

Supplementary Table 1. Process of prioritization of the WHO quality measures and list of the 175 measures selected for the CHOICE Study

PROVISION OF CARE	DATA SOURCES	REPORTING *
<p><b>Respiratory cases (denominator: total cases with respiratory condition)</b></p> <ol style="list-style-type: none"> <li>1. % cases which were assessed by the paediatrician within 90 minutes from triage</li> <li>2. % cases in which HR was recorded</li> <li>3. % cases in which RR was recorded</li> <li>4. % cases in which temperature was recorded</li> <li>5. % cases in which SO2 recorded</li> <li>6. % cases in which an antibiotic was prescribed</li> <li>7. % cases in which an anti- cough drug was prescribed</li> <li>8. % cases in which an anti-mucolytic drug was prescribed</li> <li>9. % cases in which information on emergency signs requiring reassessment was reported</li> <li>10. % cases hospitalized</li> </ol> <p><b>Diarrhoea (denominator: total cases with respiratory diarrhoea)</b></p> <ol style="list-style-type: none"> <li>11. % cases which were assessed by the paediatrician within 90 minutes from triage</li> <li>12. % cases in which weigh was recorded</li> <li>13. % cases in which temperature was recorded</li> <li>14. % cases hospitalized</li> <li>15. % cases in which intravenous fluids were administered</li> <li>16. % cases in which an antibiotic was prescribed</li> <li>17. % cases in which a probiotic was prescribed</li> <li>18. % cases in which an anti-diarrheal agent was prescribed</li> <li>19. % cases in which a clear ORS prescription (quantity, timing, duration) was provided</li> <li>20. % cases in which information on emergency signs requiring reassessment was reported</li> </ol> <p><b>Pain (denominator: total cases accessing the PED)</b></p> <ol style="list-style-type: none"> <li>21. % cases in which pain was measured</li> <li>22. % cases with pain in which a drug to reduce pain was administered</li> <li>23. % cases with pain with score <math>\geq 4</math> in which a drug to reduce pain was administered</li> <li>24. % cases with pain with score <math>\geq 7</math> in which a drug to reduce pain was administered</li> <li>25. Difference of % cases in which pain was measured and % cases in which pain was treated</li> </ol>	MEDICAL FILES	PAPERS ARI, AD, PAIN
<b>EXPERIENCE OF CARE (denominator: total cases)</b>		
<p><b>Health users</b></p> <p>CHARTER OF THE RIGHTS OF THE CHILD</p> <ol style="list-style-type: none"> <li>1. Do you know what the Charter of the Rights of the Child is?</li> <li>2. Is the Children's Bill of Rights displayed in the hospital where you are?</li> <li>3. Have you been adequately informed about your child's rights of care?</li> <li>4. Have you seen posters/brochures related to formula milk (artificial feeding) displayed in the hospital?</li> </ol> <p>ACCESSIBILITY</p> <ol style="list-style-type: none"> <li>5. Did you find access points to emergency services (including emergency room) immediately recognisable</li> <li>6. You did not encounter physical barriers to accessing services and facilities</li> <li>7. Child-friendly services are separate from adult services, ensure continuity of access and are child-friendly</li> <li>8. You have been exempted from paying for care received</li> </ol> <p>CARE IN DUE TIME</p>	Two validated questionnaires for health users and health workers <sup>2</sup>	PAPERS HU, HW

<p>9. The waiting time for the first assessment in triage seemed acceptable to you</p> <p>10. The waiting time in general for other services seemed acceptable to you</p> <p>PAIN CONTROL</p> <p>11. At the first visit and during the hospital stay, including during invasive procedures, was the child's pain adequately assessed (e.g. with a pain scale: smileys, score from 0 to 10) and, if necessary, prevented and promptly treated?</p> <p>HYGIENE</p> <p>12. Before each visit/procedure, did the doctors/nurses wash their hands/use gel cleanser (if you did not see them, please put No)</p> <p>13. Before each invasive procedure (e.g. sampling) are disinfected solutions and asepsis procedures properly used</p> <p>COMMUNICATION AND QUALITY OF INTERACTION</p> <p>14. Health workers (doctors, nurses) introduced themselves with name and role or wore an identification tag</p> <p>15. Health workers established effective communication with you (e.g. spoke clearly, listened actively)</p> <p>16. The caregivers interacted with the child in appropriate ways (e.g. by using age-appropriate modes of communication)</p> <p>INFORMATION AND PARTICIPATION IN CARE</p> <p>17. Received information regarding the child's condition in a timely manner</p> <p>18. Was informed sufficiently and comprehensively about the child's diagnostic and therapeutic options</p> <p>19. He/she felt able to give his/her opinion about which treatment options were best for the child</p> <p>20. It was explained to him/her how to actively participate in the child's care (e.g. how to monitor the child's condition, how to care for the child, how to administer medication, etc.)</p> <p>INFORMED CONSENT</p> <p>21. Has received an informed consent form to be signed for each procedure, analysis or treatment</p> <p>22. The informed consent form you were asked to sign was clear, informative and comprehensive</p> <p>23. The health professionals always provided all the necessary information and responded to your requests for clarification</p> <p>CONTINUITY OF CARE</p> <p>24. When changing shifts, the transfer of information between staff was always effective in the same ward</p> <p>25. The exchange of information between operators was always effective even between different departments/services</p> <p>26. Never had discordant information/opinions from different operators</p> <p>27. Never witnessed any episodes of aggression between health professionals (e.g. verbal aggression, bullying between them or other)</p> <p>HEALTH PROMOTION</p> <p>28. You have been given health information material appropriate to the child's condition and age or, alternatively, have been given appropriate oral explanations</p> <p>PRIVACY</p> <p>29. Your privacy was guaranteed at all times (e.g. the visit was conducted in a place where no one else could hear or see)</p> <p>30. Did you feel that your personal information was always protected, protecting your privacy</p> <p>RIGHT TO THE PRESENCE OF THE PARENT</p>		
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<p>31. Did they allow the child/young adult to have his/her parents/guardians present at all times (including during medical procedures)?</p> <p>32. Were parents offered adequate facilities to be near the child (e.g., bed to sleep next to the child, adequate toilet facilities, adequate canteen)</p> <p>EDUCATION AND PLAY</p> <p>33. The hospital offers play spaces and opportunities to respect children's need for play</p> <p>EMOTIONAL and PSYCHOLOGICAL SUPPORT</p> <p>34. You and your child have been adequately supported emotionally during hospitalisation by staff and, if necessary, also by specialised staff (e.g. psychologist)</p> <p>RESPECT AND DIGNITY</p> <p>35. You and your child have always been treated with respect for your dignity</p> <p>36. Your needs and concerns were never minimised</p> <p>37. The caregivers never made you feel guilty about anything that happened to you and/or your child during your hospital stay nor were you unfairly reprimanded</p> <p>38. You were never neglected by hospital staff</p> <p>39. Health workers have never made negative comments about your culture, ethnicity, religion</p> <p>40. It was explained to you how you could express complaints or suggestions</p>		
<b>RESOURCES (denominator: total cases)</b>		
<p><b>Health users</b></p> <p>DEPARTMENT AND ROOMS</p> <ol style="list-style-type: none"> <li>1. Decorated and cosy children's areas</li> <li>2. Comfort and general equipment of the rooms (including nappy changing stations)</li> <li>3. Number of persons per room</li> <li>4. Acoustics in the rooms</li> <li>5. Lighting (and/or use thereof) in the rooms</li> <li>6. Cleanliness of rooms</li> <li>7. Adequate bed for the parent</li> <li>8. Adequate bed for the child</li> </ol> <p>TOILET FACILITIES</p> <ol style="list-style-type: none"> <li>9. Quantity of toilets</li> <li>10. Cleanliness of toilets</li> <li>11. Location of toilets</li> <li>12. Toilets adapted to the needs and care of children (e.g. well-equipped nappy changing station, bathing basins)</li> </ol> <p>CANTEEN</p> <ol style="list-style-type: none"> <li>13. Quality of meals (sufficient food and water; hygienic, tasty food with sufficient variety to meet children's needs)</li> <li>14. Cost of the canteen (for parents and children)</li> <li>15. Areas where they can prepare special meals/meals for the child themselves</li> </ol> <p>PLAY AREAS AND OTHER SPACES</p> <ol style="list-style-type: none"> <li>16. Clean and appropriately furnished play spaces and availability of age-appropriate toys, games, books and equipment for children</li> <li>17. Waiting room spaces adequate for the comfort of children and families and to protect privacy</li> <li>18. Spaces for interviewing doctors in private</li> <li>19. Spaces where family and friends can meet during hospitalisation</li> </ol> <p>PERSONNEL</p> <ol style="list-style-type: none"> <li>20. Medical staff is present in adequate numbers</li> </ol>	<p>Two validated questionnaires for health users and health workers <sup>2</sup></p>	<p>PAPERS HU, HW</p>

<p>21. Nursing and other personnel are present in adequate numbers</p> <p>22. All staff are sufficiently qualified to perform their duties</p> <p>23. All staff is sufficiently motivated</p> <p>EQUIPMENT</p> <p>24. All diagnostic (laboratory and instrumental) procedures necessary for the investigation of the child are available</p> <p>25. All necessary medication for the child's care is available</p> <p><b>Health workers</b></p> <p>TRIAGE</p> <p>1. Clear and complete protocols</p> <p>2. Policy defining maximum waiting time</p> <p>3. 24/7 working triage</p> <p>PEDIATRIC EMERGENCIES</p> <p>4. Clear and complete protocols</p> <p>5. Adequate physical structures</p> <p>6. Visible algorithms on the walls</p> <p>7. Equipped and available crash cart</p> <p>8. Available emergency drugs</p> <p>RESPIRATORY DISEASES</p> <p>9. Clear and complete protocols</p> <p>10. Results of blood exams within 1h</p> <p>11. Available antibiotics/bronchodilators</p> <p>12. O2 availability</p> <p>13. Available O2 equipment/inhalators</p> <p>DIARRHEA</p> <p>14. Clear and complete protocols</p> <p>15. Visible rehydration algorithm on the walls</p> <p>16. Clear indications for hospitalization</p> <p>17. Available rehydration solutions</p> <p>FEVER</p> <p>18. Clear and complete protocols</p> <p>19. Microscope for urine/liquor exam</p> <p>20. Hemoculture with results within 2 days</p> <p>PAIN</p> <p>21. Clear and complete protocols</p> <p>22. Available painkillers</p> <p>23. Standard non-pharmacological procedures</p> <p>CHILD ABUSE</p> <p>24. Clear and complete protocols</p> <p>25. Multidisciplinary team for children support</p> <p>REFERRAL</p> <p>26. Clear and updated protocols</p> <p>27. Procedure for a secure timely referral</p> <p>28. Systems to review care for referred patients</p> <p>INFECTIONS PREVENTION</p> <p>29. Clear and complete protocols</p> <p>30. Sufficient n° of hand-washing stations</p> <p>31. Available surgical supply and personal protective equipment</p> <p>32. Sufficient n° of pharmacologists</p> <p>HOSPITAL PHARMACY</p> <p>33. Sufficient drugs stocks</p> <p>34. Sufficient antibiotics stocks</p> <p>35. Rapid distribution drug service</p> <p>PHYSICAL STRUCTURES</p> <p>36. Sanitary facilities for health workers</p> <p>37. Equipped working rooms</p> <p>38. Sufficient n° of computers</p>		
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39. Sufficient n° of electrical outlets 40. Adequate canteen service		
<b>ORGANIZATION OF CARE (denominator: total cases)</b>		
<b>Health workers</b> SERVICE PROVIDER ORGANIZATION 1. Written leadership structure 2. Procedures for human resources maintenance 3. Clear work plan according to health workers' roles 4. Available calendar of health workers' shifts EDUCATION 5. Education on triage and pediatric emergencies 6. Education on common pediatric disease 7. Education on pain control 8. Education on child abuse 9. Education on appropriate drug use 10. Education on child nutrition 11. Education on communication counselling 12. Education on respectful care 13. Education on ethical aspects of care DATA COLLECTING SYSTEM 14. Clear information in medical records 15. Adequate monitoring graphics 16. Clear and complete digital database QUALITY OF CARE 17. Periodic discussion of clinical cases 18. Audit for severe clinical cases or deaths 19. Monitoring of quality of care key-indicators 20. Patient involvement in quality of care improvement process 21. Clear shared action plans for quality of care improvement 22. Personal involvement in quality of care improvement process SUPERVISION 23. Adequate education on quality of care improvement process 24. Onsite education and supervision 25. Yearly work evaluation	A validated questionnaire for health workers <sup>2</sup>	PAPER HW
<b>COVID-19 (denominator: total cases)</b>		
<b>Health users</b> 1. Is there adequate infographics (signs, posters, etc.) at the entrance to the hospital and on the wards, effectively indicating the route to be followed or the rules to be observed with regard to the current COVID-19 pandemic? 2. Has the division between wards and common areas been adequately reorganised to reduce the risk of COVID-19 infection as far as possible? 3. Have in-patient rooms been adequately reorganised to reduce the risk of COVID-19 infection as far as possible? 4. Were the healthcare personnel always provided with adequate personal protective equipment (masks, gloves) at the time of the examination and did they use them correctly? 5. Did you always have easy access to appropriate hand washing stations or disinfectant solutions? 6. Were the healthcare personnel always present in sufficient numbers to care for your child despite the current COVID-19 emergency? 7. Do you feel that you had access to all necessary care despite the COVID-19 emergency? 8. Did you find the information you received regarding strictly COVID-related aspects clear and comprehensive? 9. Do you feel that staff were able to use appropriate iteration methods to reduce as much as possible the stress related to the new COVID-19 procedures in your child?	Two validated questionnaires for health users and health workers <sup>2</sup>	PAPERS HU, HW

<p>10. At the present time how concerned are you that your child or you or other carers may become infected in hospital?</p> <p><b>Health workers</b></p> <ol style="list-style-type: none"> <li>1. Clear written COVID-19 care pathways</li> <li>2. Dedicated protocols for COVID-19 patients</li> <li>3. Reorganization of clinical care</li> <li>4. Availability of personal protective equipment</li> <li>5. Access to hand-washing station</li> <li>6. Nasal-pharyngeal swab to all admitted patients</li> <li>7. Nasal-pharyngeal swab to caregivers</li> <li>8. Clear and complete protocols</li> <li>9. COVID-19 hospital guidelines</li> <li>10. COVID-19 information and education</li> </ol>		
<b>PROCESS OF PRIORITIZATION OF THE WHO QUALITY MEASURES</b>		
<p>Methods used to prioritize from the WHO Standards <sup>1</sup> a list of Quality Measures, identification of data sources, development and validation of data collection tools, and the identification of additional measures related to COVID 19 pandemic, were reported elsewhere.<sup>2</sup> Briefly, <u>for the domain of provision of care</u>, the process consisted in the following four key steps.</p> <ol style="list-style-type: none"> <li>1. <b><u>First step: Literature review</u></b> As a first step, we conducted a literature review to assess whether any other study had reported on the prioritization of WHO standard based Quality measures for use in high income countries. Relevant experts from WHO were also consulted. A wide search strategy was applied to PUBMED, with no language restrictions. A snowballing process was used to identify additional relevant articles for the review using the reference list from primary articles. No relevant study was identified.</li> <li>2. <b><u>Second step: categorization of the WHO Quality measures</u></b> WHO Quality Measures for paediatric QOC were categorised based on: a) domain of the WHO Framework <sup>1</sup> they pertained to; b) whether the information was available in the medical files.</li> <li>3. <b><u>Third step: Prioritization based on predefined criteria</u></b> <ul style="list-style-type: none"> <li>❖ The WHO Quality Measures for paediatric QOC were prioritised by a team of experts, through a Delphi process. 3 General Delphi process rules were followed, and the list was reviewed in multiple rounds.</li> <li>❖ The team which selected the Quality Measures included experts with a different background, and specifically: 48 senior paediatricians involved in the CHOICE project, plus epidemiologists and researchers involved in developing the WHO Standards <sup>1</sup>, from different settings (Italy and Brazil), and with long-term experience in developing and/or using WHO standards of care as well as QOC pediatrics standards proposed by other scientific societies, and tools to assess QOC .</li> <li>❖ Predefined criteria for prioritization were: a) relevance to QOC in the context of high- to middle-income countries; b) potential utility of the information for use in a quality improvement process; c) feasibility of data collection, including data availability in medical records across all facilities. Although limitations of the list of measured prioritized were acknowledged, it was felt that the indicators selected enabled a quick assessment of many key aspects of pediatrics QOC. A detailed assessment of the quality of the management of specific pediatrics conditions was not considered feasible, both due to the lack of unified standards of care (i.e., national pediatrics guideline), and for possible lack of information in medical records</li> </ul> </li> <li>4. <b><u>Development and field testing of the data extraction tool and standard operating procedures (SOP)</u></b> The tool for data extraction was conceptualized as a standardized Excel file containing clear instructions for compilation, and predefined fill-in tables. The tool was field tested in the hand of an independent data collector in a sample of 660 cases, and further optimized after field testing (e.g., more comprehensive and clear instructions were detailed and embedded in the tool). Data were extracted by independent researchers, adequately trained, under the supervision of an independent data analyst and of a senior pediatrician.</li> </ol>		
<b>ESSENTIAL REFERENCES</b>		

1. World Health Organization. WHO Standards to Improve the Quality of Care for Children and Young Adolescents at Facility Level. Geneva: World Health Organization; 2018.
2. Lazzerini M, Mariani I, de Melo E Lima TR, Felici E, Martelossi S, Lubrano R, Lucarelli A, Trobia GL, Cogo P, Peri F, Nisticò D, Were WM, Baltag V, Muzigaba M, Barbi E; CHOICE Study Group. WHO standards-based tools to measure service providers' and service users' views on the quality of hospital child care: development and validation in Italy. *BMJ Open*. 2022 Mar 17;12(3):e052115. doi: 10.1136/bmjopen-2021-052115.
3. McMillan SS, King M, Tully MP. How to use the nominal group and Delphi techniques. *Int J Clin Pharm*. 2016 Jun;38(3):655-62.

Abbreviations: QOC = quality of care; WHO = World Health Organization

Note: \* List of referred papers (*all papers in this collection*):

- *ARI: Evaluation of the WHO standards to assess quality of care for children with acute respiratory infections: findings of a baseline multicenter assessment (CHOICE) in Italy. doi:10.1136/bmjpo-2024-002552*
- *AD: Implementation of the WHO standards to assess the quality of care for children with acute diarrhea: findings of a multicenter study (CHOICE) in Italy. doi:10.1136/bmjpo-2024-002569*
- *PAIN: Implementation of the WHO standards to assess quality of care for children with acute pain in EDs: findings of a multicenter study (CHOICE) in Italy. doi:10.1136/bmjpo-2024-002610*
- *HU: Implementation of the WHO standards to assess quality of pediatric care at the facility level using service users' perspective as source of data: a multicentre quality improvement study in Italy. doi:10.1136/bmjpo-2024-002600*
- *HW: Implementation of the WHO standards to assess the quality of pediatric care using health workers as source of data: findings of a multicenter study (CHOICE) in Italy - Staff perspectives on pediatric quality care: multicenter study. doi:10.1136/bmjpo-2024-002612*

Supplementary Table 2. STROBE Statement Checklist for cross-sectional studies

	Item No	Recommendation	Page No
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	4
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	4
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5,6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6,7,8
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8,9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8,9
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	8,9,10
		(b) Describe any methods used to examine subgroups and interactions	8,9,10
		(c) Explain how missing data were addressed	6,7
		(d) If applicable, describe analytical methods taking account of sampling strategy	-
		(e) Describe any sensitivity analyses	-
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	10

		(b) Give reasons for non-participation at each stage	-
		(c) Consider use of a flow diagram	-
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	10, tab 4
Outcome data	15*	Report numbers of outcome events or summary measures	11,12
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11,12,13
		(b) Report category boundaries when continuous variables were categorized	9
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	-
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	12,13
Discussion			
Key results	18	Summarise key results with reference to study objectives	14,15
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	16
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14,15, 16,17
Generalisability	21	Discuss the generalisability (external validity) of the study results	17
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	3

\*Give information separately for exposed and unexposed groups.

Supplementary Table 3. Characteristic of included facilities

	Trieste - IRCCS	Alessandria	Udine	Latina	Catania	Treviso	Padova	Mantova	Ravenna	Firenze - IRCCS	Palermo
V1. Geographical location	North	North	North	South	South	North	North	North	Center	Center	South
V2. Hospital level	3° Level	3° Level	3° Level	2° Level	2° Level	2° Level	3° Level	2° Level	2° Level	3° Level	2° Level
V3. University Hospital (for child care)	yes	no	yes	yes	no	no	yes	no	no	yes	yes
V4. Paediatric ED separate from adult ED	yes	yes	yes	no	yes	no	yes	yes	no	yes	yes
V5. Number of children accessing the ED, per year (2019)	25000	19856	19816	8196	11851	11500	25578	12600	9499	42652	33963
V6. Number of children accessing the ED, per year (2020)	16000	10862	10489	2660	5927	6200	16482	7600	4540	24898	19945
V7. Total beds in ED (children only, 2019/2020)	6	4	10	2	5	5	8	3	0	8	10
V8. Total beds for children in the hospital (in 2019/2020)	79	16	27	17	17	83	213	17	40	180	170
V9. Number of children admitted in short stay-observation (2019)	1260	1138	1910	468	533	1050	3700	450	251	2556	3640

V10. Children in short stay-observation % on total access (2019)	5	5.7	9.6	5.7	4.4	9	14.5	3.5	2.6	6	10.7
V11. Number of children admitted in short stay-observation (2020)	1175	903	1159	187	207	391	2200	300	184	1673	1371
V12. Children in short stay-observation % on total access (2020)	7	8.3	11	7	3.4	6.5	13.3	3.9	4	6.7	6.8
V13. Number of children hospitalised (2019)	668	1406	586	742	851	1304	1926	840	895	2858	5138
V14. Children hospitalised % on total access (2019)	2.6	7.1	3	9	7.1	11	7.5	6	9.4	6.7	15.1
V15. Number of children hospitalised (2020)	628	999	485	642	470	1004	1681	709	773	2736	3746
V16. Children hospitalised % on total access (2020)	4	9.2	5	24	7.9	15	10.2	9.3	17	11	18.7
V17. Number of tot paediatricians (including residents) working full time in ED (2019/20)	10	7	0	0	6	0	22	0	0	14	23
V18. Number of tot paediatrician (including resident) full or part time in ED (2019/2020)	15	10	16	13	19	15	130	10	13	19	23
V19. Number of total residents in paediatrics full time in the hospital (2019/2020)	53	4	45	6	6	4	150	1	2	69	3
V20. Number of nurses working full time in ED in 2019/2020	16	12	20	4.4	10	12	34	18	5	40	39

Supplementary table 4. Population characteristics

Respiratory cases		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11 <sup>1</sup>	Total
		N=300	N=319	N=362	N=232	N=236	N=319	N=399	N=139	N=419	N=350	N=70	N=3145
		%	%	%	%	%	%	%	%	%	%	%	%
Year	2019	70.3	68.7	60.2	54.7	89.0	62.4	74.4	83.5	52.7	62.9	100.0	67.0
	2020	29.7	31.3	39.8	45.3	11.0	37.6	25.6	16.5	47.3	37.1	0.0	33.0
Age	6-23 months	45.3	32.0	41.4	27.2	35.6	38.6	25.3	33.8	45.6	43.4	44.3	37.5
	24-59 months	33.3	43.3	29.8	42.7	39.0	36.7	28.8	40.3	37.2	34.9	25.7	35.6
	5-15 years	21.3	24.8	28.7	30.2	25.4	24.8	45.9	25.9	17.2	21.7	30.0	26.8
Sex	Male	58.7	56.4	53.3	58.6	58.5	61.8	48.6	54.0	60.9	62.3	50.0	57.1
	Female	41.3	43.6	46.7	41.4	41.5	38.2	51.4	46.0	39.1	37.7	50.0	42.9
Temperature <sup>2</sup>	<38 °C	0.3	0.3	1.1	0.0	0.0	0.9	0.5	0.7	3.1	0.0	0.0	0.8
	38 - 39 °C	57.0	58.6	70.4	71.1	64.4	66.1	51.6	71.2	67.3	52.0	48.6	61.8
	>39 °C	42.7	41.1	28.5	28.9	35.6	32.9	47.9	28.1	29.6	48.0	51.4	37.4
SO2	Not recorded	4.3	14.7	4.1	0.0	26.7	9.4	22.8	45.3	26.7	21.7	65.7	17.7

	> 92%	95.3	85.0	60.2	99.1	72.9	90.3	77.2	53.2	22.2	78.0	34.3	<b>71.1</b>
	≤ 92%	0.3	0.3	35.6	0.9	0.4	0.3	0.0	1.4	51.1	0.3	0.0	<b>11.2</b>
<b>Supplementary O2</b>	<i>No</i>	100.0	97.5	99.7	99.6	99.2	99.4	100.0	99.3	96.9	98.6	100.0	<b>99.0</b>
	<i>Yes</i>	0.0	2.5	0.3	0.4	0.8	0.6	0.0	0.7	3.1	1.4	0.0	<b>1.0</b>
<b>CRP</b>	<i>Not requested</i>	98.7	90.0	77.1	92.7	44.9	70.5	90.2	89.9	64.2	91.1	78.6	<b>80.6</b>
	< 20 mg/L	0.7	4.7	17.4	3.9	30.9	15.0	2.5	5.8	27.4	4.3	11.4	<b>11.6</b>
	≥ 20 mg/L	0.7	5.3	5.5	3.4	24.2	14.4	7.3	4.3	8.4	4.6	10.0	<b>7.7</b>
<b>RX</b>	<i>Not requested</i>	97.7	89.3	90.1	76.3	61.9	86.2	98.2	88.5	85.2	90.6	95.7	<b>87.7</b>
	<i>Normal</i>	0.3	2.8	2.5	8.6	7.6	2.5	0.5	2.2	2.4	4.6	0.0	<b>3.1</b>
	<i>Abnormal</i>	2.0	7.8	7.5	15.1	30.5	11.3	1.3	9.4	12.4	4.9	4.3	<b>9.3</b>

Abbreviations: SO2 = oxygen saturation. CRP= C reactive protein. RX = chest X ray. Ind = indication.

<sup>1</sup> For C11, only 2019 data were available.

<sup>2</sup> Maximum temperature, either reported by parents or measured in the ED.

Supplementary Table 5. Findings on the 10 prioritized WHO Standard-bases Quality Measures on pediatric ARI (A), types of antibiotics prescribed (B) and types of hospitalization (C)

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11 <sup>1</sup>	Total
	%	%	%	%	%	%	%	%	%	%	%	%
	N=300	N=319	N=362	N=232	N=236	N=319	N=399	N=139	N=419	N=350	N=70	N=3145
<b>(A) Quality Measure</b>												
1. Evaluated within 90 minutes	92.6	100.0	69.7	65.4	97.9	95.6	86.6	88.3	82.0	81.7	67.5	<b>85.3</b>
2. HR documented	95.4	88.2	95.4	99.6	71.6	91.5	74.7	52.4	75.7	47.2	44.7	<b>79.2</b>
3. RR documented	59.4	26.2	62.7	10.7	13.8	27.4	12.5	18.6	55.5	19.4	14.0	<b>32.4</b>
4. T° documented	78.4	100.0	99.2	98.8	95.1	99.4	98.1	84.2	95.7	98.0	95.6	<b>95.5</b>
5. SO2% documented	95.7	85.3	95.9	100	73.3	90.6	77.2	54.7	73.3	78.3	34.3	<b>82.3</b>
6. Treated with antibiotics	38.3	75.2	68.8	58.6	62.3	46.7	39.3	35.3	25.8	22.6	80.0	<b>47.2</b>
7. Treated with anti-cough drugs	0.0	0.9	0.3	5.1	0.0	0.3	2.5	2.1	0.5	0.0	0.9	<b>1.0</b>
8. Treated with mucolytics drugs	0.0	1.6	0.0	0.8	0.0	0.0	0.5	0.0	0.0	0.0	0.0	<b>0.3</b>
9. Clear ind. for reassessment	87.3	13.8	24.3	41.8	6.8	62.4	46.6	22.3	63.2	71.7	17.1	<b>46.1</b>
10. Hospitalization (any) <sup>2</sup>	2.3	30.6	7.6	7.9	23.1	8.5	4.2	4.2	18.1	11.4	11.4	<b>11.8</b>
<b>(B) Type of antibiotics prescribed</b>												
Amoxicillin ≥ 75mg/kg <sup>3</sup>	32.3	22.6	19.3	28.0	6.4	36.1	36.1	20.1	9.3	13.4	22.8	<b>22.8</b>
Amoxicillin at lower dosages	1.3	0.0	0.0	0.0	0.4	2.2	0.0	2.9	0.5	0.6	0.9	<b>0.7</b>
Amoxicillin-clavulanic acid	2.3	0.9	21.8	2.6	30.1	4.1	0.5	3.6	9.5	4.3	36.8	<b>9.0</b>
Macrolides	0.7	14.1	17.7	23.3	28.8	6.0	3.0	5.0	4.5	2.6	7.0	<b>9.8</b>
Cephalosporins	0.0	42.0	13.3	12.5	8.9	2.8	0.3	1.4	1.4	0.9	5.3	<b>8.2</b>
Others	0.0	0.0	0.0	1.7 <sup>4</sup>	0.0	0.0	0.0	1.4 <sup>5</sup>	1.4 <sup>5</sup>	0.0	0.0	<b>0.4</b>
<b>(C) Final outcome after ED visit</b>												
Short stay	1.9	28.1	2.4	2.8	3.2	7.0	3.9	0.0	16.9	11.4	7.5	<b>8.6</b>
Hospitalization	0.3	7.5	7.1	6.4	22.7	1.5	0.5	4.2	2.9	0.6	5.3	<b>4.7</b>
Short stay and hospitalization	0.0	5.0	1.9	1.2	2.8	0.0	0.2	0.0	1.7	0.6	1.4	<b>1.4</b>

Abbreviations: HR = Heart rate. RR = respiratory rate. T° = body temperature (Celsius). SO2% = Oxygen saturation. Ind = indication.

<sup>1</sup> For C11, only 2019 data are available.

<sup>2</sup> Both hospitalization and short duration of stay

<sup>3</sup> Or 50mg/kg for pharyngitis

<sup>4</sup> Clofoctol

<sup>5</sup> Ampicillin

Supplementary Table 6. Logistic regression models - variables associated with antibiotic prescription, clear indications for reassessment and hospitalization

Dependent: Antibiotic		No	Yes	OR (univariable)	aOR (multivar. reduced) <sup>1</sup>
Center	C1	186 (62.0)	114 (38.0)	-	-
	C2	79 (26.7)	217 (73.3)	4.48 (3.18-6.37, p<0.001)	<b>4.18 (2.95-5.97, p&lt;0.001)</b>
	C3	105 (31.2)	231 (68.8)	3.59 (2.59-5.00, p<0.001)	<b>4.30 (2.99-6.22, p&lt;0.001)</b>
	C4	97 (41.6)	136 (58.4)	2.29 (1.62-3.25, p<0.001)	<b>1.68 (1.16-2.42, p=0.006)</b>
	C5	48 (25.7)	139 (74.3)	4.72 (3.18-7.12, p<0.001)	<b>3.06 (1.99-4.74, p&lt;0.001)</b>
	C6	169 (53.8)	145 (46.2)	1.40 (1.02-1.93, p=0.041)	1.00 (0.71-1.42, p=0.977)
	C7	242 (61.0)	155 (39.0)	1.05 (0.77-1.42, p=0.779)	0.87 (0.63-1.20, p=0.383)
	C8	89 (66.9)	44 (33.1)	0.81 (0.52-1.24, p=0.327)	<b>0.60 (0.38-0.95, p=0.032)</b>
	C9	307 (75.2)	101 (24.8)	0.54 (0.39-0.74, p<0.001)	<b>0.44 (0.29-0.65, p&lt;0.001)</b>
	C10	270 (77.6)	78 (22.4)	0.47 (0.33-0.66, p<0.001)	<b>0.36 (0.25-0.52, p&lt;0.001)</b>
Year	2019	1032 (53.0)	915 (47.0)	-	-
	2020	560 (55.7)	445 (44.3)	0.90 (0.77-1.04, p=0.161)	-
Age	6-23 months	660 (59.9)	441 (40.1)	-	-
	24-59 months	556 (52.3)	508 (47.7)	1.37 (1.15-1.62, p<0.001)	<b>1.26 (1.04-1.52, p=0.020)</b>
	5-15 years	376 (47.8)	411 (52.2)	1.64 (1.36-1.97, p<0.001)	<b>1.39 (1.12-1.71, p=0.002)</b>
Sex	Male	940 (55.3)	759 (44.7)	-	-
	Female	652 (52.0)	601 (48.0)	1.14 (0.99-1.32, p=0.076)	-
SO2	Not requested	274 (55.7)	218 (44.3)	-	-
	> 92%	1107 (52.0)	1021 (48.0)	1.16 (0.95-1.41, p=0.142)	<b>0.76 (0.60-0.97, p=0.025)</b>
	≤ 92%	211 (63.6)	121 (36.4)	0.72 (0.54-0.96, p=0.025)	<b>0.41 (0.27-0.60, p&lt;0.001)</b>
CRP	Not requested	1390 (56.3)	1077 (43.7)	-	-
	<20 mg/L	158 (49.1)	164 (50.9)	1.34 (1.06-1.69, p=0.014)	0.91 (0.67-1.24, p=0.564)
	≥20 mg/L	44 (27.0)	119 (73.0)	3.49 (2.47-5.03, p<0.001)	<b>3.10 (2.07-4.69, p&lt;0.001)</b>
RX	Not requested	1533 (57.7)	1126 (42.3)	-	-
	Normal	36 (42.4)	49 (57.6)	1.85 (1.20-2.89, p=0.006)	1.73 (1.05-2.88, p=0.033)
	Abnormal	23 (11.1)	185 (88.9)	10.95 (7.21-17.45, p<0.001)	<b>16.10 (9.85-27.51, p&lt;0.001)</b>
Temperature	<38°C	13 (54.2)	11 (45.8)	-	-
	>39°C	566 (51.6)	531 (48.4)	1.11 (0.49-2.55, p=0.803)	-

	38-39 °C	1013 (55.3)	818 (44.7)	0.95 (0.42-2.18, p=0.910)	-
Supplementary O2	No	1581 (53.9)	1350 (46.1)	-	-
	Yes	11 (52.4)	10 (47.6)	1.06 (0.44-2.53, p=0.886)	-
<b>Dependent: Clear In. Reassessment</b>		<b>No</b>	<b>Yes</b>	<b>OR (univariable)</b>	<b>aOR (multivar. reduced) <sup>2</sup></b>
Center	C1	37 (12.4)	262 (87.6)	-	-
	C2	252 (85.1)	44 (14.9)	0.02 (0.02-0.04, p<0.001)	<b>0.03 (0.02-0.04, p&lt;0.001)</b>
	C3	255 (75.9)	81 (24.1)	0.04 (0.03-0.07, p<0.001)	<b>0.02 (0.01-0.04, p&lt;0.001)</b>
	C4	133 (57.8)	97 (42.2)	0.10 (0.07-0.16, p<0.001)	<b>0.10 (0.06-0.15, p&lt;0.001)</b>
	C5	172 (92.5)	14 (7.5)	0.01 (0.01-0.02, p<0.001)	<b>0.01 (0.00-0.02, p&lt;0.001)</b>
	C6	117 (37.3)	197 (62.7)	0.24 (0.16-0.36, p<0.001)	<b>0.21 (0.14-0.32, p&lt;0.001)</b>
	C7	211 (53.1)	186 (46.9)	0.12 (0.08-0.18, p<0.001)	<b>0.14 (0.09-0.21, p&lt;0.001)</b>
	C8	103 (77.4)	30 (22.6)	0.04 (0.02-0.07, p<0.001)	<b>0.04 (0.02-0.07, p&lt;0.001)</b>
	C9	149 (36.5)	259 (63.5)	0.25 (0.16-0.36, p<0.001)	<b>0.11 (0.07-0.18, p&lt;0.001)</b>
	C10	97 (27.9)	251 (72.1)	0.37 (0.24-0.55, p<0.001)	<b>0.37 (0.24-0.55, p&lt;0.001)</b>
Year	2019	985 (50.7)	958 (49.3)	-	-
	2020	541 (53.9)	463 (46.1)	0.88 (0.76-1.02, p=0.101)	<b>0.78 (0.65-0.95, p=0.011)</b>
Age	6-23 months	532 (48.4)	568 (51.6)	-	-
	24-59 months	535 (50.3)	529 (49.7)	0.93 (0.78-1.10, p=0.372)	0.98 (0.80-1.20, p=0.853)
	5-15 years	459 (58.6)	324 (41.4)	0.66 (0.55-0.80, p<0.001)	<b>0.65 (0.52-0.82, p&lt;0.001)</b>
Sex	Male	853 (50.4)	841 (49.6)	-	-
	Female	673 (53.7)	580 (46.3)	0.87 (0.76-1.01, p=0.071)	-
Antibiotic	No	693 (43.6)	897 (56.4)	-	-
	Yes	833 (61.4)	524 (38.6)	0.49 (0.42-0.56, p<0.001)	<b>0.79 (0.65-0.95, p=0.013)</b>
SO2	Not requested	322 (65.4)	170 (34.6)	-	-
	> 92%	1102 (51.9)	1021 (48.1)	1.75 (1.43-2.16, p<0.001)	<b>1.51 (1.17-1.94, p=0.001)</b>
	≤ 92%	102 (30.7)	230 (69.3)	4.27 (3.18-5.77, p<0.001)	<b>7.38 (4.98-11.05, p&lt;0.001)</b>
CRP	Not requested	1293 (52.5)	1171 (47.5)	-	-
	< 20mg/L	152 (47.2)	170 (52.8)	1.23 (0.98-1.56, p=0.075)	<b>1.51 (1.10-2.07, p=0.010)</b>
	≥ 20mg/L	81 (50.3)	80 (49.7)	1.09 (0.79-1.50, p=0.594)	<b>1.61 (1.10-2.36, p=0.015)</b>
RX	Not requested	1385 (52.1)	1272 (47.9)	-	-
	Normal	47 (55.3)	38 (44.7)	0.88 (0.57-1.36, p=0.565)	1.10 (0.65-1.88, p=0.718)
	Abnormal	94 (45.9)	111 (54.1)	1.29 (0.97-1.71, p=0.084)	<b>1.65 (1.12-2.44, p=0.012)</b>

Temperature	<38°C	11 (45.8)	13 (54.2)	-	-
	>39°C	563 (51.4)	533 (48.6)	0.80 (0.35-1.81, p=0.592)	-
	38-39°C	952 (52.1)	875 (47.9)	0.78 (0.34-1.75, p=0.542)	-
Supplementary O2	No	1520 (51.9)	1406 (48.1)	-	-
	Yes	6 (28.6)	15 (71.4)	2.70 (1.10-7.60, p=0.040)	-
Dependent: Hospitalization		No	Yes	OR (univariable)	aOR (multivar. reduced) <sup>3</sup>
Center	C1	300 (99.7)	1 (0.3)	-	-
	C2	296 (92.8)	23 (7.2)	23.31 (4.87-418.44, p=0.002)	<b>16.23 (2.49-332.73, p=0.015)</b>
	C3	336 (92.8)	26 (7.2)	23.21 (4.89-415.67, p=0.002)	<b>13.80 (2.19-279.06, p=0.021)</b>
	C4	233 (93.6)	16 (6.4)	20.60 (4.16-373.15, p=0.003)	8.80 (1.32-181.26, p=0.059)
	C5	187 (77.6)	54 (22.4)	86.63 (18.81-1538.6, p<0.001)	<b>10.76 (1.74-214.93, p=0.035)</b>
	C6	314 (98.4)	5 (1.6)	4.78 (0.76-91.81, p=0.155)	0.80 (0.10-17.22, p=0.849)
	C7	397 (99.5)	2 (0.5)	1.51 (0.14-32.61, p=0.736)	1.31 (0.10-32.14, p=0.839)
	C8	133 (95.7)	6 (4.3)	13.53 (2.28-256.93, p=0.016)	8.13 (0.92-184.54, p=0.093)
	C9	408 (97.1)	12 (2.9)	8.82 (1.72-161.19, p=0.037)	1.77 (0.26-36.50, p=0.622)
	C10	348 (99.4)	2 (0.6)	1.72 (0.16-37.21, p=0.657)	0.69 (0.05-17.07, p=0.783)
Year	2019	1947 (94.7)	108 (5.3)	-	-
	2020	1005 (96.3)	39 (3.7)	0.70 (0.48-1.01, p=0.061)	-
Age	6-23 months	1101 (95.2)	55 (4.8)	-	-
	24-59 months	1064 (95.9)	46 (4.1)	0.87 (0.58-1.29, p=0.479)	<b>0.33 (0.18-0.57, p&lt;0.001)</b>
	5-15 years	787 (94.5)	46 (5.5)	1.17 (0.78-1.75, p=0.444)	<b>0.46 (0.26-0.81, p=0.008)</b>
Sex	Male	1699 (95.5)	80 (4.5)	-	-
	Female	1253 (94.9)	67 (5.1)	1.14 (0.81-1.58, p=0.454)	-
SO2	Not requested	492 (96.1)	20 (3.9)	-	-
	> 92%	2128 (95.2)	107 (4.8)	1.24 (0.78-2.07, p=0.392)	-
	≤ 92%	332 (94.3)	20 (5.7)	1.48 (0.78-2.81, p=0.225)	-
CRP	Not requested	2467 (99.2)	20 (0.8)	-	-
	<20 mg/L	322 (88.5)	42 (11.5)	16.09 (9.45-28.29, p<0.001)	<b>6.55 (3.42-12.79, p&lt;0.001)</b>
	≥20 mg/L	163 (65.7)	85 (34.3)	64.32 (39.32-110.09, p<0.001)	<b>35.18 (18.88-67.89, p&lt;0.001)</b>
RX	Not requested	2659 (98.6)	39 (1.4)	-	-
	Normal	85 (88.5)	11 (11.5)	8.82 (4.18-17.28, p<0.001)	<b>3.36 (1.40-7.60, p=0.005)</b>
	Abnormal	208 (68.2)	97 (31.8)	31.80 (21.54-47.79, p<0.001)	<b>9.02 (5.30-15.63, p&lt;0.001)</b>

Temperature	<38°C	24 (96.0)	1 (4.0)	-	-
	>39°C	1097 (95.1)	57 (4.9)	1.25 (0.26-22.49, p=0.830)	-
	38-39 °C	1831 (95.4)	89 (4.6)	1.17 (0.24-20.97, p=0.881)	-
Supplementary O2	No	2931 (95.7)	133 (4.3)	-	-
	Yes	21 (60.0)	14 (40.0)	14.69 (7.16-29.29, p<0.001)	<b>8.16 (2.91-22.65, p&lt;0.001)</b>

Abbreviations: SO2: oxygen saturation. CRP: C reactive protein. RX: chest X ray. In. = indications.

<sup>1</sup> Reduced Model: Number in dataframe = 2952, Number in model = 2952, AIC = 3420.2, C-statistic = 0.763

<sup>2</sup> Reduced Model: Number in dataframe = 2947, Number in model = 2947, AIC = 3171.6, C-statistic = 0.811

<sup>3</sup> Reduced Model: Number in dataframe = 3099, Number in model = 3099, AIC = 623.5, C-statistic = 0.957