

# THE LANCET

## Infectious Diseases

### Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: Bardsley M, Morbey RA, Hughes HE, et al. Epidemiology of respiratory syncytial virus in children younger than 5 years in England during the COVID-19 pandemic, measured by laboratory, clinical, and syndromic surveillance: a retrospective observational study. *Lancet Infect Dis* 2022; published online Sept 2. [https://doi.org/10.1016/S1473-3099\(22\)00525-4](https://doi.org/10.1016/S1473-3099(22)00525-4).

**Supplementary Table 1: Specification of study indicators and reporting statistics per surveillance system**

<b>Surveillance system</b>	<b>Study indicator</b>	<b>Numerator</b>	<b>Offset (where applicable)</b>	<b>Population coverage</b>
<i>Laboratory</i>				
Second Generation Surveillance System (SGSS)	<b>Number of RSV cases among children under five years old</b>	Number of RSV cases among children under five years old	Not available	100% England population
Respiratory DataMart System (RDS)	<b>RSV test-positivity among children under five years old</b>	Number of RSV positive tests by PCR among children under five years old	Number of RSV positive and negative tests by PCR among children under five years old	Sentinel laboratories *
<i>Clinical</i>				
Hospital Episode Statistics (HES)	<b>Number of admissions for RSV-attributable respiratory disease among children under five years old</b>	Number of hospital admissions among children under five years old with a primary diagnosis of ICD-10 codes for: <ul style="list-style-type: none"> <li>• bronchiolitis (J21)</li> <li>• pneumonia (J12-18),</li> <li>• unspecified LRTI (J22)</li> <li>• bronchitis (J20)</li> <li>• URTI (J00-06)</li> </ul>	Number of coded hospital admissions among children under five years old	All NHS hospitals in England
<i>Syndromic</i>				
NHS 111	<b>Number of calls for cough among children under five years old</b>	Number of calls for cough among children under five years old	Total number of calls	100% England population
GP in-hours syndromic surveillance system	<b>Number of in-hours consultations URTI and LRTI among children under five years old</b>	Number of consultations UTRI and LTRI among children under five years old	Number of registered patients	~60% England population
GP out-of-hours syndromic surveillance system	<b>Number of out-of-hours consultations for acute bronchitis/bronchiolitis among children under five years old</b>	Number of consultations for acute bronchitis/bronchiolitis among children under five years old	Total number of coded consultations	~80% England population
Emergency department syndromic surveillance system	<b>Number of ED attendances for acute bronchitis/bronchiolitis among children under five years old</b>	Number of ED attendances for acute bronchitis/bronchiolitis among children under five years old	Not included in study	109 EDs across England

\*Birmingham, Bristol, Cambridge, UKHSA Respiratory Virus Unit, King's College Hospital (London), Leeds, Leicester, Manchester, Newcastle, Nottingham, Royal Free Hospital (London), Southampton and Truro laboratories.

**Supplementary Table 2: Total indicator activity during winter seasons (week 40-10) among children under five years-old since 2015/16, and percentage change for 2020/21 and 2021/22**

Indicator and age group	Winter season									
	Pre-COVID-19					COVID-19				
	2015/16	2016/17	2017/18	2018/19	2019/20	Mean (a)	2020/21 (b)	Percent change b – a	2021/22 (c)	Percent change c – a
<i>Laboratory</i>										
Cases (SGSS) <sup>†</sup>	7,692	7,453	7,657	9,114	11,571	<b>8,697</b>	47	<b>-99.5%</b>	8,097	<b>-6.9%</b>
<1yrs	6222	6009	5875	6875	7793	6,555	22	-99.7%	4,641	-29.2%
1-4yrs	1465	1443	1775	2229	3773	2,137	25	-98.8%	3,455	+61.7%
Test-positivity (RDS)*	25.8%	28.6%	20.8%	22.5%	21.1%	<b>23.4%</b>	0.1%	<b>-99.6%</b>	10.1%	<b>-57.0%</b>
Positive tests	2,791	2,775	2,988	3,072	2,619	2,849	7	-99.8%	2,027	-28.9%
Total tests	10,805	9,686	14,381	13,640	12,398	12,182	7,094	-41.8%	20,134	+65.3%
<i>Clinical</i>										
Admissions for RSV-attributable respiratory disease (HES)	103,948	93,216	99,796	108,338	106,488	<b>102,357</b>	21,924	<b>-78.6%</b>	63,478 <sup>^</sup>	<b>-38.0%</b>
<1yrs	49,210	48,294	48,248	51,771	50,849	49,674	8,494	-82.9%	28,371 <sup>^</sup>	-42.9%
1-4yrs	54,738	44,922	51,548	56,567	55,639	55,639	13,430	-75.9%	35,107 <sup>^</sup>	-36.9%
<i>Syndromic</i>										
NHS 111 calls for cough	136,409	109,622	121,839	127,836	127,696	<b>124,680</b>	34,483	<b>-72.3%</b>	130,905	<b>+5.0%</b>
<1yrs	44,646	40,258	41,619	41,626	40,800	41,790	10,730	-74.3	38432	-8.0%
1-4yrs	91,763	69,364	80,220	86,210	86,896	82,891	23,753	-71.3	92473	+11.6%
GP out-of-hours contacts for acute bronchitis/bronchiolitis	5,431	4,980	4,152	4,312	3,368	<b>4,449</b>	369	<b>-91.7%</b>	1,664	<b>-62.6%</b>
<1yrs	3,957	3,652	2,998	3,133	2,502	3,248	205	-93.7%	1,086	-66.6%
1-4yrs	1,474	1,328	1,154	1,179	866	1,200	164	-86.3%	578	-51.8%
GP in-hours consultations for URTI/LRTI	115,294	107,142	107,385	104,937	101,681	<b>107,288</b>	10,248	<b>-90.4%</b>	50,714	<b>-52.7%</b>
<1yrs	29,566	29,674	27,501	26,984	24,886	27,722	2,844	-89.7%	11,636	-58.0%
1-4yrs	85,728	77,468	79,884	77,953	76,795	79,566	7,404	-90.7%	39,078	-50.9%
ED attendances for acute bronchitis/bronchiolitis	..	..	..	31,583	29,848	<b>30,716</b>	4,740	<b>-84.6%</b>	23,283	<b>-24.2%</b>
<1yrs	..	..	..	24,459	23,964	24,212	3,399	-86.0%	18,654	-23.0%
1-4yrs	..	..	..	7,124	5,884	6,504	1,341	-79.4%	4,629	-28.8%

<sup>†</sup> Total cases (SGSS) does not match the sum of <1yrs and 1-4yrs (0.06% difference) due to some records with specific age not available

\*Age breakdown not available

<sup>^</sup>HES data up until 28 February 2022 (latest available at time of extraction)

**Supplementary Table 3: Total indicator activity during summer seasons (week 11-39) among children under five years-old since 2015, and percentage change for 2021 and 2022**

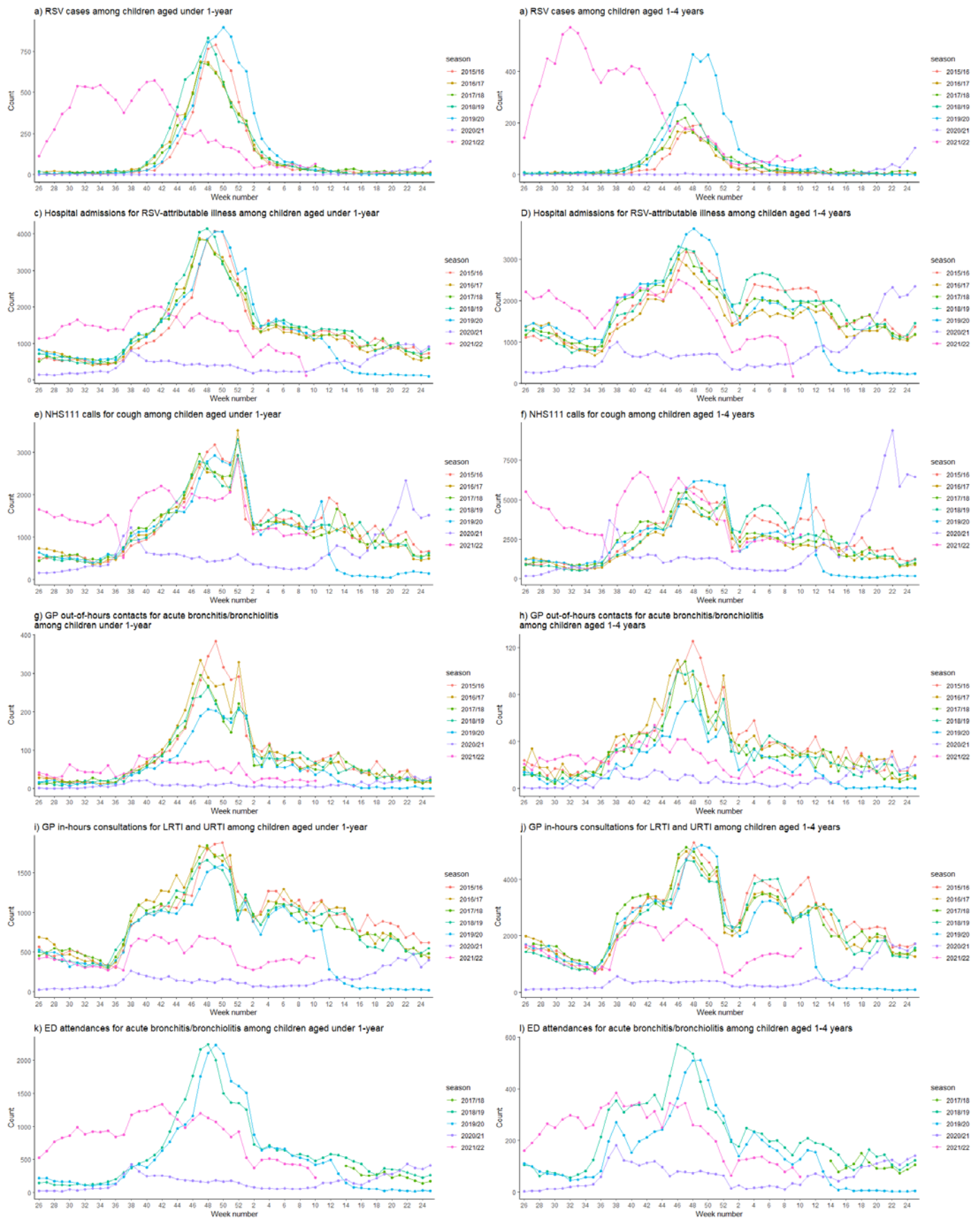
Indicator and age group	Summer season									
	Pre-COVID-19						COVID-19			
	2015	2016	2017	2018	2019	Mean (a)	2020 (b)	Percent change b – a	2021 (c)	Percent change c – a
<i>Laboratory</i>										
Cases (SGSS) <sup>†</sup>	393	637	406	843	429	<b>542</b>	51	<b>-90.6%</b>	12,150	<b>+2143.4%</b>
<1yrs	295	467	293	546	260	372	31	-91.7%	6,094	+1537.3%
1-4yrs	98	169	113	297	168	169	20	-88.2%	6,055	+3482.8%
Test-positivity (RDS)*	1.9%	2.5%	2.4%	3.4%	1.3%	<b>2.3%</b>	1.6%	<b>-30.4%</b>	13.8%	<b>+500.0%</b>
Positive tests	126	220	163	381	142	206	9	-95.6%	3,755	+1,722.8%
Total tests	6,628	8,834	6,824	11,079	10,830	8,839	550	-93.8	27,304	+208.9%
<i>Clinical</i>										
Admissions for RSV-attributable respiratory disease (HES)	56,210	63,029	59,819	61,443	67,867	<b>61,674</b>	2,940	<b>-95.2%</b>	78,370	<b>+27.1%</b>
<1yrs	21,447	24,194	22,518	23,623	25,756	23,508	1,138	-95.2%	30,401	+29.3%
1-4yrs	34,763	38,835	37,301	37,820	42,111	38,166	1,802	-95.3%	47,969	+25.7%
<i>Syndromic</i>										
NHS 111 calls for cough	61,147	72,033	61,141	59,971	67,462	<b>64,351</b>	35,296	<b>-45.2%</b>	152,070	<b>+136.3%</b>
<1yrs	21,610	25,289	21,805	22,366	22,839	22,782	10,132	-55.5%	36,293	+59.3%
1-4yrs	39,537	46,744	39,336	37,605	44,623	41,569	25,164	-39.5%	115,777	+178.5%
GP out-of-hours contacts for acute bronchitis/bronchiolitis	1,963	1,751	1,493	1,419	1,260	<b>1,577</b>	369	<b>-76.6%</b>	1,458	<b>-7.6%</b>
<1yrs	1,216	1,081	952	933	838	1,004	236	-76.5%	893	-11.1%
1-4yrs	747	670	541	486	422	573	133	-76.8%	565	-1.4%
GP in-hours consultations for URTI/LRTI	69,835	74,310	71,007	64,238	66,890	<b>69,256</b>	11,280	<b>-83.7%</b>	42,185	<b>-39.1%</b>
<1yrs	18,268	20,271	18,910	17,157	17,144	18,350	2,934	-84.0%	9,488	-48.3%
1-4yrs	51,567	54,039	52,097	47,081	49,746	50,906	8,346	-83.6%	32,697	-35.8%
ED attendances for acute bronchitis/bronchiolitis				8924	12034	<b>10,479</b>	4,526	<b>-56.8%</b>	21,319	<b>+103.4%</b>
<1yrs	..	..	..	5721	8532	7,127	3,416	-52.1%	16,153	+126.6%
1-4yrs	..	..	..	3203	3502	3,353	1,110	-66.9%	5,166	+54.1%

<sup>†</sup> Total cases (SGSS) does not match the sum of <1yrs and 1-4yrs (0.02% difference) due to some records with specific age not available

\*Age breakdown not available

**Supplementary Figure 1. RSV-associated indicator activity among children under five years-old monitored through laboratory reports, hospital admissions and syndromic surveillance (NHS 111, GP out-of-hours, GP in-hours, emergency department) by age group, 2015-2022**

*Note the y-axis scale varies in each visualisation*



**Supplementary Table 4: Interrupted time series analyses of predicted versus observed RSV-associated indicator activity during COVID-19 (since week 11 2020) among children under five years-old in England reported to laboratory, clinical and syndromic surveillance systems**

Indicator and data source	Predicted (modelled) indicator activity from week 11 2020 to latest available data <sup>¥</sup> {95% prediction interval}	Actual (observed) indicator activity	Absolute difference in indicator activity (observed – predicted)	% change {95% prediction interval}
<b>Laboratory</b>				
Total number of cases (SGSS)	23,033 {22,823, 23,242}	20,441	-2,592	<b>-11.3%</b> {-11.4, -11.2}
Mean percentage test positivity (RDS)	12.4% {N/A}	9.7%	-2.7%	<b>-21.8%</b> {N/A}
<b>Clinical</b>				
Total number of admissions for RSV-attributable respiratory disease (HES)	364,855 {364,639, 365,072}	186,280	-178,575	<b>-48.9%</b> {-49.0%, -48.9%}
<b>Syndromic</b>				
Total number of NHS 111 calls for cough	393,837 {393,618, 394,056}	352,754	-41,083	<b>-10.4%</b> {-10.4, -10.4}
Total GP out-of-hours consultations for acute bronchitis/bronchiolitis	8,366 {8,149, 8,584}	3,860	-4,506	<b>-53.9%</b> {-55.3, -52.5}
Total GP in-hours consultations for URTI and LRTI	329,061 {328,840, 329,282}	114,427	-214,634	<b>-65.2%</b> {-65.3, -65.2}
Total number of ED attendances for acute bronchitis/bronchiolitis	86,884 {86,674, 87,094}	53,868	-33,016	<b>-38.0%</b> {-38.1, -37.9}

<sup>^</sup> Prediction intervals not estimated due to repeated zero counts in weekly reports

<sup>¥</sup> latest available data is up until the end of week 10 2022 for all data sources, apart from HES, which is until the end of week 9 2022.

**Supplementary Table 5: Denominator data during summer seasons (week 11-39) and winter seasons (week 40-10) among children under five years-old in England reported to clinical and syndromic surveillance systems**

Indicator and age group	Summer						
	2015	2016	2017	2018	2019	2020	2021
<i>Clinical</i>							
Number of coded hospital admissions among children under five years old – HES	748,197	765,789	745,618	732,755	730,593	24,353	692,018
<1 yrs	509,724	523,269	509,135	494,656	491,582	16,178	480,222
1-4 yrs	238,473	242,520	236,483	238,099	239,011	8,175	211,796
<i>Syndromic</i>							
Total number of calls – NHS 111	879,694	936,554	927,126	972,352	982,249	784,762	1,206,984
<1 yrs	293,805	325,035	318,600	338,295	344,442	269,432	355,407
1-4 yrs	585,889	611,519	608,526	634,057	637,807	515,330	851,577
Total number of coded consultations – GP out-of-hours	388,606	336,611	332,582	313,536	275,520	149,969	264,189
<1 yrs	125,800	113,781	110,828	103,654	91,145	56,003	77,925
1-4 yrs	262,806	222,830	221,754	209,882	184,375	93,966	186,264
Number of registered patients- GP in-hours	8,135,000	7,831,755	7,793,719	7,988,197	7,936,310	8,212,385	7,821,120
<1 yrs	1,442,293	1,381,832	1,358,749	1,367,183	1,348,767	1,377,261	1,351,861
1-4 yrs	6,692,707	6,449,923	6,434,970	6,621,014	6,587,543	6,835,124	6,469,259
<b>Winter</b>							
Indicator and age group	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
<i>Clinical</i>							
Number of coded hospital admissions among children under five years old – HES	678,514	637,611	634,301	646,675	622,912	469,824	510,816
<1 yrs	450,597	428,024	420,957	417,607	409,061	351,269	346,806
1-4 yrs	227,917	209,587	213,344	229,068	213,851	118,555	164,010
<i>Syndromic</i>							
Total number of calls – NHS 111	998,972	920,595	1,001,573	1,039,693	1,014,670	628,183	1,113,006
<1 yrs	325,400	316,509	330,297	341,892	336,447	228,167	344,739
1-4 yrs	673,572	604,086	671,276	697,801	678,223	400,016	768,267
Total number of coded consultations – GP out-of-hours	380,809	338,851	344,828	306,555	253,643	131,227	215,947
<1 yrs	119,131	112,007	108,785	96,164	79,407	50,274	64,271
1-4 yrs	261,678	226,844	236,043	210,391	174,236	80,953	151,676
Number of registered patients– GP in-hours	9,735,413	9,813,028	9,824,841	9,969,996	10,119,998	9,915,525	9,852,891
<1 yrs	1,707,590	1,744,162	1,715,894	1,724,222	1,718,973	1,676,966	1,653,955
1-4 yrs	8,027,823	8,068,866	8,108,947	8,245,774	8,401,025	8,238,559	8,198,936

**Supplementary Table 6. Time series model equations used in analyses**

<b>Data source</b>	<b>Model equation</b>
SGSS	glm.nb( n ~ cos52+sin52+sin26+cos26+BH+time, data=sgss_training )
DataMart	glm.nb(rsv_pos_0_05 ~ cos52+sin52+cos26+sin26+BH, offset(log(rsv_tot_0_05)), data=datamart_training ) glm.nb(rsv_tot_0_05 ~ cos52+sin52+cos26+sin26+BH, data=datamart_training )
HES	glm.nb( count ~ cos52+sin52+cos26+sin26+BH+time, offset(log(total)), data=hes_training )
NHS 111	glm.nb( total_cough_5 ~ cos52+sin52+cos26+sin26+BH+time, offset(log(total_calls_5)), data=NHS_U5_training )
GP out-of-hours	glm.nb( total_bronchitis_5 ~ cos52+sin52+cos26+sin26+BH+time, offset(log(total_calls_5)), data=Bronch_U5_training )
GP in-hours	glm.nb( total_infection_5 ~ cos52+sin52+cos26+sin26+BH+time, offset(log(total_pop_5)), data=IH_U5_training )
Emergency department	glm.nb(total_bronchitis_all ~ cos52+sin52+cos26+sin26+BH+time, data=ED_training )



## Data sharing statement

Applications for requests to access relevant anonymised data included in this study should be submitted to the UKHSA Office for Data Release (<https://www.gov.uk/government/publications/accessing-ukhsa-protected-data/accessing-ukhsa-protected-data>).