Supplementary files

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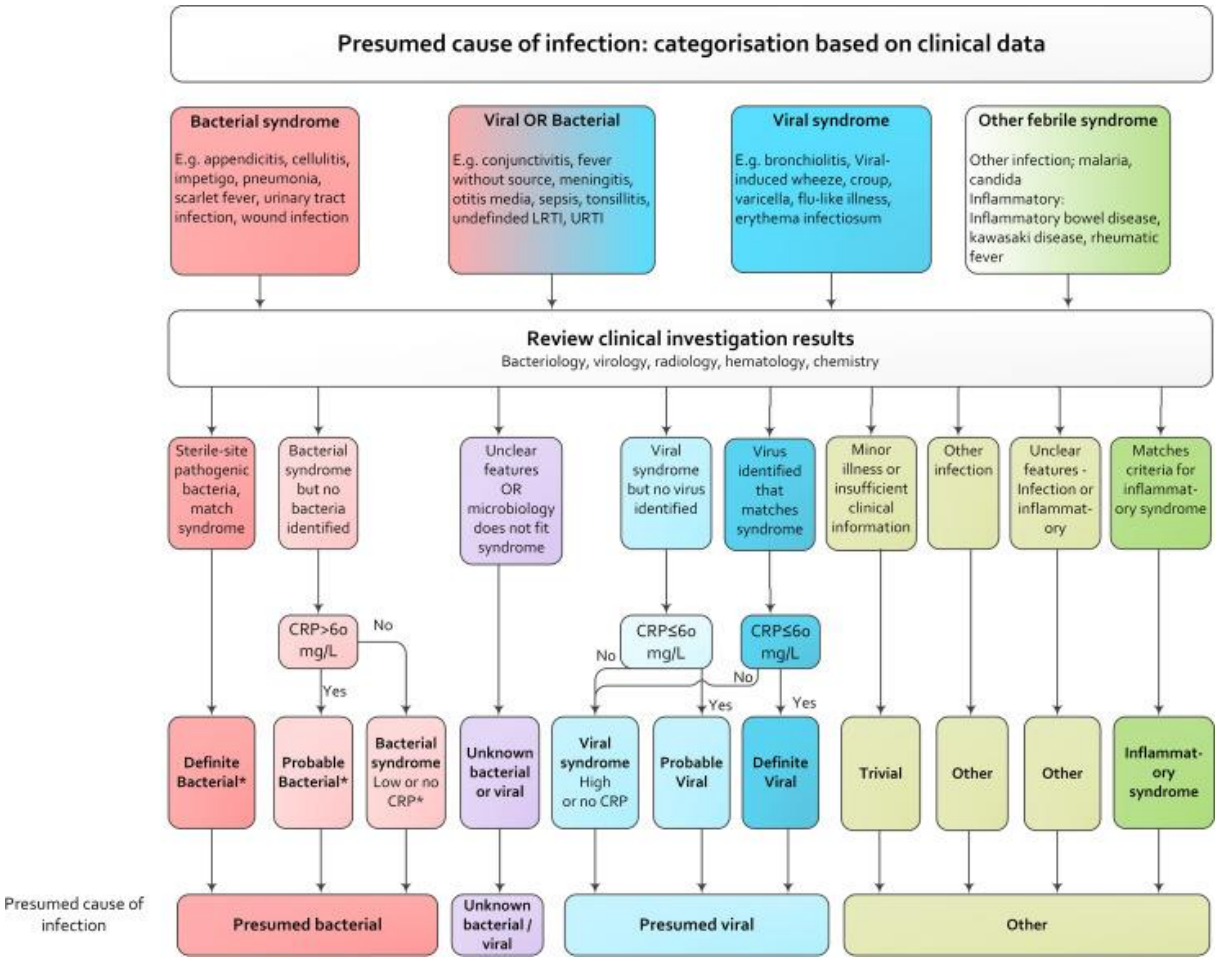
Appendix A – Hospital characteristics

Hospital	City, country	Type of hospital	Annual pediatric ED visits	Primary care during OOH	Self-referrals	GP referrals
Radboud University Medical Center (N=677)	Nijmegen, the Netherlands (NL1)	University	<10,000	Yes	4%	40%
Erasmus MC – Sophia Children's Hospital (N=1683)	Rotterdam, the Netherlands (NL2)	University	<10,000	Yes	22%	20%
Univerzitetni klinicni center (N=3667)	Ljubljana, Slovenia	University	<10,000	Yes	1%	13%
Canisius Wilhelmina Ziekenhuis (N=423)	Nijmegen, the Netherlands (NL3)	Teaching	<10,000	Yes	1%	90%
Medizinische Universität Graz (N=2241)	Graz, Austria	University	10,000-30,000	No	43%	4%
P. and A. Kyriakou Children's Hospital (N=4548)	Athens, Greece	University	>30,000	No	92%	0.1%
St. Mary's Hospital (N=5714)	London, UK (UK3)	University	>30,000	Yes	54%	4%
Hospital Clínico Universitario (N=3877)	Santiago de Compostela, Spain	University	>30,000	Yes	86%	12%
Children's Clinical University Hospital (N=9000)	Riga, Latvia	University	>30,000	No	53%	4%
Alder Hey Children's Hospital (N=1623)	Liverpool, UK (UK1)	University	>30,000	Yes	66%	16%
Dr. von Hauner Children's Hospital (N=1173)	Munich, Germany	University	10,000-30,000	Yes	95%	0.3%
Great North Children's Hospital (N=3854)	Newcastle, UK (UK2)	University	>30,000	Yes	60%	11%

Appendix B - Phenotyping algorithm PERFORM



*In case of viral co-infection, bacterial infection got priority

Appendix C – Immediate life-saving interventions

ILSI	**Procedures**
1. Airway and breathing support	Intubation, non-invasive ventilation, non-rebreathing mask, nasal cannula for oxygen
2. Electrical therapy	Defibrillation, emergent cardioversion, external pacing
3. Emergency procedures	Chest needle decompression, pericardiocentesis, open thoracotomy
4. Hemodynamic support	Significant intravenous or intraosseous fluid resuscitation, blood administration, control of major bleeding
5. Emergency medication	Atropine, adenosine, epinephrine, naloxone or inotropes

Appendix D - Questionnaire and corresponding answers on EMS per country during the MOFICHE study period 2017-2018

Could you please answer the questions below? Please select all answer options that apply.

Q1) How does the process look like, starting from the call to the emergency number until arrival at the hospital by EMS?

Q2) Who can call the emergency number for EMS transport?

a) Doctors
b) Parents
c) Other, please specify

Q3) What happens when the EMS arrive at the patient?

a) The patient is always transported by EMS
b) They assess/triage the patient first and then decide whether they transport the patient by EMS
c) Other, please specify

Q4) Where can EMS transport the patients to?

a) The patient is always transported to the ED
b) The patient can be transported to a GP out of office
c) The EMS team can decide to let the patient stay at home
d) Other, please specify

Q5) What are in practice the reasons for EMS use?

a) Transport of critically ill patients
b) Lack of private transport
c) Emergency call during out of office hours
c) Other, please specify

Answers:

	Q1
The Netherlands	Everyone can directly call the emergency number and the caller is asked to explain the medical situation of the patient. The staff at the operation center can advise to call the GP (out of office) when appropriate. When EMS arrive at the patient they triage the patient first and then decide whether the patient need to be transported to the hospital or they can advise the patient to go to the GP (out of office). When arriving at the ED the patients are directly transported to the examination room, where the EMS staff present the patient to the physicians at the ED and the patients' vital signs and medical procedures they already performed.

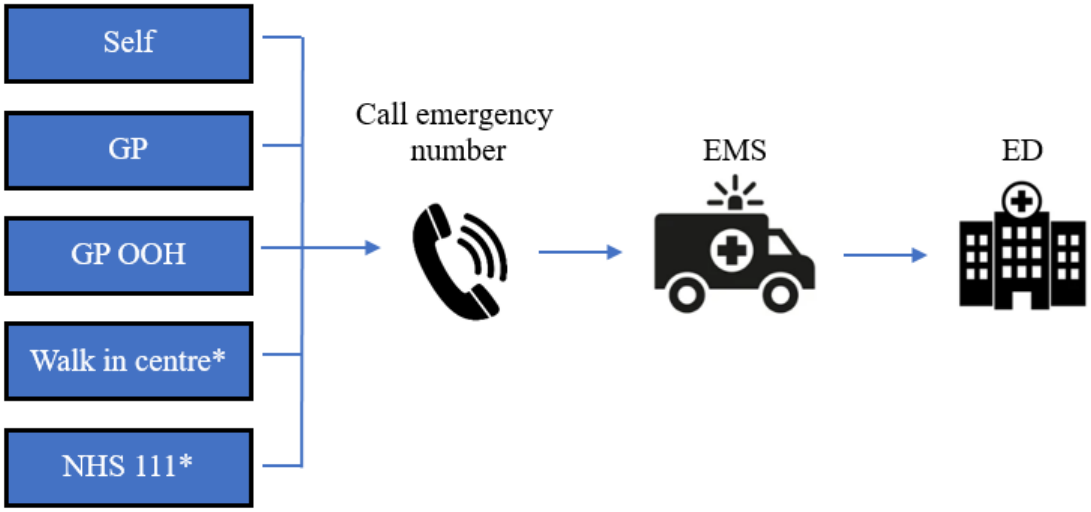
Spain	Anyone can call directly to the emergency number. A specific trained subject will attend the call and determine whether an effective should go directly to the address or if the issue may be sorted by phone. If the ambulance goes to the indicated address and the subject is attended and problem solved, the process ends here; otherwise, the subject will be transferred to the hospital in a medical ambulance and treated if necessary during the transport.
Austria	It is run by various private companies, mainly the red cross, but also other like green cross. Those companies provide emergency transports but also regular patient transports. Emergency transports include at least one emergency paramedic. Depending on the severity, an additional emergency doctor can be included, either upfront or at arrival of the paramedic. The emergency doctor always comes with a separate car and driver.
Greece	After the call to the emergency number, the staff at the operation centre asks for some information about the patient to evaluate the severity and give priority to critically ill patients. But eventually any patient will be transferred to ED, even with less severe symptoms, as long as the parents are patient enough to wait.
UK	In case of a serious medical emergency anyone can call 999. When the EMS are going to the patient a call number will be made. EMS staff will assess the patient first and decide whether transport to the hospital is needed. If they decide on transporting the patient to the hospital they will report this via the call center.
Slovenia	The call to 112 is triaged and the need for EMS is established by qualified healthcare personnel at the dispatch centre. We have different types of mobile units – a reanimobile (with a doctor, nurse and paramedic for medical interventions at the site of the incident), emergency vehicle (nurse and paramedic - for transport of patients), motorbike (nurse), helicopter (doctor and nurse - for transport of critically ill patients). The type of help (could be a combination) that will be deployed is decided at the dispatch center. When the EMS arrives, they asses the patient, apply treatment if necessary and transport to the nearest hospital with an appropriate ED which they notify about their upcoming arrival.
Latvia	Operator asks the first red flag questions - if emergency they will send an ambulance car in a define time depending on emergency situation. If not so acute, may transfer to consultation line.
Germany	When calling the emergency number the caller is asked to shortly explain the (current) medical situation of the person in question. Depending on the situation the emergency dispatcher may stay on the phone in order to assist the caller. When EMS arrive they triage the patient and decide whether there are medical procedures that need to be performed on the spot before transportation, whether the patient needs to be transported to the ED or whether they may also remain where they are. On the way to the ED patients vitals´ are being monitored by EMS. If possible EMS also ask about history of current and prior medical illness and medication. Upon arrival at the ED the patients are almost always directly transported to an examination room, where EMS present the doctor with the priory collected information.

	Q2	**Q3**	**Q4**	**Q5**
The Netherlands	Anyone	EMS staff triage the patient first and decide whether transport by EMS is needed.	The patient is always transported to the ED. The EMS team can decide to let the patient stay at home or advice	Transport of critically ill patients. Lack of private transport. Emergency call during out of office hours.

			the patient to go the GP (out of office).	
Spain	Doctors, parents, any person eg the school director.	They assess/triage the patient first and then decide whether they transport the patient by EMS.	Patient not always transported to the ED, only if needed. Patient can be transported to GP out of office. The EMS team can decide to let the patient stay at home.	Transport of critically ill patients. Lack of private transport. Emergency call during out of office hours.
Austria	Doctors, mainly parents, anyone	The patient is almost always transported by EMS, except for patients that refuse transport (e.g. some alcohol intoxication with only mild intoxication).	Patient is always transported to the ED. The Ems can decide to let the patient stay at home if the Ems is accompanied by an emergency doctor.	Transport of critically ill patients. Lack of private transport in case of emergency, emergency call during out of office hours.
Greece	Anyone can call (doctors, parents)	The patient is always transported by EMS.	The patient is always transported to the ED.	Transport of critically ill patients. Lack of private transport.
UK	Everyone can call 999	They assess/triage the patient first and then decide whether they transport the patient by EMS. EMS cannot refuse to transport patients under the age of 1.	The patient is always transported to the ED. The EMS team can decide to let the patient stay at home.	Transport of critically ill patients, Lack of private transport, Emergency call during out of office hours, hospital to hospital transport.
Slovenia	Doctors, parents, anyone that thinks there is need for EMS (ie 112)	They assess/triage the patient first and then decide whether they transport the patient by EMS – but it's very rare that they don't transport them, as the triage has already been done at the dispatch center.	The patient is always transported to the ED. The EMS team can decide to let the patient stay at home (but this occurs only rarely).	Transport of critically ill patients. Lack of private transport - the dispatch center also allocates resources (vehicles & personnel) for non-emergency transport of patients Emergency call during out of office hours.
Latvia	Doctors, parents, everyone	Mostly always children below 1 year of age are transported to the	The patient is always transported to the ED. The EMS team can decide to	Transport of critically ill patients. But in reality also in case

		ED otherwise not necessarily at all. They assess/triage the patient first and then decide whether they transport the patient by EMS.	let the patient stay at home.	of lack of private transport and emergency call during out of office hours.
Germany	Doctors, parents, everyone	They assess/triage the patient first and then decide whether they transport the patient by EMS, if the patient/guardian insist even if the EMS don't triage the patient as someone in need of EMS transportation.	The patient is always transported to the ED, the EMS team can decide to let the patient stay at home, from one hospital to another hospital.	Transport of critically ill patients, lack of private transport, emergency call during out of office hours.

Appendix E – Diagram of healthcare pathways initiating EMS transport to ED



*Health care providers in UK
GP OOH = GP out of office hours, not present in all settings

Appendix F – Range of EMS use and discordant EMS use across the EDs in absolute numbers and percentages (%)

Hospital	**Transport by EMS***	**Discordant EMS use**[∞]
Total (N=36,156)	*5464 (15)*	*1601 (29)*
NL1 (N=664)	70 (11)	1 (1)
NL2 (N=1422)	171 (12)	4 (2)
Slovenia (N=3656)	288 (8)	23 (8)
NL3 (N=404)	16 (4)	2 (13)
Austria (N=1241)	63 (5)	9 (14)
Greece (N=4513)	6 (0.1)	1 (17)
UK3 (N=5678)	380 (7)	66 (17)
Spain (N=3864)	69 (2)	16 (23)
Latvia (N=8994)	3740 (42)	1106 (30)
UK1 (N=1589)	95 (6)	38 (40)
Germany (N=830)	9 (1)	4 (44)
UK2 (N=3301)	557 (17)	331 (59)

Table is ordered according increasing percentages of discordant EMS use

[*] Denominator total visits per ED setting

[∞] Denominator transport by EMS per ED setting

Appendix G – Odds ratios and adjusted odds ratios of logistic regression analysis

Association between markers of urgency and EMS use

	OR (95% CI)	**aOR (95% CI)**
High/intermediate triage urgency	2.7 (2.5-2.8)	3.5 (3.3-3.7)
Advanced diagnostics	1.2 (1.1-1.3)	1.2 (1.0-1.3)
Immediate life-saving interventions	3.0 (2.6-3.6)	4.5 (3.8-5.4)
O2 therapy	1.6 (1.4-1.9)	1.7 (1.5-2.0)
Admission	1.8 (1.7-1.9)	1.7 (1.6-1.8)

Non-EMS group as reference group.

Adjusted for age, gender visiting hours, presenting symptoms, ED setting.

Appendix H – Sensitivity analysis for discordant EMS use

Hospital	**Transport by EMS 100%**	**Transport by EMS 80%**	**Discordant EMS use in 80%***	**Discordant EMS use in 100%**[∞]
Total (N=36,156)	*5464*	*4335*	*1261 (29%)*	*1601 (29%)*
NL1 (N=664)	70	52	1 (2)	1 (1)
NL2 (N=1422)	171	140	4 (3)	4 (2)
Slovenia (N=3656)	288	227	18 (8)	23 (8)
NL3 (N=404)	16	14	1 (7)	2 (13)
Austria (N=1241)	63	43	6 (14)	9 (14)
Greece (N=4513)	6	5	1 (20)	1 (17)
UK3 (N=5678)	380	307	50 (16)	66 (17)
Spain (N=3864)	69	58	12 (21)	16 (23)
Latvia (N=8994)	3740	2956	871 (30)	1106 (30)
UK1 (N=1589)	95	74	33 (45)	38 (40)
Germany (N=830)	9	7	4 (43)	4 (44)
UK2 (N=3301)	557	448	262 (59)	331 (59)

[*] Denominator transport by EMS per ED setting in the column with 80%

[∞] Denominator transport by EMS per ED setting in the column with 100%

Appendix I – Age distribution per ED setting in EMS group and in discordant EMS group

EMS use (N=5464)	**Median age in years (IQR 25-75)**
NL1 (N=70)	2.5 (1.7-5.4)
NL2 (N=171)	2.8 (1.6-5.5)
Slovenia (N=288)	1.9 (1.2-3.1)
NL3 (N=16)	1.5 (1.2-2.9)
Austria (N=63)	1.8 (1.3-4.6)
Greece (N=6)	4.9 (3.1-7.0)
UK3 (N=380)	2.3 (1.2-4.4)
Spain (N=69)	2.0 (1.2-4.0)
Latvia (N=3740)	2.6 (1.3-5.3)
UK1 (N=95)	2.4 (1.1-5.0)
Germany (N=9)	5.7 (2.9-7.8)
UK2 (N=557)	2.8 (1.6-4.0)

Range median age: 1,5-5,7 years

Discordant EMS use (N=1601)	**Median age in years (IQR 25-75)**
NL1 (N=1)	14.1 (14.1-14.1)
NL2 (N=4)	3.2 (2.3-3.5)
Slovenia (N=23)	2.4 (1.5-4.7)
NL3 (N=2)	1.4 (1.3-1.4)
Austria (N=9)	3.2 (1.2-5.6)
Greece (N=1)	4.6 (4.6-4.6)
UK3 (N=66)	3.0 (1.3-4.4)
Spain (N=16)	2.4 (1.2-8.3)
Latvia (N=1106)	2.6 (1.3-5.3)
UK1 (N=38)	2.3 (1.1-4.4)
Germany (N=4)	6.1 (3.2-7.7)
UK2 (N=331)	2.0 (1.1-3.8)

Range median age: 1,4 – 14,1 years

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