

## Appendix

### Emergency KPI in the 1,200,000-inhabitant Italian Region Friuli Venezia Giulia, 2018.

<b>Id</b>	<b>Key Performance Indicator</b>	<b>Type</b>	<b>Setting</b>	<b>Value</b>
<b>General topic</b>				
1	Number of EMS responses with red or yellow priority codes <sup>a</sup> per 100,000 inhabitants	n/a	Pre-hospital	Yellow: 3706/100,000 (95%CI: 3672-3740) Red: 265/100,000 (95%CI: 255-274)
2	Response time (minutes from EMS call to arrival on target) for responses with red or yellow priority codes (25 <sup>th</sup> - 50 <sup>th</sup> -75 <sup>th</sup> percentiles)	Process	Pre-hospital	Ambulance (N=44,962): 9 - 12 - 16 Helicopter (N=198): 19 - 23 - 35
3	EMS responses with red or yellow priority codes <sup>a</sup> for the “first hour quintet” <sup>b</sup> per 100,000 inhabitants	n/a	Pre-hospital	Yellow: 1458/100,000 (95%CI: 1437-1480) Red: 159/100,000 (95%CI: 152-166)
4	Number of alive patients not transported to the hospital / total EMS responses	Process	Pre-hospital	2.0% (N=3248)
5	Time from EMS call to departure of the first response unit towards target for red or yellow codes	Process	Pre-hospital	Ambulance (N=36,820): 5 - 6 - 8 Helicopter (N=114): 13 - 17 - 29
6	Number and proportion of white or green code <sup>c</sup> responses with yellow or red return codes	Process	Pre-hospital	N=3069; 5.7% of white-green code responses; 3.2% of all responses
7	ED waiting time (minutes from start of triage to doctor visit) by triage color code (25 <sup>th</sup> - 50 <sup>th</sup> -75 <sup>th</sup> percentiles)	Process	Hospital	White (N=154,407): 8 - 38 - 110 Green (N=249,977): 12 - 40 - 102 Yellow (N=84,453): 6 - 12 - 26 Red (N=6168): 1 - 2 - 5
8	ED workout time (minutes from start of doctor visit to discharge) by triage color code (25 <sup>th</sup> - 50 <sup>th</sup> -75 <sup>th</sup> percentiles)	Process	Hospital	White (N=154,407): 6 - 31 - 107 Green (N=249,977): 32 - 105 - 205 Yellow (N=84,453): 108 - 201 - 427 Red (N=6168): 48 - 102 - 225
9	Number of short-stay emergency observations / total number of ED visits	Process	Hospital	12.3% (N=61,154)

10	Proportion of short-stay emergency observations with duration < 6 h, 6 – 24h, > 24h	Process	Hospital	< 6 h: 38.9% 6 – 24h: 49.7% > 24h: 11.4%
11	Number of ED inappropriate presentations / total number of ED presentations	Process	Hospital	25.5% (N=126,293)
12	Number of deaths in the ED / total number of ED presentations	Outcome	Hospital	0.08% (N=419)
13	Number and proportion of patients discharged home from the ED who are hospitalized within 7 days from discharge	Outcome	Hospital	2.3% (N=8183)
14	Number of patients admitted to hospital from the ED / total number of ED presentations by triage color code	Outcome	Hospital	White: 2.0% (N=3081) Green: 10.7% (N=26,864) Yellow: 31.6% (N=26,687) Red: 74.9% (4620)
15	Number of patients admitted to hospital from the ED after a short-stay emergency observation / total number of short-stay emergency observations	Process	Hospital	30.3% (N=18536)
16	Number and proportion of transfers to hub hospitals / number of presentations at spoke ED	Process	Hospital	N=4552; 1.7% of all presentations to spoke ED
53	Number of contemporary busy EMS call-center operators by hour (mean, median)	Process	Pre-hospital	See Figure 3.
54	Time (seconds) between EMS phone's ring and EMS call-center operator phone pickup (25 <sup>th</sup> - 50 <sup>th</sup> - 75 <sup>th</sup> percentiles) <sup>i</sup>	Process	Pre-hospital	6 – 10 - 17
55	Time (minutes) of EMS call-center's operators occupation in activities from phone pickup to EMS unit alert (in case of EMS unit deployment response) or to end of call registration (if no EMS unit is deployed) (25 <sup>th</sup> - 50 <sup>th</sup> -75 <sup>th</sup> percentiles)	Process	Pre-hospital	1 – 3 - 6
56	Time (seconds) from EMS phone pickup to choice	Process	Pre-hospital	70 – 132 - 191

	of priority code for calls followed by EMS unit deployment (call processing time) (25 <sup>th</sup> - 50 <sup>th</sup> -75 <sup>th</sup> percentiles)			
57	Proportion of EMS calls with use of dispatch	Process	Pre-hospital	26.9% (3.08% when no EMS units are alerted, 44.45% when EMS units are deployed)
58	Time (seconds) from EMS phone pickup to EMS unit alert by use of dispatch (25 <sup>th</sup> - 50 <sup>th</sup> -75 <sup>th</sup> percentiles)	Process	Pre-hospital	233 – 351 – 837 with dispatch 183 – 297 – 746 with no dispatch
59	Proportion of white or green code <sup>c</sup> responses with yellow or red return codes by use of dispatch	Process	Pre-hospital	5.2% with dispatch 6.2% with no dispatch
60	Proportion of patients who leave the ED without being seen (LWBS) or during treatment (LDT)	Process	Hospital	3.6% LWBS 1.4% LDT
61	Number of patients waiting to be seen in the ED per minute by hub ED (median)	Process	Hospital	White tags: 32 in hub1, 24 in hub2, 34 in hub3 Green tags: 85 in hub1, 78 in hub2, 71 in hub3 Yellow tags: 46 in hub1, 35 in hub2, 34 in hub3 Red tags: 4 in hub1, 3 in hub2, 3 in hub3
<b>Acute myocardial infarction</b>				
17	Number of cases of STEMI admitted to hospital in the year	n/a	n/a	N=1099
18	Number and proportion of patients with STEMI transported to a hub center by the EMS / all patients with STEMI transported by the EMS	Process	Pre-hospital	N=306; 57.0% of the 537 patients with STEMI transported by the EMS
19	Number and proportion of patients with STEMI transported to a spoke center by the EMS / all patients with STEMI transported by the EMS	Process	Pre-hospital	N=231; 43.0% of the 537 patients with STEMI transported by the EMS
20	Number of patients with STEMI who present directly to a hub ED (no EMS)	Process	Pre-hospital	N=194
21	Number of patients with STEMI who present directly to a spoke ED (no EMS)	Process	Pre-hospital	N=287
22	Number and proportion of patients with STEMI	Process	Hospital	N=519 (4812%) based on cardiac cath lab data

	treated with primary PCI <sup>d</sup>			N=725 (67.2%) based on hospital discharge data, N=597 (55.3%) when restricting the indicators to procedures within 1 day from hospital admission <sup>e</sup>
23	Number and proportion of patients with STEMI treated with primary PCI <sup>d</sup> among those transported to a hub center by the EMS	Process	Pre-hospital/ Hospital	N=208 (68.0%) based on cardiac cath lab data N=243 (79.4%) based on hospital discharge data, N=223 (72.9%) when restricting the indicators to procedures within 1 day from hospital admission <sup>e</sup>
24	Number and proportion of patients with STEMI treated with primary PCI <sup>d</sup> among those transported to a spoke center by the EMS	Process	Pre-hospital/ Hospital	N=91 (39.4%) based on cardiac cath lab data N=131 (56.7%) based on hospital discharge data, N=107 (46.3%) when restricting the indicators to procedures within 1 day from hospital admission <sup>e</sup>
25	Number and proportion of patients with STEMI treated with primary PCI <sup>d</sup> among those directly presenting to a hub ED (no EMS)	Process	Pre-hospital/ Hospital	N=100 (51.5%) based on cardiac cath lab data N=141 (72.7%) based on hospital discharge data, N=105 (54.1%) when restricting the indicators to procedures within 1 day from hospital admission <sup>e</sup>
26	Number and proportion of patients with STEMI treated with primary PCI <sup>d</sup> among those directly presenting to a spoke ED (no EMS)	Process	Pre-hospital/ Hospital	N=84 (29.3%) based on cardiac cath lab data N=161 (56.1%) based on hospital discharge data, N=119 (41.5%) when restricting the indicators to procedures within 1 day from hospital admission <sup>e</sup>
27	First medical contact to balloon (FMCTB, minutes) for patients with STEMI undergoing primary PCI (25 <sup>th</sup> - 50 <sup>th</sup> -75 <sup>th</sup> percentiles) <sup>f</sup>	Process	Hospital	N=515; 62 – 83 - 109
28	Door in – door out (DI-DO, minutes): time from triage to discharge from a spoke ED for patients with STEMI who passed through a spoke ED	Process	Hospital	N=175; 28 – 39 - 79

	before undergoing primary PCI (25 <sup>th</sup> - 50 <sup>th</sup> -75 <sup>th</sup> percentiles)			
29	In-hospital mortality for patients with STEMI	Outcome	Hospital	N=94 (8.7%) when considering only the last hospitalization of a patient N=88 (8.2%) when considering only the first
30	30-day mortality for patients with STEMI	Outcome	n/a	N=185 (17.1%)
31	In-hospital mortality for patients with STEMI treated with primary PCI <sup>§</sup>	Outcome	Hospital	N=41 (6.3%)
32	30-day mortality for patients with STEMI treated with primary PCI <sup>§</sup>	Outcome	n/a	N=46 (7.1%)
33	1-year mortality for patients with STEMI treated with primary PCI <sup>§</sup>	Outcome	n/a	N=65 (10.0%)
34	Number of patients hospitalized for NSTEMI who pass through a spoke center (ED or other hospital ward)	Process	Hospital	N=574; 55.2% of all NSTEMI
35	In-hospital mortality for patients with NSTEMI	Outcome	Hospital	N=27 (2.6%) when considering only the last hospitalization of a patient N=26 (2.5%) when considering only the first
36	30-day mortality for patients with NSTEMI	Outcome	n/a	N=29 (2.8%)
<b>Trauma</b>				
37	Number of major traumas	n/a	n/a	N=972 considering patients presenting to the ED and admitted to ICU N=564 considering patients presenting to the ED and admitted to ICU and EMS patient data N=3036 considering patients transported with EMS vehicles with highest priority (red code) and yellow/red return codes
38	Number of major traumas per 100,000 inhabitants	n/a	n/a	80/100,000 considering patients presenting to the ED and admitted to ICU 46/100,000 considering patients presenting to

				the ED and admitted to ICU with EMS patient data 250/100,000 considering patients transported with EMS vehicles with highest priority (red code) and yellow/red return codes
39	Number of Helicopter EMS for major trauma / total major traumas	Process	Pre-hospital	N=122 (12.5%) considering patients presenting to the ED and admitted to ICU (information only from ED) N=131 (23.2%) considering patients presenting to the ED and admitted to ICU and EMS patient data N=340 (11.2%) considering EMS trauma responses with highest priority (red code) and yellow/red return codes (N=481, 15.8%, considering also HEMS responses not transporting patients to hospital)
40	Number of fly-car responses / total number of EMS vehicles used in major traumas	Process	Pre-hospital	N=327; used in 10.8% of trauma patients transported with EMS vehicles with highest priority (red code) and yellow/red return codes
41	Number of ALS ambulance responses / total number of EMS vehicles used in major traumas	Process	Pre-hospital	N=2379; used in 78.4% of trauma patients transported with EMS vehicles with highest priority (red code) and yellow/red return codes
42	Major trauma: time (minutes) on scene (25 <sup>th</sup> - 50 <sup>th</sup> - 75 <sup>th</sup> percentiles)	Process	Pre-hospital	13 – 19 – 28 considering patients presenting to the ED and admitted to ICU and EMS patient data 13 – 20 – 29 considering EMS trauma responses with highest priority (red code) and yellow/red return codes
43	Major trauma: total pre-hospital time (minutes from EMS call to EMS vehicle arrive at hospital) (25 <sup>th</sup> -	Process	Pre-hospital	42 – 56 – 71 considering patients presenting to the ED and admitted to ICU and EMS patient

	50 <sup>th</sup> -75 <sup>th</sup> percentiles)			data 40 – 52 - 70 considering EMS trauma responses with highest priority (red code) and yellow/red return codes
44	Major trauma: Time (minutes) from EMS call to arrival at final hospital (25 <sup>th</sup> - 50 <sup>th</sup> -75 <sup>th</sup> percentiles)	Process	Pre-hospital/ Hospital	49 – 64 - 83
45	Major trauma: Management time (minutes) in a spoke ED before transfer to a hub hospital <sup>h</sup>	Process	Pre-hospital	8 – 27 - 121
46	Major trauma: time (hours) from EMS call to entry in operatory room for cases with EMS calla and surgery (25 <sup>th</sup> - 50 <sup>th</sup> -75 <sup>th</sup> percentiles)	Process	Pre-hospital/ Hospital	4.8 – 9.2 – 38.1
47	Major trauma: time (hours) from arrival at the ED to entry in operatory room for cases with surgery (25 <sup>th</sup> - 50 <sup>th</sup> -75 <sup>th</sup> percentiles)	Process	Hospital	3.5 – 8.7 – 40.9
48	Major trauma: number and proportion of in-hospital deaths	Outcome	Hospital	N=87 (8.9%)
<b>Stroke</b>				
49	Number of patients with TIA or stroke who arrive at the ED with EMS / total number of subjects who receive a diagnosis of TIA or stroke at the ED	Process	Pre-hospital	N=2970 (66.8%)
50	Number of patients with intravenous thrombolysis / total number of patients with a hospital discharge diagnosis of ischemic stroke	Process	Hospital	N=360 (10.2%)
51	Number of patients with intra-arterial thrombectomy thrombolysis / total number of patients with a hospital discharge diagnosis of ischemic stroke	Process	Hospital	N=86 (2.4%)
52	Number of stroke patients treated with intravenous thrombolysis or intra-arterial thrombectomy / 100,000 inhabitants	Process	Hospital	33.40/100,000

<sup>a</sup> high priority (lights and sirens); red is highest severity

<sup>b</sup> cardiac arrest, severe breathing difficulties, major trauma, stroke, cardiac chest pain

<sup>c</sup> low priority

<sup>d</sup> in case of multiple events, only the first STEMI in the year was considered

<sup>e</sup> hospital discharge data do not distinguish primary and non-primary PCI

<sup>f</sup> data from cardiac catheterization laboratory; only cases with times recorded both for the diagnostic ECG and the guidewire passage

<sup>g</sup> all patients identified as having STEMI and undergoing primary PCI in the cardiac catheterization laboratories (N=651), even no consistent if discharge diagnosis was recorded on the hospital discharge record

<sup>h</sup> 7 cases

<sup>i</sup> before the EMS phone rings, the emergency call is answered by an operator of the European Unique Emergency Number (112) center, which eventually redirects the health-related calls to the EMS call-center