.3%)	39,269 (79.2%)	55,131 (81.4%)	66,824 (81.4%)	72,793 (82.2%)	343,312 (77.3%)
No – n (%)	17 (0.3%)	30 (0.4%)	63 (0.6%)	79 (0.5%)	81 (0.4%)	84 (0.4%)	82 (0.2%)	95 (0.2%)	108 (0.2%)	150 (0.2%)	195 (0.2%)	214 (0.2%)	1,198 (0.3%)
Missing – n (%)	2,305 (44.7%)	2,975 (38.2%)	4,157 (36.1%)	5,147 (34.9%)	6,562 (35.7%)	7,838 (34.8%)	7,959 (24.5%)	9,366 (21.5%)	10,212 (20.6%)	12,429 (18.4%)	15,079 (18.4%)	15,502 (17.5%)	99,531 (22.4%)
Census Region													
Midwest – n (%)	638 (12.4%)	1,116 (14.3%)	1,507 (13.1%)	2,734 (18.6%)	3,950 (21.5%)	5,321 (23.6%)	7,547 (23.3%)	8,657 (19.9%)	11,284 (22.8%)	16,392 (24.2%)	20,422 (24.9%)	22,266 (25.2%)	101,834 (22.9%)
Northeast – n (%)	201 (3.9%)	218 (2.8%)	361 (3.1%)	461 (3.1%)	640 (3.5%)	758 (3.4%)	947 (2.9%)	1,607 (3.7%)	1,876 (3.8%)	2,950 (4.4%)	3,875 (4.7%)	4,924 (5.6%)	18,818 (4.2%)
South – n (%)	3,326 (64.5%)	5,014 (64.4%)	7,648 (66.4%)	9,438 (64.0%)	11,392 (61.9%)	13,581 (60.4%)	19,653 (60.6%)	21,904 (50.2%)	28,818 (58.1%)	38,394 (56.7%)	45,126 (55.0%)	44,885 (50.7%)	249,179 (56.1%)
West – n (%)	984 (19.1%)	1,437 (18.4%)	1,981 (17.2%)	2,087 (14.2%)	2,403 (13.1%)	2,822 (12.5%)	4,281 (13.2%)	5,342 (12.3%)	7,155 (14.4%)	9,563 (14.1%)	12,036 (14.7%)	13,005 (14.7%)	63,096 (14.2%)
Missing – n (%)	4 (0.1%)	5 (0.1%)	16 (0.1%)	16 (0.1%)	19 (0.1%)	22 (0.1%)	21 (0.1%)	6,076 (13.9%)	456 (0.9%)	411 (0.6%)	639 (0.8%)	3,429 (3.9%)	11,114 (2.5%)

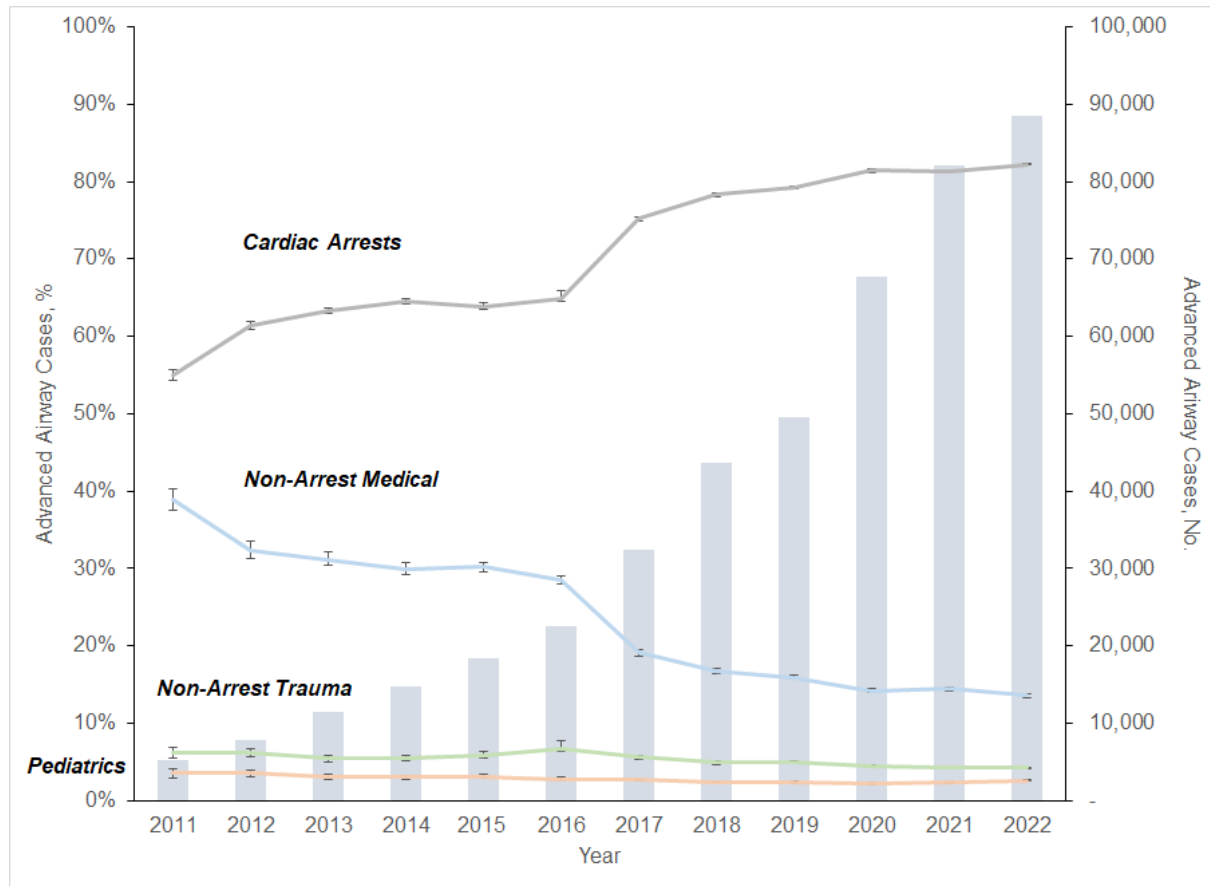
eFIGURE 1

Longitudinal trends in the incidence of EMS events with advanced airway management efforts. Bar graph depicts total number of advanced airway cases in the data set. ESO Data Collaborative 2011-2022. Test of trend from unobserved components model: p for trend=0.62.



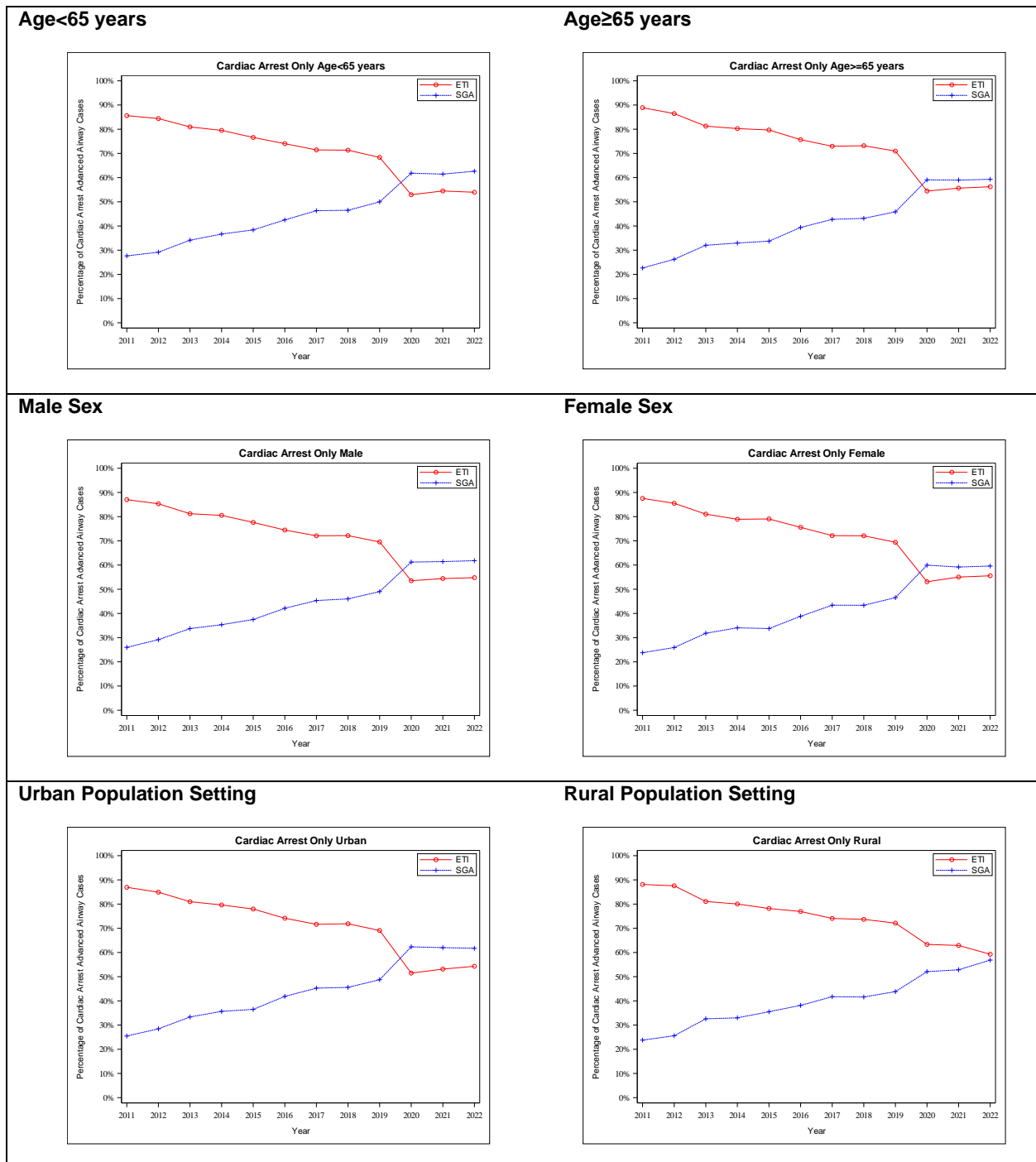
eFIGURE 2

Longitudinal trends in annual advanced airway management cases, stratified by subgroups (cardiac arrest, non-arrest medical and non-arrest trauma, and pediatrics). ESO Data Collaborative, 2011-2022. Bar graph depicts total number of advanced airway management cases in the data set. Includes 343,312 cardiac arrest, 79,358 non-arrest medical, and 21,371 non-arrest trauma and 11,204 pediatric advanced airway management cases. Tests of trend from unobserved components models: Cardiac arrest p for trend=0.002. Non-arrest medical p for trend<0.001. Non-arrest trauma p for trend<0.01. Pediatrics p for trend<0.001.

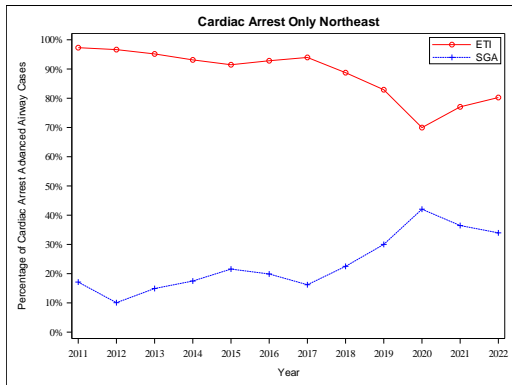


eFIGURE 3

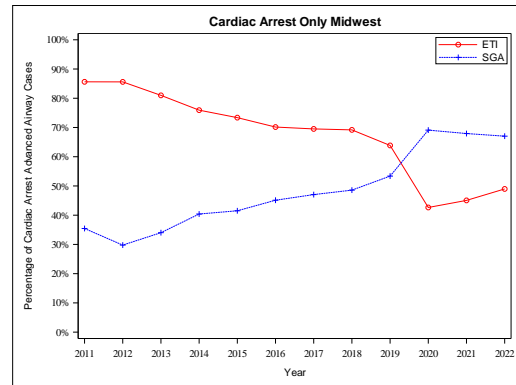
Sensitivity analysis. Longitudinal trends in the annual percentage of cardiac arrests undergoing endotracheal intubation (ETI) or supraglottic airway (SGA) insertion attempts, stratified by key population subsets (patient age, sex, population setting, census region). ESO Data Collaborative, 2011-2022. Totals may exceed 100% because an individual patient may have undergone both SGA and ETI attempts.



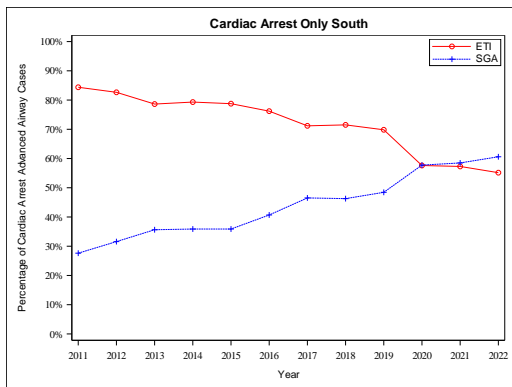
Northeast Census Region



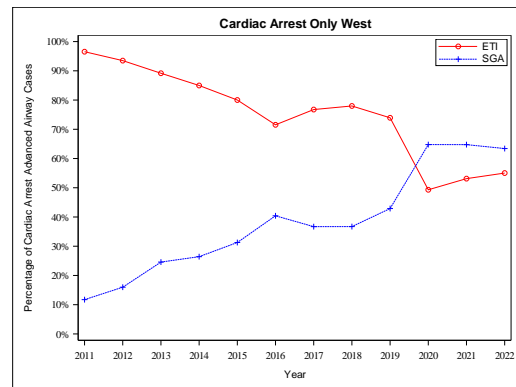
Midwest Census Region



South Census Region

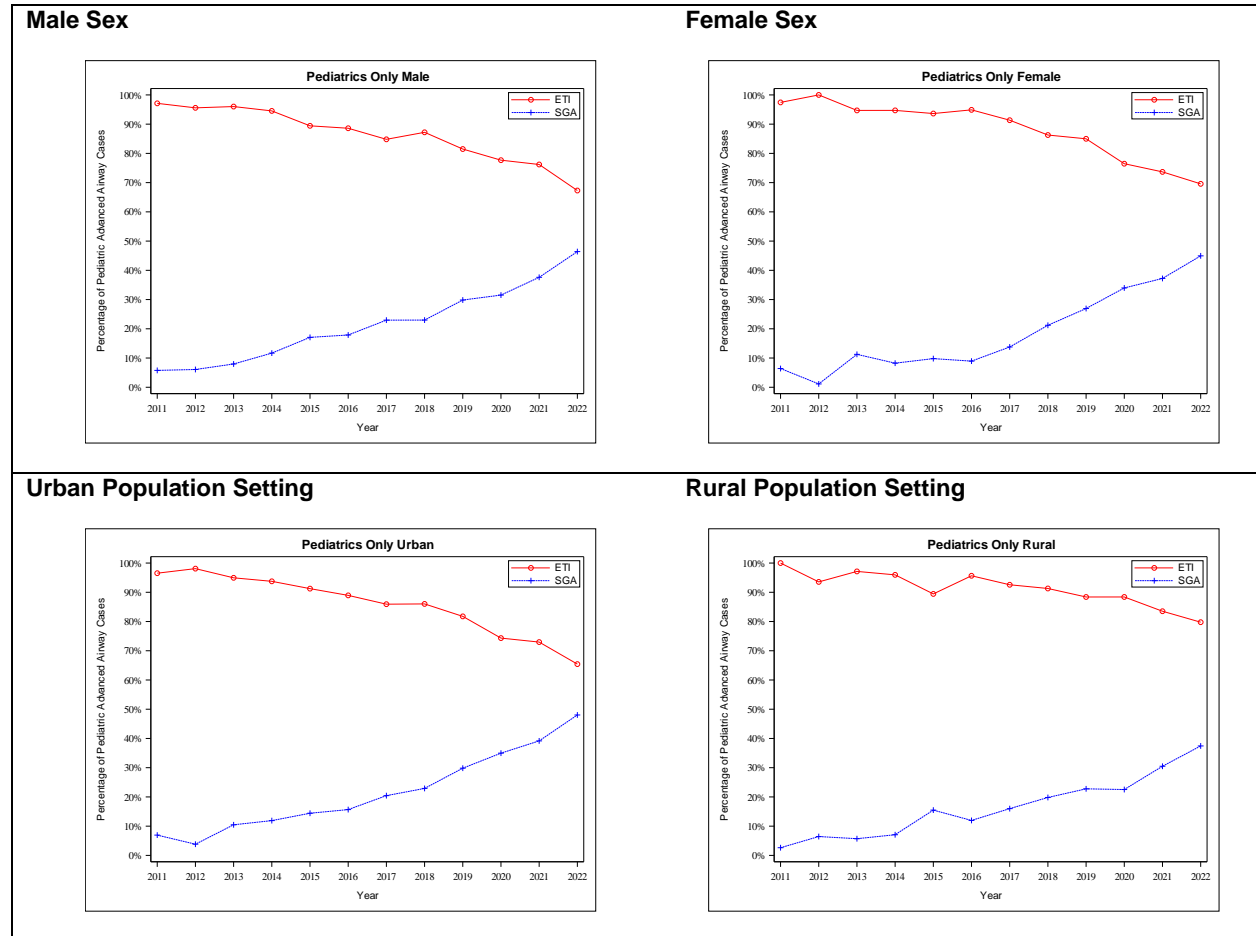


West Census Region

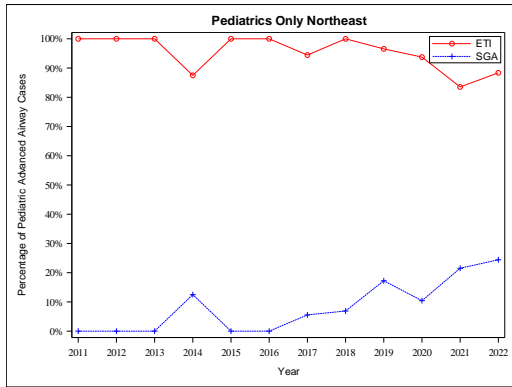


eFIGURE 4

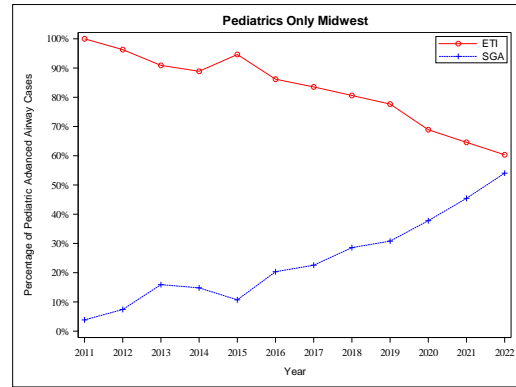
Sensitivity analysis. Longitudinal trends in the annual percentage of pediatric patients undergoing endotracheal intubation (ETI) or supraglottic airway (SGA) insertion attempts, stratified by key population subsets (patient sex, population setting, census region). ESO Data Collaborative, 2011-2022. Totals may exceed 100% because an individual patient may have undergone both SGA and ETI attempts.



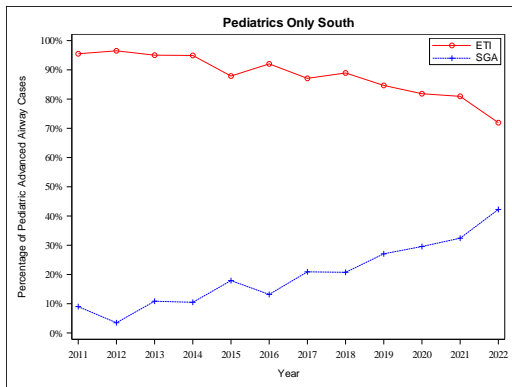
Northeast Census Region



Midwest Census Region



South Census Region



West Census Region

