

**Appendix 1. Description of the different study sites**

	<b>Erasmus MC, Rotterdam, the Netherlands</b>	<b>St Mary's Hospital, London, United Kingdom</b>	<b>General Hospital, Vienna, Austria</b>
Hospital characteristics	University hospital 60 pediatric beds	University hospital 46 pediatric beds	University hospital 134 pediatric beds
Catchment area	Urban  Mixed high and low socio-economic status	Urban  Mixed high and low socio-economic status	Urban  Mixed high and low socio-economic status
Emergency department characteristics	Before October 2014: Pediatric only 6500 children/year Major trauma service in separate department	Pediatric only  27,000 children/year Major trauma service	Pediatric only  22,000 children/year Major trauma service in separate department
Inclusion period	01-01-2012 to 31-12-2014	01-07-2014 to 28-02-2015	01-01-2014 to 31-12-2014
Study population	n = 18,594 (16%)	n = 15,556 (13%)	n = 20,300 (18%)

**Appendix 2. Coding of comorbidity**

Trained medical students, blinded for the outcome of this study, manually reviewed the records of all ED visits. Co-occurring illnesses were documented in free text fields and coded based on the International Classification of Diseases, Ninth Revision (ICD-9 codes). Based on these ICD-9 codes, each child was classified into one of three categories of medical complexity according to the Pediatric Medical Complexity Algorithm (PMCA). This validated algorithm uses diagnostic codes to classify children into having complex chronic disease, non-complex chronic disease, or without chronic disease. Non-complex chronic diseases are physical, mental or developmental conditions involving a single body system that can be expected to last longer than a year (e.g. type 1 diabetes, asthma). Children with complex chronic disease have: a) chronic conditions in two or more body systems; or b) a progressive condition that is associated with deteriorating health with a decreased life expectancy in adulthood; or c) continuous dependence on technology for at least 6 months; or d) progressive or metastatic malignancies. Examples include muscular dystrophy, leukemia and the combination of mental retardation and epilepsy. We did not have coded data on technology dependence, and thus could not use this criterion for complex chronic disease in our study.

**Appendix 3. Definitions of physiological parameters and measurements in the different study sites**

	<b>Definition</b>	<b>Erasmus MC, Rotterdam, the Netherlands</b>	<b>St Mary's Hospital, London, United Kingdom</b>	<b>General Hospital, Vienna, Austria</b>
Heart rate	Beats per minute	By monitoring device	By monitoring device	By monitoring device
Respiratory rate	Breaths per minute	By manual count	By manual count	By manual count
Oxygen saturation	Percentage on room air	By pulse oximetry	By pulse oximetry	By pulse oximetry
Consciousness	Normal: Alert (AVPU); GCS 15; or Awake (scale Vienna) Abnormal: any other	As measured by AVPU scale or GCS (<5%)	As measured by AVPU scale	As measured by own scale (e.g. Awake, Somnolent, Comatose)
Capillary refill time	Normal: <3 seconds Abnormal: ≥3 seconds	Centrally measured by pressing on skin for 5 seconds	Centrally measured by pressing on skin for 5 seconds	Peripherally measured and when abnormal confirmed centrally
Work of breathing	Normal: No abnormalities Abnormal: presence of mild/moderate/severe respiratory distress, nasal flaring, recessions, tracheal tug, inability to speak in sentences, stridor, wheeze, increased expirium, signs of exhaustion, grunting, respiratory insufficiency	Several yes/no items in patient's record, partly based on nurses' description in free text	Based on nurses' description in free text	Work of breathing as item in patient's record
Temperature	Degrees Celsius	Measured rectally in children <6 months, and with auricular device in older children	Axillary measurement in children <5 years, and orally for older children	Measured with a forehead thermometer
Pain score	Score 0-10	According to MTS pain scale	According to MTS pain scale	According to MTS pain scale

AVPU= Alert, Verbal, Pain, Unresponsive; GCS = Glasgow Coma Scale; MTS = Manchester Triage System

#### **Appendix 4. Development of the reference standard for the TRIAGE project**

First, we conducted a systematic review to identify reference standards that are currently used in triage research. An exhaustive list of all potential reference standards was created. Second, an expert meeting was held with the members of the TRIAGE research group, whom are all paediatricians with extensive experience in paediatric emergency medicine. The panel discussed the individual reference standards and selected the most relevant items to develop a 3-category reference standard. Items had to be feasible (e.g. expert opinion was considered too time-consuming) and independent of setting (e.g. costs are difficult to compare across countries). The classification of the reference standard was based on the concept of how long a patients could safely wait before being seen by a physician. Patients in the high urgency category should be seen within 10 minutes, patients in the intermediate urgency category within 60 minutes, and patients in the low urgency category could safely wait more than 60 minutes.

Finally a reference standard was constructed consisting of: mortality at the ED, ICU admission immediately after the ED visit, immediate lifesaving interventions or oxygen administration (High urgency); and hospital admission immediately after the ED visit, IV medication or fluids or inhalation medication at the ED, and >1 of the following: Radiology or Lab test or Oral medication (Intermediate urgency). Low urgency was defined as no interventions or either Radiology or Lab tests or Oral medication, not fulfilling the criteria for the high or intermediate urgency categories.

**Appendix 5. Baseline characteristics of the study population stratified by hospital**

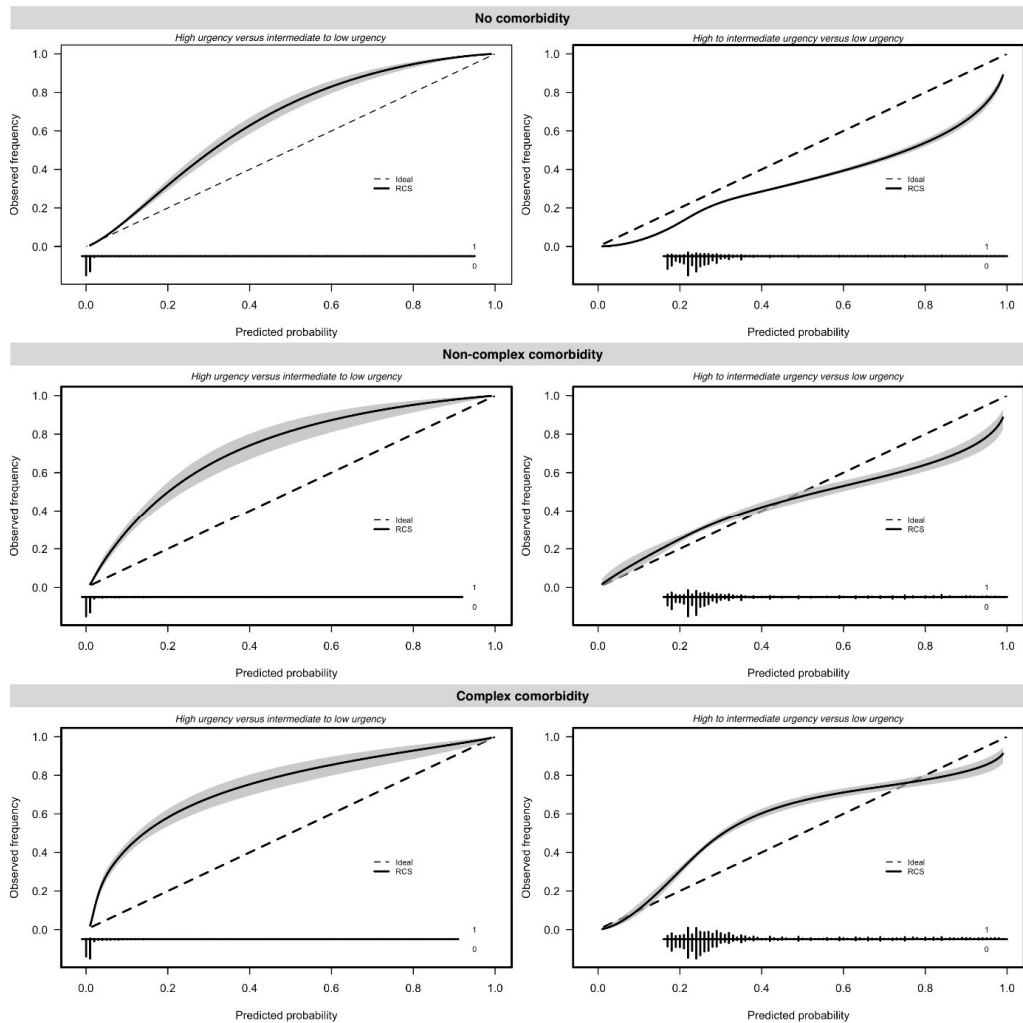
	<b>Erasmus MC (n=18,024)</b>	<b>St. Mary's Hospital (n=15,556)</b>	<b>General Hospital Vienna (n=20,249)</b>
Age			
Median, IQR	4.3 (1.4-9.8)	3.9 (1.5-8.8)	3.9 (1.6-8.3)
Sex			
Female, n (%)	7,587 (42.1)	6,879 (44.2)	9,575 (47.3)
Triage urgency, n (%)			
Emergent   Very urgent	2,427 (13)	1,605 (10)	1,084 (5)
Urgent	8,745 (49)	3,961 (25)	3,852 (19)
Standard   Non-urgent	6,852 (38)	9,990 (64)	15,314 (76)
Disposition, n (%)			
ICU or mortality at the ED	500 (2.8)	26 (0.2)	11 (0.1)
Hospital admission	3,704 (21)	1,599 (10)	1,1113 (5)
Discharge / other	13,820 (77)	13,931 (90)	19,125 (94)
Reference standard classification			
High urgency	1,301 (7)	275 (1.8)	109 (0.5)
Intermediate urgency	5,498 (31)	2,610 (17)	3,297 (16)
Low urgency	11,225 (62)	12,671 (81)	16,843 (83)

**Appendix 6. Recording of physiological parameters in children with and without comorbidity**

	<b>Total population n= 55,450 (100%)</b>	<b>No comorbidity n=43,239 (78%)</b>	<b>Non-complex comorbidity n=5,053 (9%)</b>	<b>Complex comorbidity n=5,537 (10%)</b>
Heart rate measured, n(%)	29,965 (56)	23,101 (53)	3,255 (64)	3,609 (65)
Respiratory rate measured, n(%)	20,782 (39)	16,183 (37)	2,291 (45)	2,308 (42)
O2 saturation measured, n(%)	26,546 (49)	21,111 (49)	2,687 (53)	2,748 (50)
Consciousness measured, n(%)	46,835 (87)	37,590 (87)	4,401 (87)	4,844 (87)
Work of breathing*	NA	NA	NA	NA
Capillary refill time measured, n(%)	19,693 (37)	15,296 (35)	2,096 (41)	2,301 (42)

\* No missings due to how variable is constructed

### Appendix 7. Calibration of the ED-PEWS in the three medical complexity groups



Calibration curves for the ED-PEWS in each of the three comorbidity groups. At the bottom of the graphs, histograms of the predicted risks are shown for patients with (1) and without (0) the outcome: high urgency for the plots in the left column and high or intermediate urgency for the plots in the right column.

**Appendix 8. Performance of the ED-PEWS in children with comorbidity, stratified by age**

	High vs intermediate and low urgency			High and intermediate vs low urgency		
	C-statistic	Confidence interval	Prediction interval	C-statistic	Confidence interval	Prediction interval
<b>Overall</b>						
No comorbidity	0.86	0.84-0.88	0.84-0.88	0.63	0.62-0.63	0.61-0.64
Non-complex comorbidity	0.87	0.84-0.90	0.82-0.91	0.63	0.61-0.65	0.61-0.65
Complex comorbidity	0.88	0.83-0.94	0.80-0.96	0.63	0.58-0.68	0.53-0.73
<b>Age &lt;1 year</b>	<b>C-statistic</b>	<b>Confidence interval</b>	<b>Prediction interval</b>	<b>C-statistic</b>	<b>Confidence interval</b>	<b>Prediction interval</b>
No comorbidity	0.86	0.83-0.88	0.83-0.88	0.67	0.65-0.69	0.65-0.69
Non-complex comorbidity	0.87	0.82-0.92	0.82-0.92	0.69	0.64-0.74	0.64-0.74
Complex comorbidity	0.88	0.83-0.94	0.80-0.96	0.70	0.65-0.74	0.65-0.74
<b>Age 1-2 years</b>	<b>C-statistic</b>	<b>Confidence interval</b>	<b>Prediction interval</b>	<b>C-statistic</b>	<b>Confidence interval</b>	<b>Prediction interval</b>
No comorbidity	0.88	0.84-0.92	0.84-0.92	0.68	0.66-0.70	0.66-0.70
Non-complex comorbidity	0.91	0.87-0.94	0.87-0.94	0.64	0.59-0.70	0.59-0.70
Complex comorbidity	0.87	0.74-0.99	0.64-1.00	0.63	0.57-0.70	0.54-0.73
<b>Age 2-5 years</b>	<b>C-statistic</b>	<b>Confidence interval</b>	<b>Prediction interval</b>	<b>C-statistic</b>	<b>Confidence interval</b>	<b>Prediction interval</b>
No comorbidity	0.88	0.83-0.93	0.81-0.96	0.64	0.60-0.69	0.56-0.73
Non-complex comorbidity	0.91	0.86-0.96	0.84-0.99	0.67	0.61-0.74	0.57-0.78
Complex comorbidity	0.87	0.83-0.90	0.83-0.90	0.67	0.64-0.70	0.64-0.70
<b>Age 5-12 years</b>	<b>C-statistic</b>	<b>Confidence interval</b>	<b>Prediction interval</b>	<b>C-statistic</b>	<b>Confidence interval</b>	<b>Prediction interval</b>
No comorbidity	0.88	0.78-0.99	0.68-1.00	0.56	0.55-0.58	0.55-0.58
Non-complex comorbidity	0.86	0.77-0.94	0.72-0.99	0.60	0.55-0.64	0.53-0.67
Complex comorbidity	0.89	0.86-0.92	0.86-0.92	0.63	0.59-0.68	0.56-0.70
<b>Age ≥12 years</b>	<b>C-statistic</b>	<b>Confidence interval</b>	<b>Prediction interval</b>	<b>C-statistic</b>	<b>Confidence interval</b>	<b>Prediction interval</b>
No comorbidity	0.77	0.70-0.83	0.70-0.83	0.55	0.53-0.58	0.51-0.59
Non-complex comorbidity	0.82	0.74-0.89	0.74-0.89	0.59	0.55-0.63	0.55-0.63
Complex comorbidity	0.85*	0.80-0.91	0.80-0.91	0.59	0.51-0.67	0.46-0.72

\*Based on hospitals EMC and SMH because only 1 high urgent patient in GHV



**Appendix 9.** Decision curves for each of the settings

