

SUPPLEMENT - Report 37: Children's role in the COVID-19 pandemic: a systematic review of early surveillance data on susceptibility, severity, and transmissibility

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Section S1: Inclusion and Exclusion criteria

Our inclusion and exclusion criteria are as follows:

Inclusion criteria:

Mention of severity in children

- Mention of incidence in children
- Estimates of population-level incidence / attack rates
- Mention of infectiousness or secondary attack rate from infected children
- Mention of onwards transmission from children
- Mentions of asymptomatic infection in children

Exclusion criteria:

- Non-English language articles
- Not peer reviewed articles
- Duplicated articles (with the exclusion of pre-prints where the duplicate is the peer reviewed version)
- SARS-CoV-2 not included or the focus of the paper
- Articles covering study periods before December 2019
- Studies that excluded children and adolescents from their participants.
- No mention of severity in children OR incidence/prevalence in children OR infectiousness of children OR clusters of transmission OR vertical transmission from mother-to-child
- Editorials/commentaries/opinion/news articles that present no new data/research
- Modelling studies that are not age structured
- Modelling studies that are not fitted to real data

Section S2: Supplementary Tables

Supplementary Table S1: Table of papers included in our study with indicators for the information extracted from each study.

Study	Susceptibility	Transmissibility	Severity
Armann 2020 [1]	x		
Asfahan 2020 [2]			x
Bai 2020 [3]			x
Belhadjer 2020 [4]			x
Belot 2020 [5]			x
Bi 2020 [6]	x		x
Brambilla 2020 [7]	x		x
Buonsenso 2020 [8]	x		x
Cai 2020 [9]	x	x	x
Chen 2020 [10]			x
Chen 2020 [11]	x	x	
Danis 2020 [12]	x	x	x
DeBiasi 2020 [13]	x		x
deCeano-Vivas 2020 [14]	x		x
Deloris 2020 [15]		x	x
deLusignan 2020 [16]	x		
Dimeglio 2020 [17]	x		x
Docherty 2020 [18]	x		x
Dodi 2020 [19]	x	x	x
Dong 2020 [20]	x		x
Dong 2020 [21]			x
Du 2020 [22]			x
Du 2020 [23]		x	x
Du 2020 [24]	x		x
Dufort 2020 [25]			x
Foster 2020 [26]	x		
Gao 2020 [27]		x	
Garazzino 2020 [28]	x	x	x
García-Salido 2020 [29]			
González Cortés 2020 [30]			x
Götzinger 2020 [31]			x
Guan 2020 [32]	x		x
Gudbjartsson 2020 [33]	x		
Gujski 2020 [34]	x		
Han 2020 [35]		x	x
Han 2020 [36]			x
Harman 2020 [37]			x
He 2020 [38]	x		x
Heavey 2020 [39]		x	

Hildenwall 2020 [40]	x	x	x
Hrusak 2020 [41]			
Hu 2020 [42]			x
Hua 2020 [43]		x	x
Ibrahim 2020 [44]	x		
Ji 2020 [45]	x		x
Korean Society of Infectious Diseases 2020 [46]	x		
Korkmaz 2020 [47]		x	x
L'Huillier 2020 [48]		x	x
Lavezzo 2020 [49]	x		
Li 2020 [50]	x		
Li 2020 [51]			x
Li 2020 [52]	x		x
Liu 2020 [53]	x		x
Liu 2020 [54]	x		x
Liu 2020 [55]	x		
Liu 2020 [56]	x	x	x
Lu 2020 [57]	x		x
Lu 2020 [58]	x	x	x
Lu 2020 [59]		x	x
Ma 2020 [60]	x		x
Ma 2020 [61]			x
Mannheim 2020 [62]	x	x	x
Marlais 2020 [63]	x		x
Martínez-Perez 2020 [64]			x
Melgosa 2020 [65]	x	x	x
Mithal 2020 [66]	x	x	x
Mizumoto 2020 [67]	x		
Moratto 2020 [68]	x		x
Ng 2020 [69]	x		x
Otto 2020 [70]	x		
Oualha 2020 [71]		x	x
Pan 2020 [72]	x		x
Park 2020 [73]		x	
Parri 2020 [74]	x		x
Parri 2020 [75]	x	x	x
Pathak 2020 [76]			x
Peng 2020 [77]	x	x	x
Posfay-Barbe 2020 [78]	x	x	x
Pouletty 2020 [79]		x	x
Preßler 2020 [80]	x	x	x
Qiu 2020 [81]	x		x

Qiu 2020 [82]			x
Ranabothu 2020 [83]	x		x
Rezaei 2020 [84]	x		x
Rha 2020 [85]	x		x
Russell 2020 [86]	x		
Schwierzeck 2020 [87]	x		
Shekerdemian 2020 [88]	x		x
Shen 2020 [89]	x		
Shi 2020 [90]	x	x	
Soltani 2020 [91]			x
Somekh 2020 [92]		x	
Son 2020 [93]			x
Song 2020 [94]	x	x	x
Song 2020 [95]			x
Spiteri 2020 [96]	x		
Stringhini 2020 [97]	x		
Sun 2020 [98]	x		
Sun 2020 [99]			x
Talarico 2020 [100]	x		
Tan 2020 [101]	x	x	x
Tian 2020 [102]	x		x
Tong 2020 [103]	x		x
Turner 2020 [104]	x		
Valente 2020 [105]		x	x
Verdoni 2020 [106]			x
Wu 2020 [107]	x		x
Wu 2020 [108]	x	x	x
Wu 2020 [109]			x
Xia 2020 [110]	x		x
Xiong 2020 [111]			x
Xiong 2020 [112]		x	x
Xu 2020 [113]		x	x
Xu 2020 [114]	x	x	
Xu 2020 [115]	x		
Ye 2020 [116]	x		x
Yongchen 2020 [117]			x
Yuan 2020 [118]	x		
Yung 2020 [119]		x	
Zachariah 2020 [120]	x	x	x
Zachariah 2020 [121]	x	x	x
Zhang 2020 [122]	x		
Zhang 2020 [123]	x		

Zhang 2020 [124]		x	x
Zhang 2020 [125]		x	
Zhao 2020 [126]	x		
Zhao 2020 [127]			x
Zheng 2020 [128]	x	x	x

Supplementary Table S2: Questions used to do quality assessment for the included publications for the review.

Item	Criteria	Notes
1	Was the study question or objective clearly stated?	score 1 if 'yes', 0.5 if partially stated, 0 if 'no' or unclear
2	Was the study setting (geography) and period (time) clearly described?	score 1 if 'yes', 0.5 if partially described, 0 if 'no' or unclear
3	Was the sampling frame a true or close representation of the target population?	score 1 if 'yes', 0.5 if partially stated, 0 if 'no' or unclear
4	Were case definitions clearly and fully described? (eg. asymptomatic cases, mild, moderate, severe cases)	score 1 if 'yes', 0.5 if partially described, 0 if 'no' or unclear
5	Is the testing procedure clearly mentioned and appropriate for the study? Do we know how many patients were given antigen tests/PCR/clinically identified	score 1 if 'yes', 0.5 if partially stated, 0 if 'no' or unclear
6	Are the eligibility criteria (inclusion and exclusion criteria) for entry into the study explicit and appropriate?	score 1 if 'yes', 0 if 'no' or unclear
7	Was the length of follow-up reported and loss to follow-up if appropriate?	score 1 if 'yes', 0.5 if partially stated, 0 if 'no' or unclear
8	Were the outcomes reported i.e. were the number of deaths/recoveries reported?	score 1 if 'yes', 0.5 if partially stated, 0 if 'no' or unclear
9	Are the characteristics of the participants included in the study described? Age breakdown - if very broad(e.g. ≤ 17), give low score	score 1 if patient characteristics reported individually, 0.5 if summarized as a group, 0 if not described
10	Are the conclusions of the study supported by results?	score 1 if 'yes', 0.5 if partially stated, 0 if 'no' or unclear

Good	Score ≥ 7
Fair	Score 5 - 6
Poor	Score < 5

Supplementary Table S3: Quality assessment scores

No.	Study	QAs questions										Score	Rating
		1	2	3	4	5	6	7	8	9	10		
1	Bi <i>et al</i> , 2020	1	1	1	1	1	1	0.5	1	1	1	9.5	Good
2	Lu <i>et al</i> , 2020	0.5	1	1	0.5	1	1	0	1	1	1	8	Good
3	Hu <i>et al</i> , 2020	1	1	0	0	1	0.5	0	1	1	1	6.5	Fair
4	Cai <i>et al</i> , 2020	0.5	1	1	1	1	1	1	1	1	1	9.5	Good
5	Chen <i>et al</i> , 2020	1	1	1	0.5	1	1	0.5	1	0	1	8	Good
6	Kostas <i>et al</i> , 2020	1	1	0.5	1	1	1	1	1	0.5	1	9	Good
7	Dong <i>et al</i> , 2020	1	1	0	1	1	0	1	1	1	1	8	Good
8	Du <i>et al</i> , 2020	1	1	1	1	1	0.5	0	1	0	1	7.5	Good
9	Dong <i>et al</i> , 2020	1	0.5	1	1	1	1	0	0	1	1	7.5	Good
10	CDC Covid-response team	0	1	1	0	0.5	0.5	0	0.5	0.5	1	5	Fair
11	Guan <i>et al</i> , 2020	1	1	1	0.5	1	0.5	1	1	0.5	1	8.5	Good
12	Gudbjrtsson <i>et al</i> , 2020	1	0.5	1	0	1	0.5	0	0	0	1	5	Poor
13	Sun <i>et al</i> , 2020	0.5	0	0	0	0	0	0	0.5	0	1	2	Poor
14	Spiteri <i>et al</i> , 2020	1	0.5	1	0.5	1	0	0.5	1	0.5	1	7	Good
15	Schwierzeck <i>et al</i> , 2020	1	0.5	0	0.5	0.5	0.5	0.5	0	0.5	1	5	Fair
16	He <i>et al</i> , 2020	0.5	0.5	0	0.5	0.5	0	0	0	0	0.5	2.5	Poor
17	Ji <i>et al</i> , 2020	1	0.5	1	1	1	0.5	0	0.5	0.5	1	7	Good
18	Xu <i>et al</i> , 2020	1	1	0.5	0.5	0.5	0.5	0	0	1	0.5	5.5	Fair
19	Lavezzo <i>et al</i> , 2020	1	1	1	1	1	1	0.5	0	0.5	1	8	Good
20	Li <i>et al</i> , 2020	1	1	0	1	1	1	0	1	0	0.5	6.5	Fair
21	Xu <i>et al</i> , 2020	1	1	1	0	1	0.5	0.5	0	0.5	1	6.5	Fair
22	Parri <i>et al</i> , 2020	1	1	0.5	1	1	0.5	0	1	1	1	8	Good
23	Song <i>et al</i> , 2020	1	1	0.5	1	1	0.5	1	1	1	1	9	Good
24	Song <i>et al</i> , 2020	1	1	0.5	0	1	0.5	0	1	1	1	7	Good
25	Xia <i>et al</i> , 2020	1	1	0.5	0	0.5	0.5	0.5	1	0.5	1	6.5	Fair
26	Shi <i>et al</i> , 2020	1	1	1	0	1	1	0.5	0	0.5	1	7	Good
27	Russell <i>et al</i> , 2020	1	1	0.5	1	0.5	1	1	1	1	1	9	Good
28	Qiu <i>et al</i> , 2020	1	1	1	1	1	1	1	1	0.5	1	9.5	Good
29	Melgosa <i>et al</i> , 2020	1	1	0.5	0.5	0.5	0	1	1	0.5	1	7	Good
30	Dodi <i>et al</i> , 2020	0	1	1	1	1	0.5	1	0	1	1	7.5	Good
31	Gujski <i>et al</i> , 2020	1	1	1	0	1	0.5	1	1	0.5	1	8	Good
32	Rha <i>et al</i> , 2020	1	1	1	0.5	1	1	1	1	0	1	8.5	Good
33	Ranabothu <i>et al</i> , 2020	0.5	0.5	1	0.5	0.5	1	0	1	1	0.5	6.5	Fair
34	Mithal <i>et al</i> , 2020	1	1	1	0	1	1	0.5	0.5	0.5	1	7.5	Good
35	Garazzino <i>et al</i> , 2020	1	0.5	1	0.5	1	1	0.5	1	1	1	8.5	Good
36	Stringhini <i>et al</i> , 2020	1	1	1	0	1	1	0	0	0.5	1	6.5	Fair
37	Otto <i>et al</i> , 2020	1	1	0.5	0.5	1	1	0.5	1	0.5	1	8	Good
38	Wu <i>et al</i> , 2020	1	1	0.5	0.5	0.5	0.5	1	1	0	1	7	Good
39	Zheng <i>et al</i> , 2020	1	1	0.5	0.5	0.5	0.5	0.5	1	0.5	1	7	Good
40	Götzinger <i>et al</i> , 2020	1	1	1	0.5	1	1	1	1	1	1	9.5	Good
41	Zhang <i>et al</i> , 2020	1	1	1	0	0	0.5	0	0	0.5	1	5	Poor

42	Xiong et al, 2020	1	1	0	0.5	0.5	0	0	0	0.5	1	4.5	Poor
43	L'Huillier et al, 2020	0.5	1	0	0	1	0	0	0	0.5	1	4	Poor
44	Hua et al, 2020	1	1	1	0.5	1	0	1	1	0.5	1	8	Good
45	Deloris et al, 2020	1	1	0.5	1	1	0.5	1	1	1	1	9	Good
46	Hildenwall et al, 2020	0.5	1	1	0.5	1	1	0.5	1	0.5	1	8	Good
47	Zachariah et al, 2020	1	1	0	0.5	1	1	0	0.5	0	1	6	Fair
48	Dimeglio et al, 2020	0	1	1	0	1	1	0	1	0	0.5	5.5	Fair
49	Moratto et al, 2020	0.5	1	0	0.5	0.5	0.5	0	0	1	1	5	Fair
50	Brambilla et al, 2020	1	1	1	1	1	1	0	1	0	1	8	Good
51	Yung et al, 2020	1	0.5	0	0.5	1	1	1	1	0.5	1	7.5	Good
52	Docherty et al, 2020	1	1	1	0	0.5	1	1	1	0.5	1	8	Good
53	Li et al, 2020	1	1	0.5	0	1	1	0	0	0.5	1	6	Fair
54	Ibrahim et al, 2020	1	1	0.5	0	1	0.5	0	0	0.5	1	5.5	Fair
55	Yuan et al, 2020	1	1	1	0	1	0.5	0	0	0.5	1	6	Fair
56	Wu et al, 2020	1	1	0	1	0.5	0	1	1	0.5	1	7	Good
57	Mannheim et al, 2020	1	1	1	0.5	1	0.5	1	1	0.5	1	8.5	Good
58	Valente et al, 2020	1	1	0	0.5	0.5	0.5	0.5	1	1	1	7	Good
59	Parri et al, 2020	1	1	1	1	0.5	1	0	1	0.5	1	8	Good
60	Belhadjer et al, 2020	1	1	1	0.5	1	1	1	1	0	0.5	8	Good
61	deCeano-Vivas et al, 2020	1	1	1	0	1	1	0	1	0.5	1	7.5	Good
62	Du et al, 2020	1	1	0.5	1	1	0.5	1	1	1	1	9	Good
63	Marlais et al, 2020	0.5	1	1	0	0	1	0	0.5	0.5	0.5	5	Fair
64	deLusignan et al, 2020	1	1	1	1	1	1	1	1	0	1	9	Good
65	GonzálezCortés et al, 2020	1	1	1	0.5	0	0	0	0	0	1	4.5	Poor
66	Sun et al, 2020	1	1	0.5	0.5	0.5	0	1	1	0.5	1	7	Good
67	Lu et al, 2020	1	1	0.5	0	1	0.5	0	1	0.5	1	6.5	Fair
68	Foster et al, 2020	1	1	1	0.5	1	1	0	1	0	1	7.5	Good
69	Armann et al, 2020	0.5	1	0.5	0.5	0.5	1	0.5	1	0	1	6.5	Fair
70	Chen et al, 2020	1	0.5	0	0	1	0	0	1	1	1	5.5	Fair
71	Du et al, 2020	1	1	0.5	1	0.5	1	1	1	0.5	1	8.5	Good
72	Harman et al, 2020	1	1	0	0.5	0.5	0.5	1	1	0.5	1	7	Good
73	Qiu et al, 2020	1	1	0.5	1	0.5	0.5	0	0.5	0.5	1	6.5	Fair
74	Shekerdemian et al, 2020	1	1	0.5	1	0.5	0	1	1	0.5	1	7.5	Good
75	Zachariah et al, 2020	1	0.5	0	0.5	0.5	1	0	0	0.5	1	5	Fair
76	Xiong et al, 2020	1	1	1	0	0.5	1	0	1	0	0.5	6	Fair
77	Soltani et al, 2020	1	1	0.5	1	1	0.5	1	1	0.5	1	8.5	Good
78	Somekh et al, 2020	1	1	0.5	0	1	0	0	0	0.5	0.5	4.5	Poor
79	Zhao et al, 2020	1	1	0.5	0.5	0	0.5	1	1	0.5	1	7	Good
80	Gao et al, 2020	1	1	1	1	1	1	0	1	1	0.5	8.5	Good
81	Ma et al, 2020	1	1	0.5	0	1	1	1	1	0.5	1	8	Good
82	Ma et al, 2020	1	1	0	0.5	0.5	0.5	1	1	0.5	1	7	Good
83	Asfahan et al, 2020	1	0.5	1	0	0	0	0	1	1	1	5.5	Fair
84	Zhang et al, 2020	1	1	0	0.5	0.5	0	0.5	1	0.5	1	6	Fair
85	Zhao et al, 2020	1	1	0	0	0.5	0.5	0	1	0.5	0.5	5	Fair

86	Shen et al, 2020	1	1	1	0	1	1	0	0	0.5	1	6.5	Fair
87	Talarico et al, 2020	1	1	0.5	0	1	1	0	0	0.5	0.5	5.5	Fair
88	DeBiasi et al, 2020	1	1	1	0	0	1	0	1	1	1	7	Good
89	García-Salido 2020	1	1	1	0.5	1	1	1	1	1	1	9.5	Good
90	Zhang et al, 2020	1	1	1	1	1	1	1	1	1	1	10	Good
91	Liu et al, 2020	1	1	1	0.5	1	1	1	1	0.5	1	9	Good
92	Lu et al, 2020	1	1	0.5	1	0.5	0	0	0	1	1	6	Fair
93	Korkmaz et al, 2020	1	1	0.5	0.5	1	0	0.5	1	0.5	1	7	Good
94	Han et al, 2020	0.5	1	0	1	1	1	0	0	1	1	6.5	Fair
95	Zhang et al, 2020	1	1	1	0.5	0.5	1	1	1	0	1	8	Good
96	Bai et al, 2020	1	1	0.5	1	1	0.5	1	1	0.5	1	8.5	Good
97	Qualha et al, 2020	1	1	0	0	0.5	0.5	1	1	1		6	Good
98	Peng et al, 2020	1	1	0	0	0.5	0.5	0.5	1	0.5	1	6	Fair
99	Posfay-Barbe et al, 2020	1	1	0	0.5	1	1	1	0	0.5	1	7	Good

Supplementary Table S4: Recruitment criteria for study participants in studies detailing asymptomatic infection

Author	Title	Recruitment criteria	Action
Mithal	SARS-CoV-2 Infection in Infants Less than 90 Days Old	Symptomatic	Exclude
Dodi	SARS-CoV-2 infection in children in Parma	Symptomatic or asymptomatic contact of confirmed case	Include
Sun	SARS-CoV-2 infection in infants under 1 year of age in Wuhan City, China	Tested on hospital admission	Exclude
Russell	Estimating the infection and case fatality ratio for coronavirus disease (COVID-19) using age-adjusted data from the outbreak on the Diamond Princess cruise ship, February 2020	Whole population tested	Include
Hua	Epidemiological features and viral shedding in children with SARS-CoV-2 infection	Symptomatic or asymptomatic contact of confirmed case	Include
Du	Clinical characteristics of 182 pediatric COVID-19 patients with different severities and allergic status	Symptomatic or asymptomatic contact of confirmed case	Include
Zhao	Characteristics of Children With Reactivation of SARS-CoV-2 Infection After Hospital Discharge	Tested in hospital	Exclude
Song	Clinical features of pediatric patients with coronavirus disease (COVID-19)	Symptomatic or asymptomatic contact of confirmed case	Include
Peng	Coronavirus disease 2019 in children: Characteristics, antimicrobial treatment, and outcomes	Tested in hospital	Exclude
Lu	SARS-CoV-2 Infection in Children	Symptomatic or asymptomatic contact of confirmed case	Include
Lu	Symptomatic Infection is Associated with Prolonged Duration of Viral Shedding in Mild Coronavirus Disease 2019: A Retrospective Study of 110 Children in Wuhan	Symptomatic or asymptomatic contact of confirmed case	Include
Xu	Characteristics of pediatric SARS-CoV-2 infection and potential evidence for persistent fecal viral shedding	Symptomatic or asymptomatic contact of confirmed case	Include
Lu	Clinical characteristics and radiological features of children infected with the 2019 novel coronavirus	Symptomatic or asymptomatic contact of confirmed case	Include
Han	Viral RNA Load in Mildly Symptomatic and Asymptomatic Children with COVID-19, Seoul, South Korea	Tested in hospital	Exclude
Hildenwall	Paediatric COVID-19 admissions in a region with open schools during the two first months of the pandemic	Tested in hospital	Exclude

Dong	Epidemiology of COVID-19 Among Children in China	Symptomatic or asymptomatic contact of confirmed case	Include
Parri	Children with Covid-19 in Pediatric Emergency Departments in Italy.	Tested in hospital	Exclude
Bai	Clinical Analysis of 25 Novel Coronavirus Infections in Children	Symptomatic or asymptomatic contact of confirmed case	Include
Zhang	Clinical Features of 33 Cases in Children Infected With SARS-CoV-2 in Anhui Province, China-A Multi-Center Retrospective Cohort Study	Symptomatic	Exclude
Xiong	A Comparison Between Chinese Children Infected with COVID-19 and with SARS	Symptomatic or asymptomatic contact of confirmed case	Include
Valente	Ocular manifestations and viral shedding in tears of pediatric patients with coronavirus disease 2019: a preliminary report	Symptomatic	Exclude
Parri	Characteristic of COVID-19 infection in pediatric patients: early findings from two Italian Pediatric Research Networks	Unclear	Exclude
Melgosa	SARS-CoV-2 infection in Spanish children with chronic kidney pathologies	Symptomatic or asymptomatic contact of confirmed case	Include
Ma	Characteristics of asymptomatic patients with SARS-CoV-2 infection in Jinan, China	Unclear	Exclude
Korkmaz	The Epidemiological and Clinical Characteristics of 81 Children with COVID-19 in a Pandemic Hospital in Turkey: an Observational Cohort	Symptomatic or asymptomatic contact of confirmed case	Include
De Loris	Dynamic Viral Severe Acute Respiratory Syndrome Coronavirus 2 RNA Shedding in Children: Preliminary Data and Clinical Consideration from a Italian Regional Center	Unclear	Exclude
Armann	Hospital Admission in Children and Adolescents With COVID-19	Unclear	Exclude
Ma	A single-center, retrospective study of COVID-19 features in children: a descriptive investigation	Symptomatic or asymptomatic contact of confirmed case	Include

Section S3: Supplementary figures

Figure S1 shows the results of a metaanalysis based on all studies contained in table S3; figure 3 in the main text shows only the results from “included” studies in table S3. The pooled estimate of asymptomatic children was 18.0% (95% CI: 13.0 - 22.1%) with a τ^2 (between-trial-variance) of 0.009 (95%CI:0.004 - 0.022).

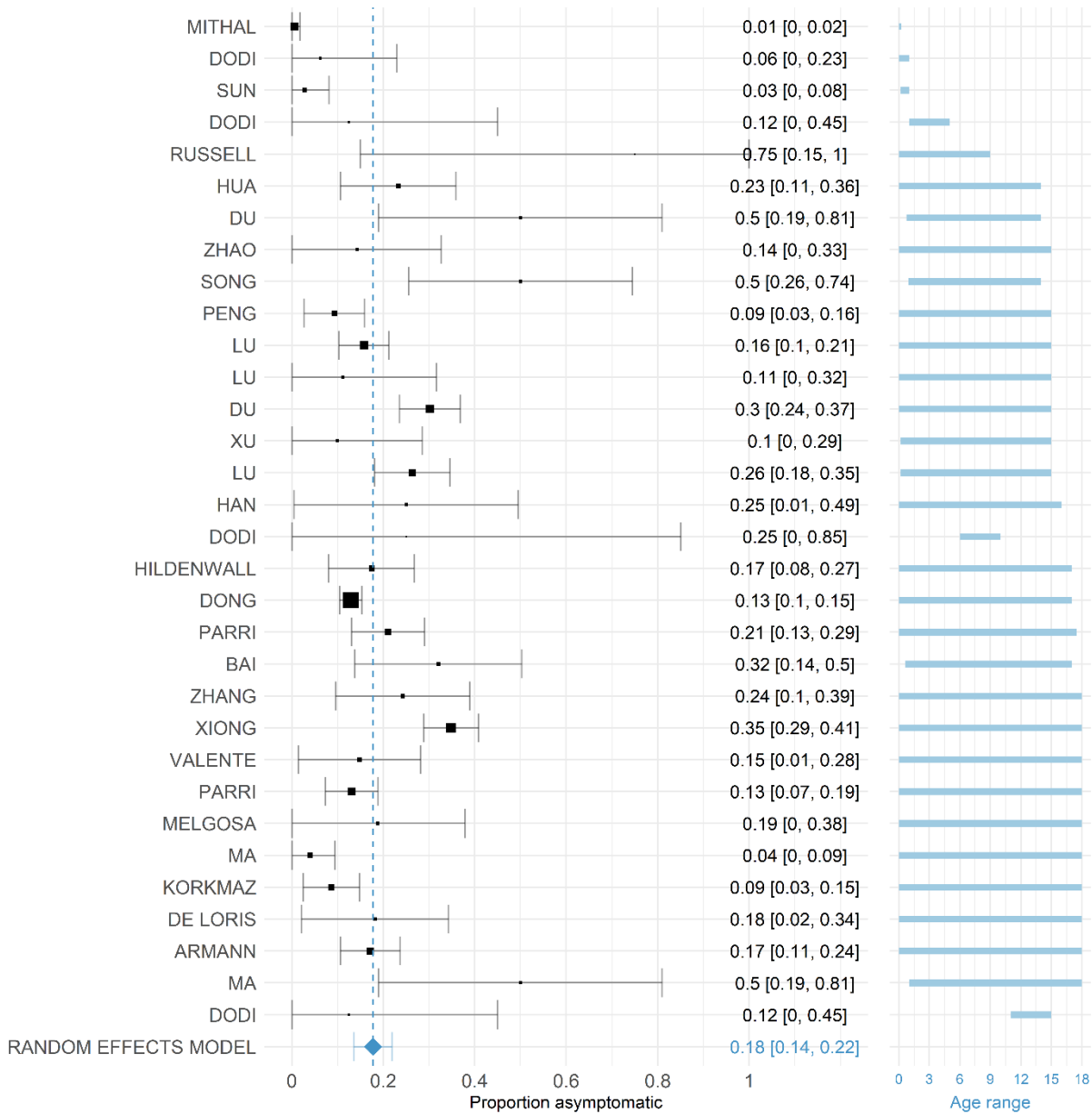


Figure S1: Proportion of SARS-CoV-2 positive children who are defined as asymptomatic at the time of the study in each published study. The random effects model result is given at the bottom indicated by a blue diamond. The squares are proportional in size to the number of COVID-19 positive individuals in the study. All studies were conducted in 2020. The labels on the left provide first author, the labels on the right give point estimate and confidence interval of the asymptomatic proportion estimated. Studies are ordered by the mean of the age range with age range given in blue on the right.

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