Supplementary files

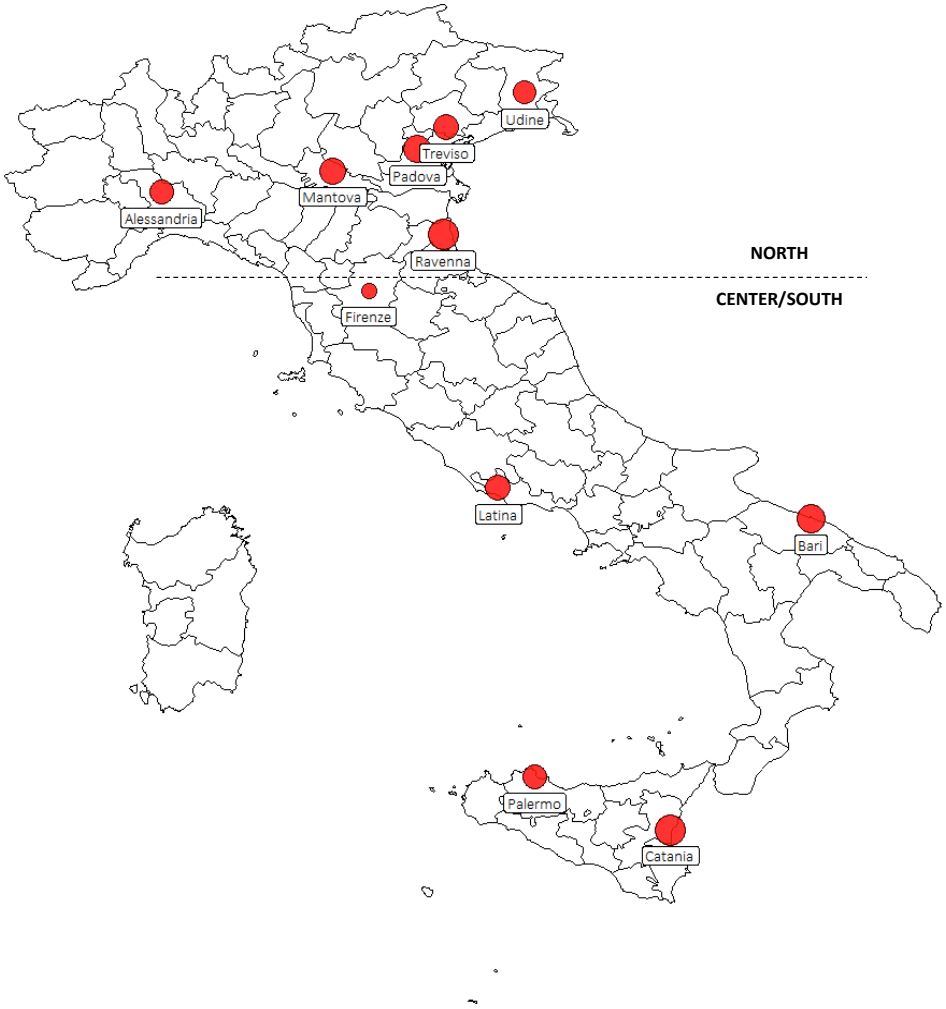
Supplemental Table 1. STROBE Checklist

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5
Objectives	3	State specific objectives, including any prespecified hypotheses	5, 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
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6, 7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7, 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	6,7,8
Bias	9	Describe any efforts to address potential sources of bias	9
Study size	10	Explain how the study size was arrived at	7

Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7,8,9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7,8,9
		(*b*) Describe any methods used to examine subgroups and interactions	7,8,9
		(*c*) Explain how missing data were addressed	7, Figure 1
		(*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, Figure 1
		(b) Give reasons for non-participation at each stage	10, Figure 1
		(c) Consider use of a flow diagram	Figure 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	10, 11 Suppl Table 5, Suppl Table 6
		(b) Indicate number of participants with missing data for each variable of interest	Suppl Table 5, Suppl Table 6
Outcome data	15*	Report numbers of outcome events or summary measures	10 to 14

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	10 to 14
		(*b*) Report category boundaries when continuous variables were categorized	Suppl Table 6
		(*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 to 14
Discussion			
Key results	18	Summarise key results with reference to study objectives	15-19
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	17
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15 to 18
Generalisability	21	Discuss the generalisability (external validity) of the study results	16,17, 18, 19
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	20

Supplemental Figure 1. Distribution of study hospitals across the national territory



Notes: the width of the red circle is proportional to the sample size of the related facility.

Supplemental Table 2. Hospital characteristics in terms of organizational structure, i.e., facility level and type, and volume of work

	Alessandria	Udine	Latina	Catania	Treviso	Padova	Mantova	Ravenna	Palermo	Firenze – IRCCS	Bari
Geographical location	North	North	South	South	North	North	North	Center	South	Center	South
Hospital level	3° Level	3° Level	2° Level	2° Level	2° Level	3° Level	2° Level	2° Level	2° Level	3° Level	3° Level
University Hospital (for child care)	no	yes	yes	no	no	yes	no	no	yes	Yes	yes
Pediatric ED separate from adult ED	yes	yes	no	yes	no	yes	yes	no	yes	yes	yes
Number of children accessing the ED, per year (2019)	19856	19816	8196	11851	11500	25578	12600	9499	33963	42652	25000
Number of children accessing the ED, per year (2020)	10862	10489	2660	5927	6200	16482	7600	4540	19945	24898	19000
Total beds in ED (children only, 2019/2020)	4	10	2	5	5	8	3	0	10	8	4
Total beds for children in the hospital (in 2019/2020)	16	27	17	17	83	213	17	40	170	180	115
Number of children admitted in short stay-observation (2019)	1138	1910	468	533	1050	3700	450	251	3640	2556	2500
Children in short stay-observation % on total access (2019)	5.7	9.6	5.7	4.4	9	14.5	3.5	2.6	10.7	6	10
Number of children admitted in short	903	1159	187	207	391	2200	300	184	1371	1673	2280

stay-observation (2020)											
Children in short stay-observation % on total access (2020)	8.3	11	7	3.4	6.5	13.3	3.9	4	6.8	6.7	12
Number of children hospitalised (2019)	1406	586	742	851	1304	1926	840	895	5138	2858	3750
Children hospitalised % on total access (2019)	7.1	3	9	7.1	11	7.5	6	9.4	15.1	6.7	15
Number of children hospitalised (2020)	999	485	642	470	1004	1681	709	773	3746	2736	3420
Children hospitalised % on total access (2020)	9.2	5	24	7.9	15	10.2	9.3	17	18.7	11	18
Number of tot pediatricians (including residents) working full time in ED (2019/20)	7	0	0	6	0	22	0	0	25	14	6
Number of tot pediatrician (including resident) full or part time in ED (2019/2020)	10	16	13	19	15	130	10	13	23	19	12
Number of total residents in pediatrics full time in the hospital (2019/2020)	4	45	6	6	4	150	1	2	10	69	70
Number of nurses working full time in ED in 2019/2020	12	20	4.4	10	12	34	18	5	40	40	21

Supplemental Table 3. Process of prioritization of the WHO quality measures for the CHOICE Study and list of the 10 measures selected for the COVID-19 subsection

PROCESS OF PRIORITIZATION OF THE WHO QUALITY MEASURES
Methods used to prioritize from the WHO Standards [1] 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.[2] Briefly, <u>for the domain of provision of care</u>, the process consisted in the following four key steps. **<u>1. First step: Literature review</u>** 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. **<u>2. Second step: categorization of the WHO Quality measures</u>** WHO Quality Measures for pediatric QOC were categorised based on: a) domain of the WHO Framework [1] they pertained to; b) whether the information was available in the medical files. **<u>3. Third step: Prioritization based on predefined criteria</u>** ❖ The WHO Quality Measures for pediatric 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. ❖ The team which selected the Quality Measures included experts with a different background, and specifically: 48 senior pediatricians involved in the CHOICE project, plus epidemiologists and researchers involved in developing the WHO Standards [1], 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 . ❖ 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 **<u>4. Development and field testing of the data extraction tool and standard operating procedures (SOP)</u>** 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.
<u>COVID-19 – Data source: validated questionnaire for health users [2]</u>

Health users 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? 10. At the present time how concerned are you that your child or you or other carers may become infected in hospital?
ESSENTIAL REFERENCES
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: Each quality measure could be rated by responders based on a qualitative three option scale about adequacy of service, with three possible answers: “Yes”, “No, needing some improvement”, “No, needing substantial improvement”.

Supplemental Table 4. Predefined scoring system

	Number of questions				QOC Index range	Score for each question
	Service users survey	Health worker survey	Hospital records	CHOICE project		
Domain of care						
1.Provision of care	-	-	20	20	0-100	0-2.5-5
2. Experience of care	40	-	-	40	0-100	0-1.25-2.5
3 Resources for patients	25	-	-	25	0-100	0-2-4
4. Covid-19	10	10		20	0-100	0-5-10
5. Resources for operators	-	40	-	40	0-100	0-1.25-2.5
6.Organization of care	-	25	-	25	0-100	0-2-4
Total QOC Index						
Total QOC Index for health workers		75		75	0-300	
Total QOC Index for service users	75	-	-	75	0-300	

Abbreviations: CHOICE= Child HOspItal CarE; QOC = quality of care.
Note: Each quality measure could be rated by responders based on a qualitative three option scale about adequacy of service, with three possible answers: “Yes”, “No, needing some improvement”, “No, needing substantial improvement”

Supplemental Table 5. COVID-19 QOC Index, Overall QOC perceived and COVID-19 new positive cases, comparison between COVID-19 periods

	Periods	N	Mean	SD	Min	Q1	Median	Q3	Max	p-value
COVID-19 QOC Index	Period 1	317	95.22	10.46	0	95	100	100	100	<0.001
	Period 2	639	91.19	15.20	0	90	100	100	100	
Overall QOC perceived	Period 1	317	85.11	13.21	0	80	90	100	100	0.001
	Period 2	639	81.88	15.58	0	70	80	90	100	
COVID-19 new positive cases	Period 1	336	9465.92	6981.98	389	3391	7245	14447.0	26824	< 0.001
	Period 2	211	58990.41	50930.84	2834	20587	46631	75738.5	220532	

Abbreviations: QOC = quality of care.
Period 1 (until 31 October 2021), Period 2 (from 1 November 2021)

Supplemental Table 6. Fear of accessing health services and contracting COVID-19 in the hospital, comparison between COVID-19 periods

	Answer		Period 1		Period 2		p-value
			N	%	N	%	
Fear of accessing health services	Yes, crucially	Not provided	298	94.0	588	92.0	0.294
		Provided	19	6.0	51	8.0	
	Yes, to a little extent	No	252	79.5	468	73.2	0.038
		Yes	65	20.5	171	26.8	
	One of the previous	No	233	73.5	417	65.3	0.010
		Yes	84	26.5	222	34.7	
Fear of contracting COVID-19 in the hospital	Yes, a lot	No	307	96.8	606	94.8	0.186
		Yes	10	3.2	33	5.2	
	Yes, pretty much	No	260	82.0	437	68.4	<0.001
		Yes	57	18.0	202	31.6	
	One of the previous	No	250	78.9	404	63.2	<0.001
		Yes	67	21.1	235	36.8	

Period 1 (until 31 October 2021), Period 2 (from 1 November 2021)

Supplemental Table 7. Spearman's correlations indexes between key indicators and COVID-19 positives over time, by COVID-19 periods

Fear of accessing health services	Period 1		Period 2	
	ρ	p-value	ρ	p-value
Yes, to a little extent	0.185	0.032	0.1189	0.146
Yes, crucially	-0.0716	0.409	0.2608	0.001
Both combined	0.1366	0.114	0.2087	0.01
Fear of contracting COVID-19 in the hospital	**Period 1**		**Period 2**	
	ρ	p-value	ρ	p-value
Yes, pretty much	0.0659	0.447	0.2294	0.005
Yes, a lot	-0.088	0.31	0.1396	0.087
Both combined	0.0635	0.464	0.2456	0.002
COVID-19 QOC Index	**Period 1**		**Period 2**	
	ρ	p-value	ρ	p-value
	-0.008	0.927	0.0294	0.72
Overall QOC perceived	**Period 1**		**Period 2**	
	ρ	p-value	ρ	p-value
	-0.0396	0.649	0.0687	0.402

Abbreviations: QOC = quality of care.
Period 1 (until 31 October 2021), Period 2 (from 1 November 2021)

Supplemental Table 8. Characteristics of responders, by facility and overall

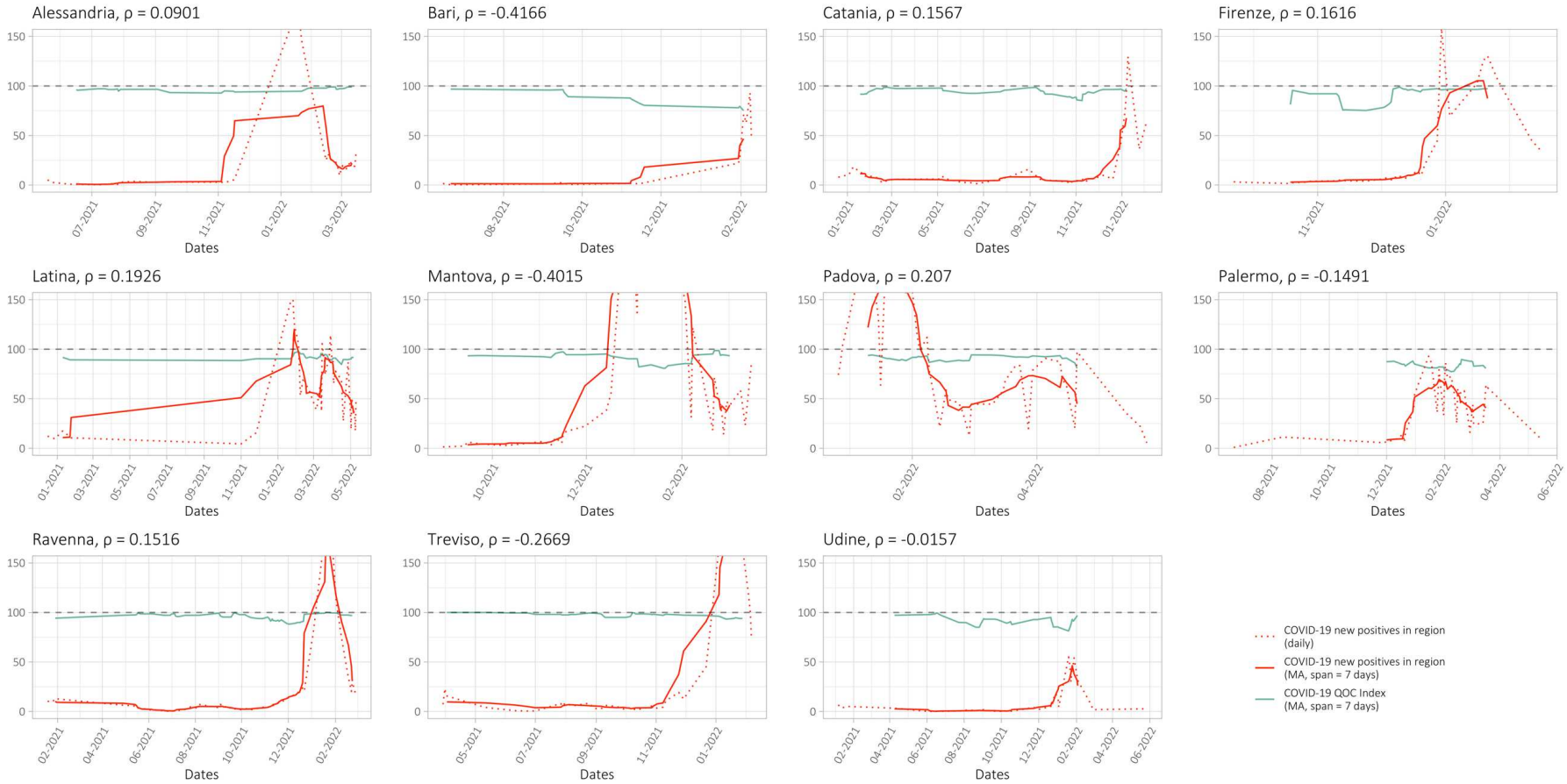
Characteristics		Alessandria	Bari	Catania	Firenze	Latina	Mantova	Padova	Palermo	Ravenna	Treviso	Udine	Total
		N=77	*N=99*	*N=112*	*N=59*	*N=81*	*N=87*	*N=94*	*N=78*	*N=115*	*N=82*	*N=72*	*N=956*
Age (missing = 5)	*Median*	39.00	33.82	35.93	37.41	37.37	38.28	40.62	35.65	39.26	39.45	40.21	38.0
	IQR	[34, 44]	[29, 38]	[30, 41]	[35, 42]	[32, 41]	[35, 43.5]	[35, 46]	[32, 40]	[34, 44]	[35, 44]	[33, 48]	[32, 43]
Sex (missing = 1)	*Male*	3.9	17.2	5.4	22.0	9.9	9.2	8.5	5.1	17.4	17.1	19.4	12.0
	Female	93.5	82.8	93.8	78.0	90.1	90.8	91.5	94.9	80.9	82.9	80.6	87.4
	Other	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.4
Working position (missing = 0)	*Unemployed*	32.5	25.3	46.4	13.6	35.8	19.5	20.2	47.4	17.4	24.4	15.3	27.5
	Part time job	14.3	39.4	17.0	23.7	22.2	31.0	20.2	23.1	18.3	31.7	27.8	24.3
	Full time job	53.2	35.4	36.6	62.7	42.0	49.4	59.6	29.5	64.3	43.9	56.9	48.2
Education (missing = 0)	*None*	1.3	1.0	1.8	0.0	1.2	0.0	0.0	1.3	0.9	0.0	1.4	0.8
	Primary/secondary sch.	22.1	15.2	18.8	13.6	16.0	18.4	10.6	23.1	9.6	11.0	13.9	15.5
	High School	45.5	49.5	50.9	28.8	54.3	51.7	47.9	44.9	55.7	57.3	48.6	49.5
	University	24.7	30.3	22.3	42.4	22.2	24.1	24.5	15.4	27.0	22.0	26.4	25.2
	Post-University	6.5	4.0	6.2	15.3	6.2	5.7	17.0	15.4	7.0	9.8	9.7	9.0
Number of children (missing = 0)	*None*	2.6	4.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.7
	1 child	29.9	35.4	30.4	33.9	32.1	31.0	30.9	24.4	30.4	28.0	34.7	31.0
	2 children	51.9	40.4	52.7	52.5	59.3	49.4	57.4	56.4	49.6	52.4	48.6	51.7
	3 children	14.3	17.2	13.4	11.9	7.4	17.2	9.6	12.8	17.4	12.2	11.1	13.4
	> 3 children	1.3	3.0	3.6	1.7	1.2	2.3	1.1	6.4	2.6	7.3	5.6	3.2
Survey completed by (missing = 0)	*Mother only*	90.9	82.8	90.2	81.4	90.1	85.1	88.3	87.2	79.1	80.5	80.6	85.1
	Father only	6.5	16.2	7.1	18.6	9.9	10.3	7.4	2.6	13.9	17.1	15.3	11.2
	Other family /caregiver	1.3	1.0	0.9	0.0	0.0	2.3	0.0	1.3	0.9	0.0	1.4	0.8
	>1 together	1.3	0.0	1.8	0.0	0.0	2.3	4.3	9.0	6.1	2.4	2.8	2.8
Parents nationality (missing = 0)	*Both Italian*	71.4	91.9	100.0	84.7	77.8	85.1	84.0	96.2	80.9	81.7	80.6	*85.5*
	One Italian	5.2	7.1	0.0	8.5	7.4	4.6	5.3	1.3	9.6	4.9	18.1	*6.3*
	Both other nationalities	23.4	1.0	0.0	6.8	14.8	10.3	10.6	2.6	9.6	13.4	1.4	*6.3*

Supplemental Table 9. Characteristics of hospitalized children, by facility and overall

Characteristics		*Alessandria*	*Bari*	*Catania*	*Firenze*	*Latina*	*Mantova*	*Padova*	*Palermo*	*Ravenna*	*Treviso*	*Udine*	*Total*
		N=77	*N=94*	*N=112*	*N=57*	*N=78*	*N=87*	*N=94*	*N=78*	*N=115*	*N=82*	*N=72*	*N=956*
Age (missing = 3)	*< 6 m*	18.2	18.2	15.2	6.8	6.2	13.8	19.1	17.0	19.1	23.2	7	14.7
	≥ 6 m < 3 y	23.4	27.3	36.6	50.8	27.2	16.1	18.1	36.9	27.0	13.4	20	26.6
	≥ 3 y < 6 y	6.5	28.3	15.2	10.2	22.2	16.1	12.8	17.0	9.6	12.2	11	15.3
	≥ 6 y < 12 y	18.2	20.2	19.6	16.9	25.9	25.3	19.1	17.7	27.8	24.4	17	23.4
	≥ 12 y < 16 y	33.8	6.1	13.4	15.3	18.5	28.7	30.9	11.3	16.5	26.8	17	20.0
Sex (missing = 2)	*Male*	51.9	44.2	41.1	40.7	55.6	55.2	44.7	57.7	55.7	52.4	40	50.5
	Female	48.1	55.8	58.9	59.3	44.4	44.8	55.3	42.3	44.3	47.6	32	49.5
	Other	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Reason for hospital visit (missing = 2)	*Fever*	31.2	40.4	24.1	22.0	22.2	10.3	18.1	28.2	24.3	20.7	10	23.5
	Diarrhea	6.5	10.1	8.0	6.8	7.4	3.4	1.1	5.1	3.5	1.2	1	5.0
	Resp. disease	13.0	29.3	27.7	30.5	9.9	19.5	9.6	7.7	15.7	13.4	13	17.8
	Other	49.4	20.2	40.2	40.7	60.5	66.7	71.3	59.0	56.5	64.6	48	53.7
Admission to (missing = 4)	*Emergency Dep.*	23.4	29.3	58.9	96.6	42.0	36.8	52.1	97.4	41.7	30.5	42	49.8
	Pediatric Ward	76.6	70.7	41.1	3.4	58.0	63.2	47.9	2.6	58.3	69.5	30	50.2
Duration of hospitalization (missing = 5)	*< 1 day*	1.3	15.2	1.8	18.6	2.5	10.3	12.8	15.4	0.9	4.9	33	10.7
	1-3 days	37.7	17.2	15.2	64.4	24.7	23.0	33.0	42.3	28.7	7.3	12	26.8
	3-7 days	42.9	43.4	70.5	13.6	50.6	54.0	35.1	39.7	45.2	53.7	19	45.0
	> 7 days	9.1	15.2	10.7	1.7	14.8	10.3	12.8	2.6	16.5	19.5	5	11.5
	> 15 days	6.5	6.1	1.8	0.0	4.9	2.3	4.3	0.0	8.7	8.5	2	4.4
	> 1 month	2.6	3.0	0.0	1.7	2.5	0.0	2.1	0.0	0.0	6.1	1	1.7
Child country of birth (missing = 10)	*Italy*	90.9	99.0	100.0	98.3	95.1	100.0	96.8	100.0	98.3	97.6	95.8	97.6
	Others	9.1	1.0	0.0	1.7	4.9	0.0	3.2	0.0	1.7	2.4	4.2	2.4
Child participated to survey (missing = 1)	*Yes*	41.6	30.3	26.8	11.9	32.1	43.7	37.2	38.5	39.1	30.5	20	33.3
	No	58.4	69.7	73.2	88.1	67.9	56.3	62.8	61.5	60.9	69.5	52	66.7

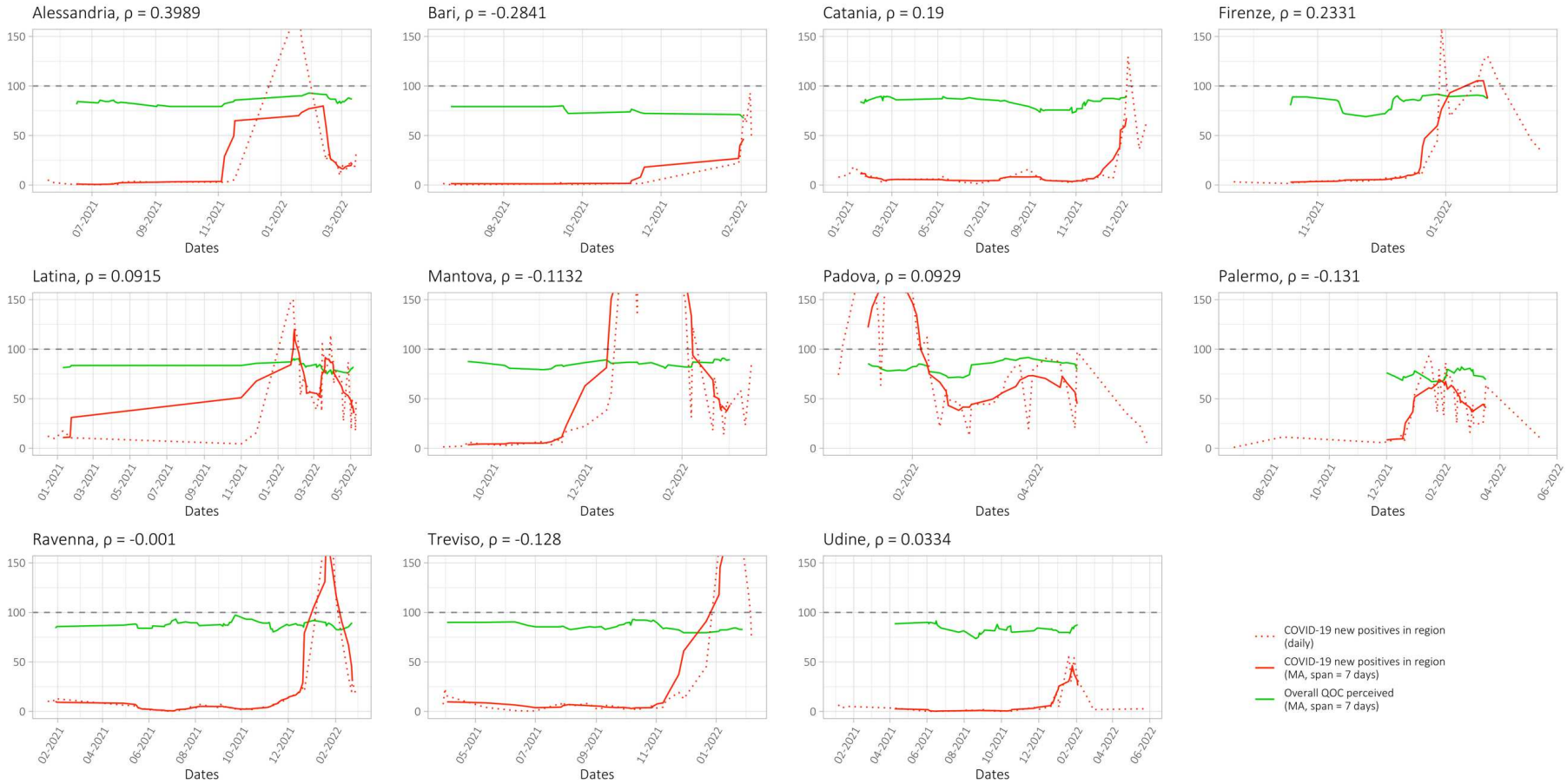
Abbreviations: m = months; y = years; Resp. = respiratory; Dep. = department

Supplemental Figure 2. COVID-19 QOC index and new positives over time, by facility and region



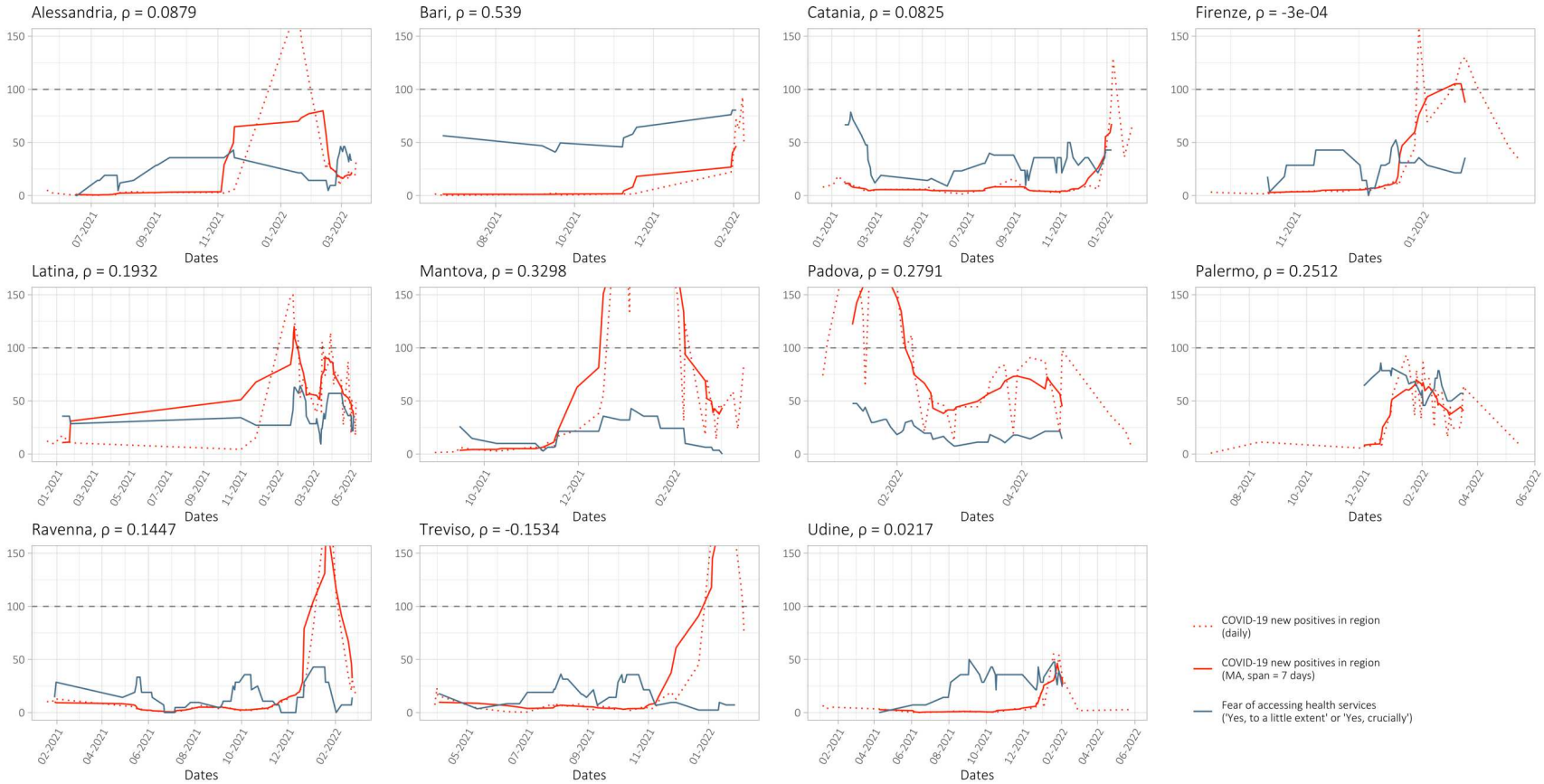
Note: the red line refers to the number of new COVID-19 positives in hundreds of the Italian region to which the facility belongs; the time span is limited to the period in which data were collected from the hospitals. The dotted line indicates the daily time trend, while the full line refers to the moving average values with a span of 7 days.
Abbreviation: QOC = quality of care; MA = moving average.

Supplemental Figure 3. Overall QOC perceived and new COVID-19 positives over time, by facility and region



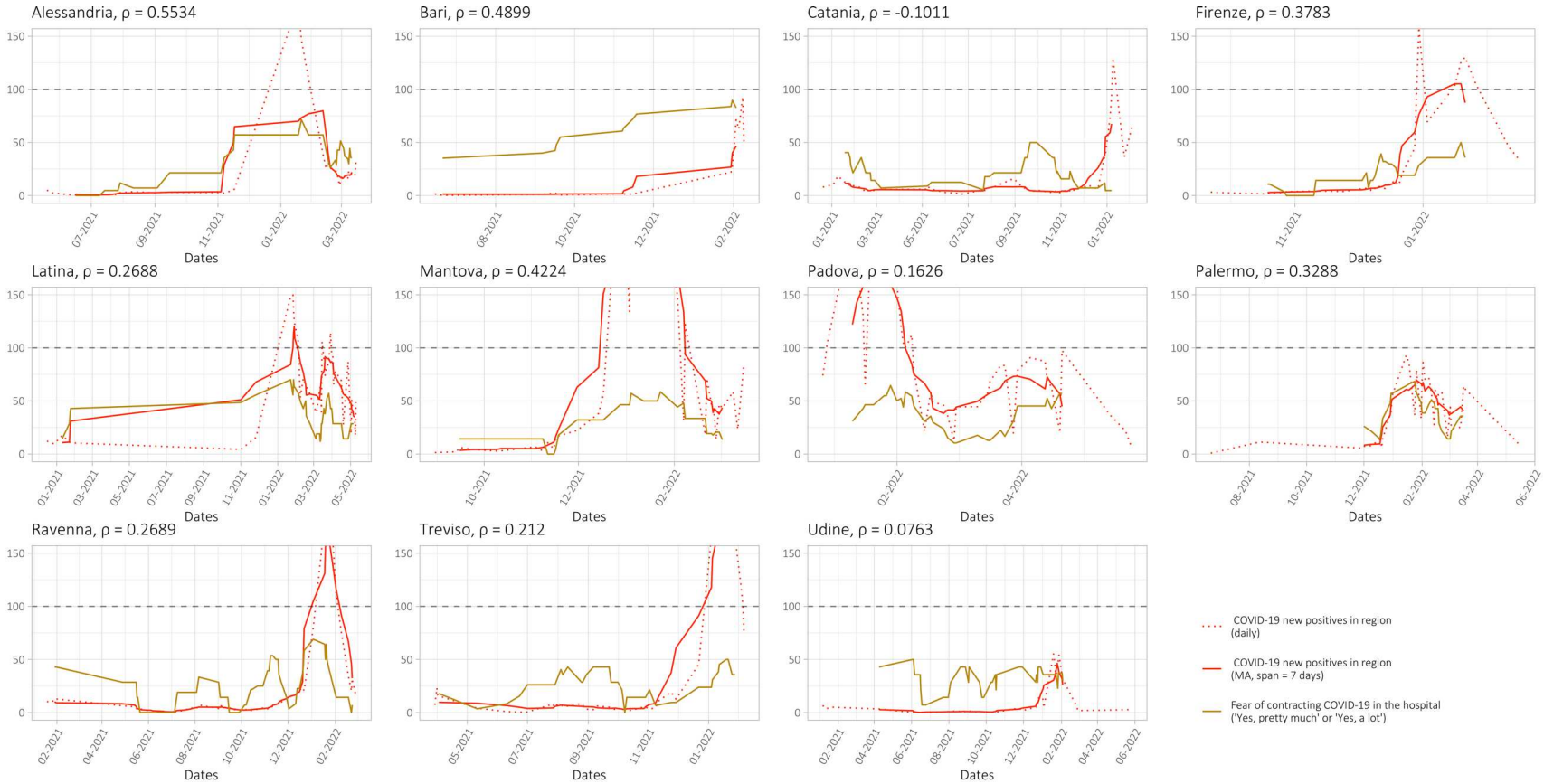
Note: the red line refers to the number of new COVID-19 positives in hundreds of the Italian region to which the facility belongs; the time span is limited to the period in which data were collected from the hospitals. The dotted line indicates the daily time trend, while the full line refers to the moving average values with a span of 7 days.
Abbreviation: QOC = quality of care; MA = moving average.

Supplemental Figure 4. Fear to access health services and new COVID-19 positives over time, by facility and region



Note: the red line refers to the number of new COVID-19 positives in hundreds of the Italian region to which the facility belongs; the time span is limited to the period in which data were collected from the hospitals. The dotted line indicates the daily time trend, while the full line refers to the moving average values with a span of 7 days.
Abbreviation: MA = moving average.

Supplemental Figure 5. Fear of contracting COVID-19 in the hospital and new COVID-19 positives over time, by facility and region



Note: the red line refers to the number of new COVID-19 positives in hundreds of the Italian region to which the facility belongs; the time span is limited to the period in which data were collected from the hospitals. The dotted line indicates the daily time trend, while the full line refers to the moving average values with a span of 7 days.
Abbreviation: MA = moving average.