

# Covid – 19 Modelling Workshop Results

01 March 2020

NHS England and NHS Improvement



# Our understanding of the overall demand for NHS capacity is dependent on a few key assumptions

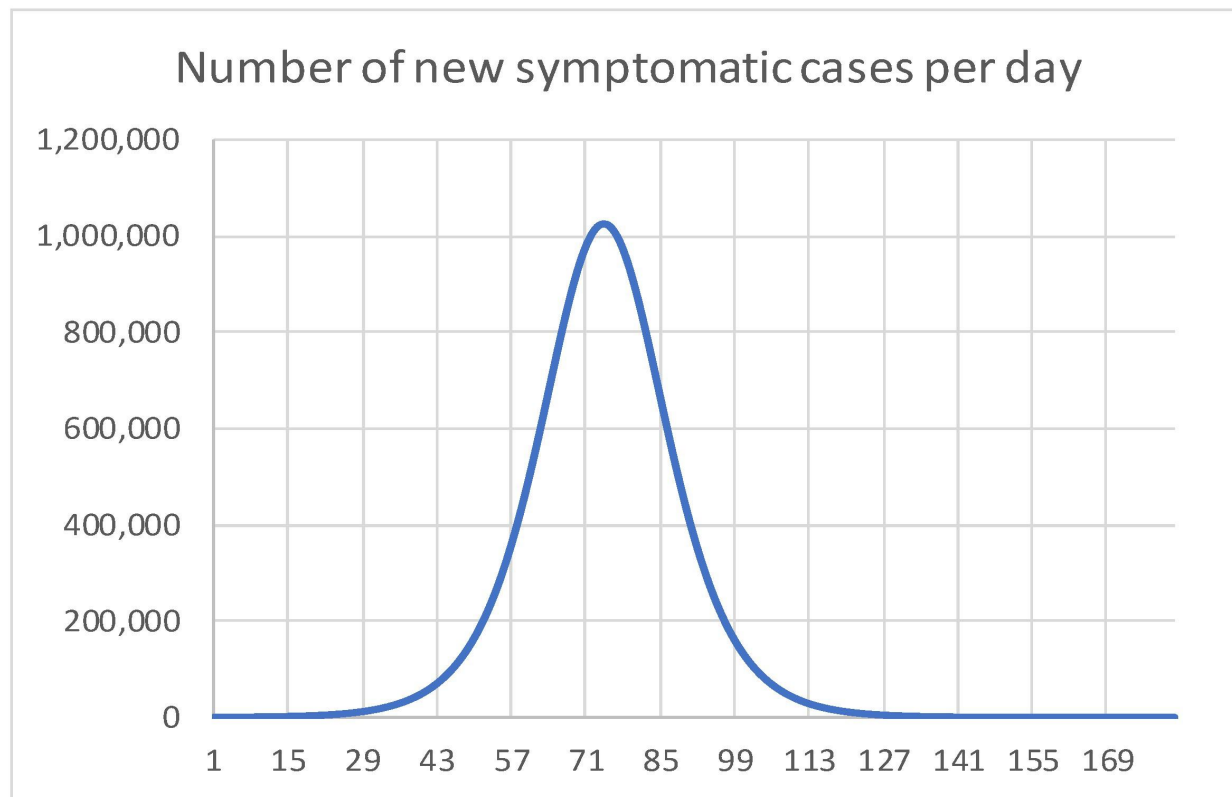
England population	60m	
People infected	49m	81% of the England population
People showing symptoms	32m	53% of the England population not used in subsequent analysis
Time from showing symptoms to being hospitalised	6 days	90% of hospitalisations in the range 3-8 days after first showing symptoms
People hospitalised	3.9m	Hospitalisation 3-8 days after first symptoms
Requiring oxygen 'O Group'	3.2m	4 l/min, average length of stay 7.8 days
Requiring non-invasive ventilation 'O+ Group'	360k	6 l/min, average length of stay 11.7 days
Requiring invasive ventilation 'V Group'	360k	8 l/min, average length of stay 15.6 days
Infection Fatality ratio (proportion of those infected who die)	1% 480k	Principally based on data from Wuhan, an overwhelmed health system



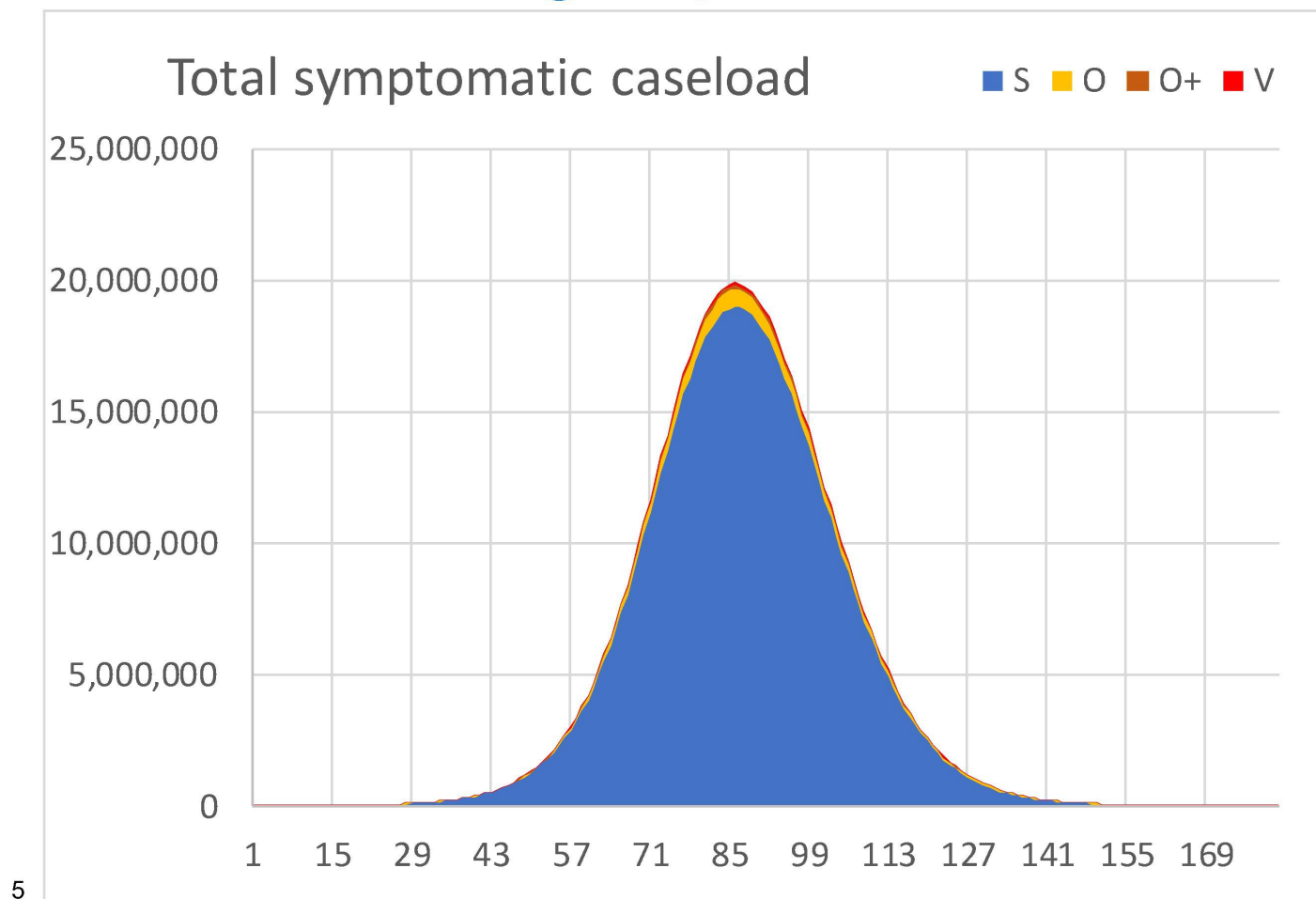
# Results – Without Mitigation

Week	Ave no. of new symptomatic cases per day	New hospital admissions per day	Caseload (average per day) in:						Recovered patients	Number of deaths (avg per day)	Number of deaths (cumulative total)
			S	O	O+	V	All beds	All settings			
1	473	10	1,514	15	3	1	19	1,533	6	0	2
2	1,239	80	7,281	217	43	24	283	7,565	59	4	27
3	3,037	198	21,235	676	133	77	885	22,120	398	11	106
4	7,433	485	54,722	1,711	336	197	2,244	56,966	2,021	29	309
5	18,133	1,186	135,133	4,215	828	488	5,531	140,663	7,412	72	810
6	43,882	2,887	329,306	10,299	2,022	1,194	13,516	342,822	21,582	175	2,033
7	104,158	6,953	792,863	24,942	4,897	2,895	32,733	825,597	56,481	424	4,998
8	236,251	16,310	1,859,894	59,254	11,634	6,889	77,776	1,937,670	141,243	1,007	12,047
9	484,777	36,036	4,119,469	134,779	26,463	15,736	176,978	4,296,448	344,056	2,295	28,114
10	817,880	70,182	8,151,083	279,515	54,880	32,942	367,337	8,518,420	815,041	4,781	61,583
11	1,011,020	108,767	13,453,864	488,868	95,985	58,701	643,554	14,097,418	1,849,724	8,437	120,645
12	861,329	121,227	17,736,055	664,154	130,400	82,351	876,906	18,612,961	3,923,123	11,642	202,141
13	530,123	94,266	18,733,988	677,870	133,093	88,036	898,999	19,632,986	7,537,831	12,158	287,245
14	263,877	54,654	16,209,133	542,032	106,423	74,389	722,844	16,931,977	12,738,029	9,997	357,227
15	117,517	26,368	11,670,910	369,790	72,605	53,458	495,853	12,166,763	18,650,681	7,007	406,278
16	49,729	11,576	7,109,950	233,427	45,831	34,787	314,045	7,423,996	23,877,411	4,495	437,746
17	20,587	4,869	3,768,718	143,783	28,230	21,260	193,273	3,961,991	27,534,352	2,757	457,047
18	8,445	2,010	1,802,069	88,422	17,361	12,493	118,276	1,920,345	29,651,993	1,656	468,636
19	3,451	824	804,693	54,545	10,709	7,205	72,459	877,152	30,723,763	987	475,543
20	1,408	337	344,674	33,793	6,635	4,086	44,513	389,187	31,221,901	585	479,639
21	574	137	144,179	20,932	4,110	2,218	27,260	171,439	31,442,942	341	482,025
22	234	56	59,544	12,707	2,495	1,117	16,319	75,863	31,539,410	191	483,363
23	95	23	24,428	7,316	1,436	519	9,271	33,699	31,581,726	101	484,073
24	39	9	9,988	3,874	761	226	4,861	14,849	31,600,552	50	484,425
25	16	4	4,077	1,866	366	95	2,328	6,405	31,608,958	23	484,588
26	6	2	1,663	832	163	39	1,035	2,698	31,612,642	10	484,659
Total	32,100,000	3,916,196	n/a	n/a	n/a	n/a	n/a	n/a	n/a	484,659	n/a
Daily Peak	1,027,525	124,005	18,999,796	703,222	138,071	89,669	930,633	19,927,885	n/a	12,476	n/a
Day of peak	74	80	86	85	85	86	85	86	n/a	86	n/a

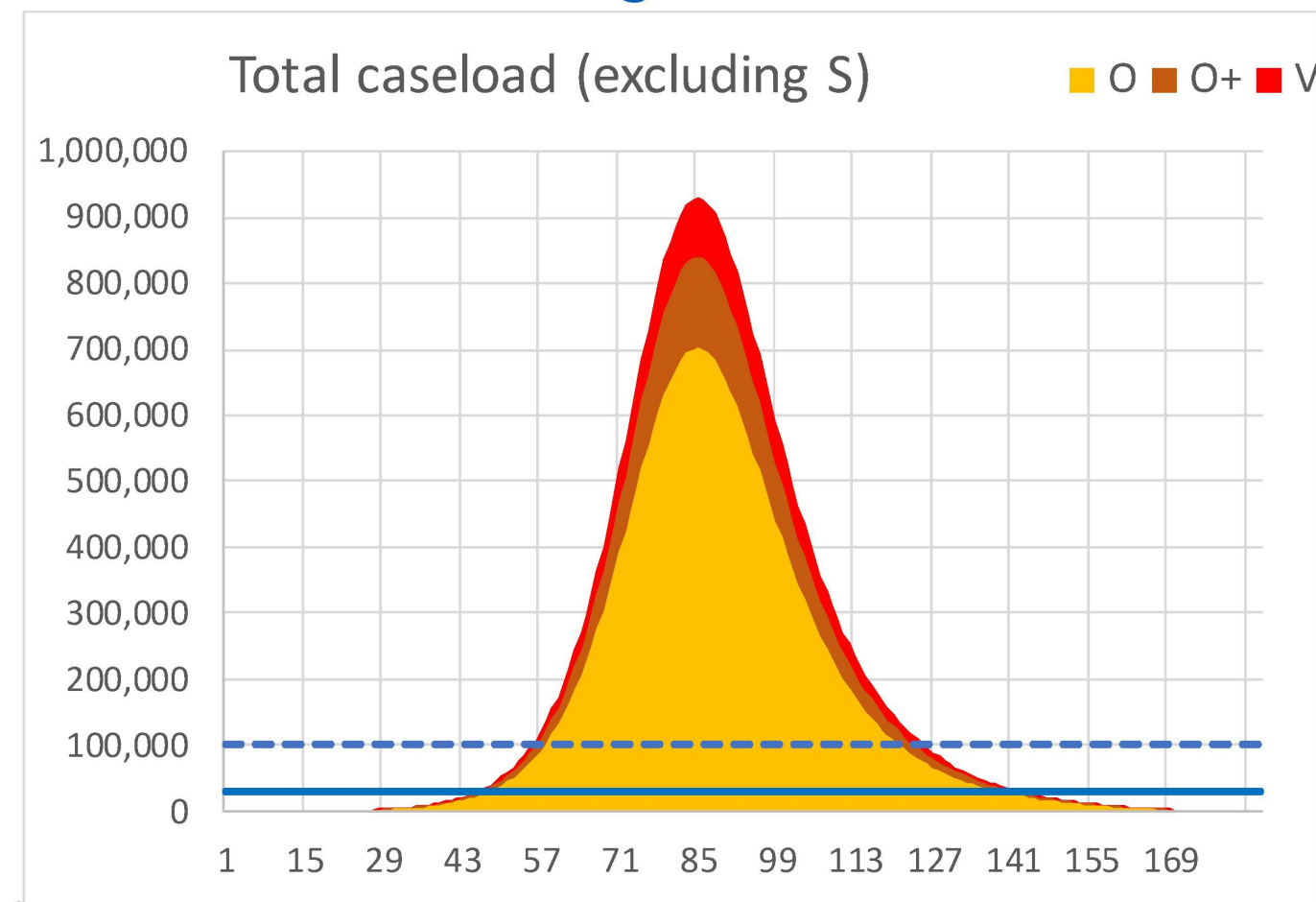
# Number of Symptomatic Cases Per Day



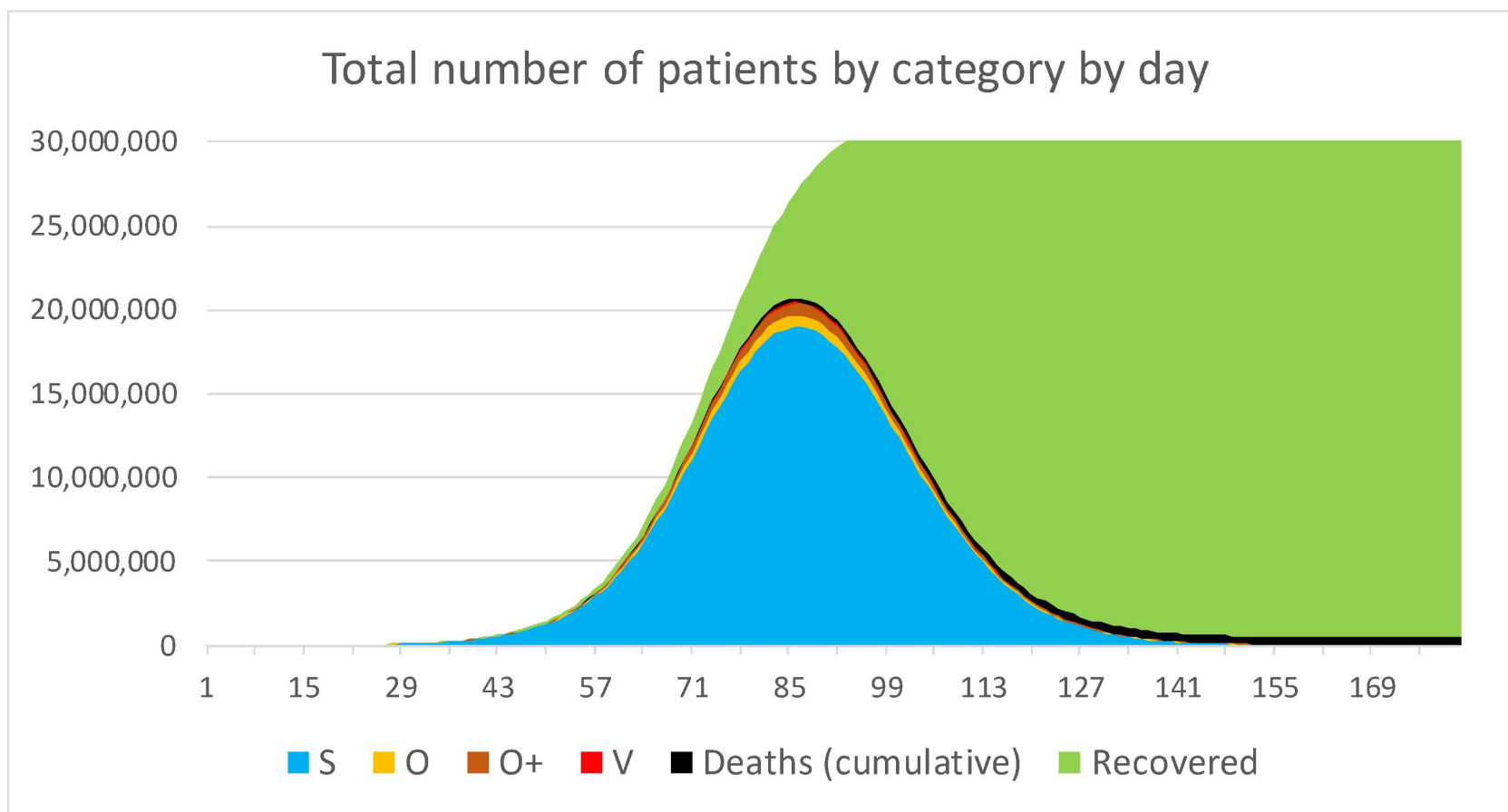
# Attack Curve – Age Specific?



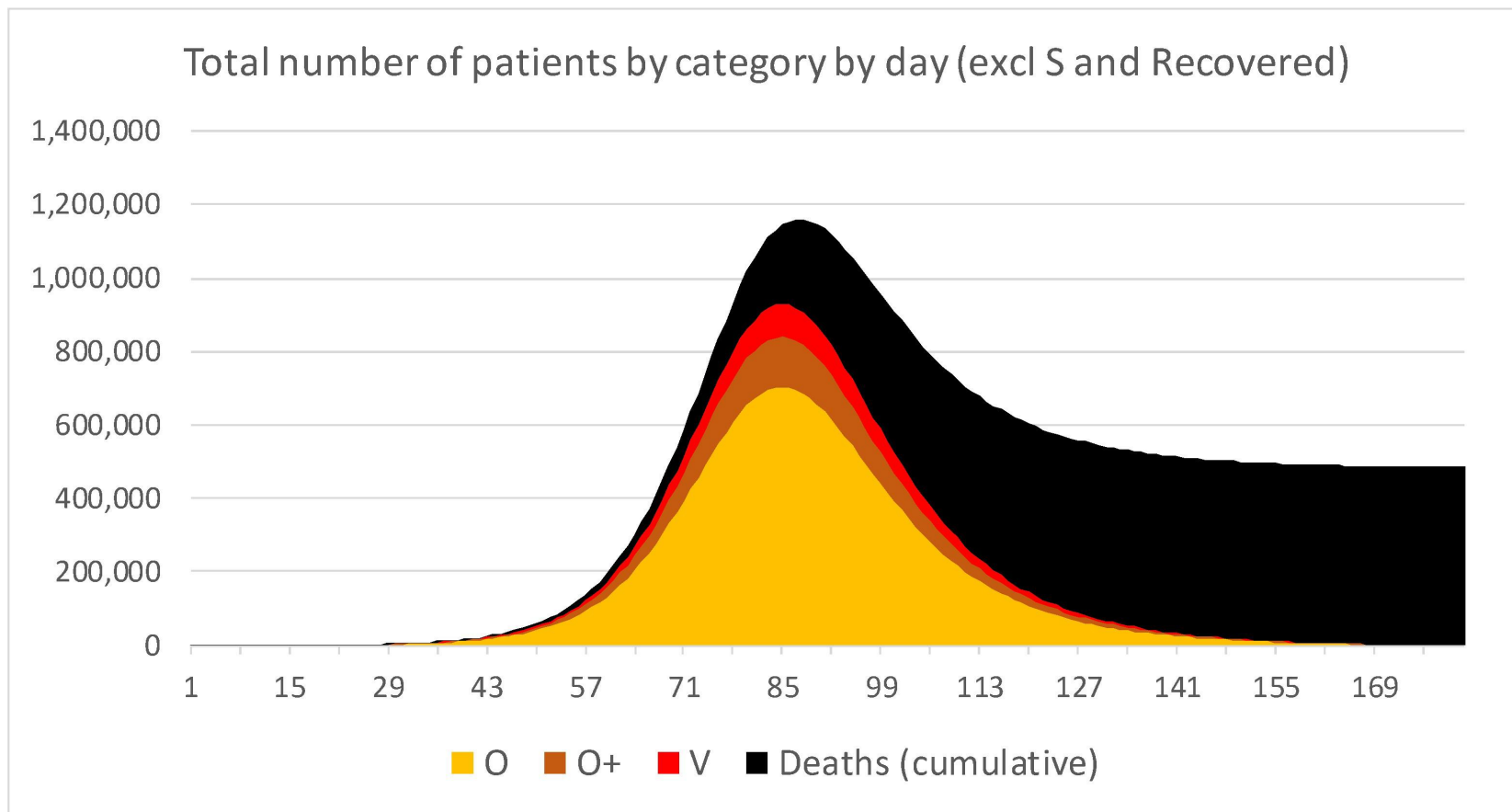
# Caseload Excluding S



# Patients Per Day



# Patients By Ca



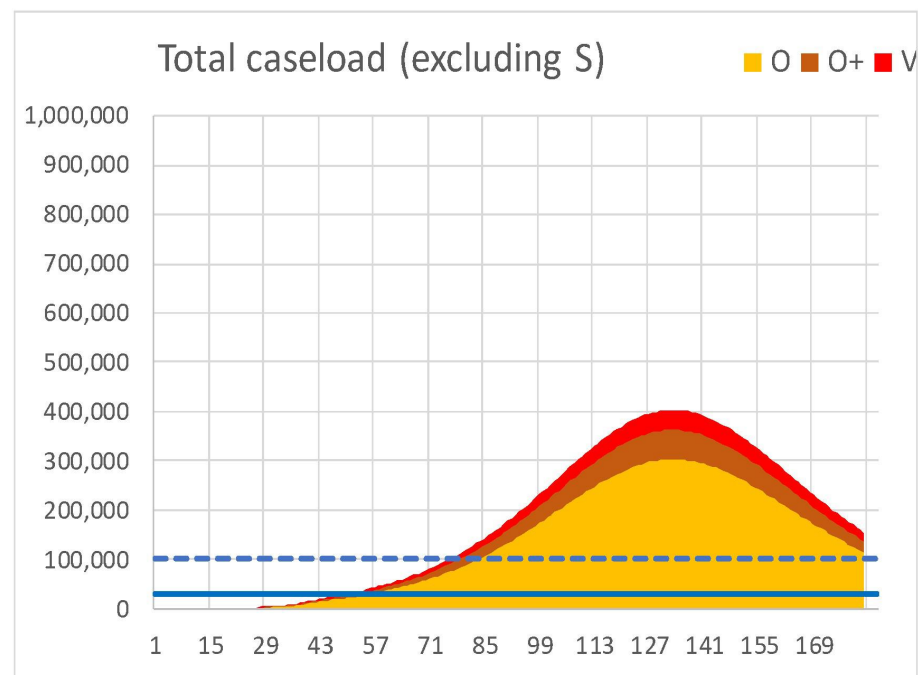
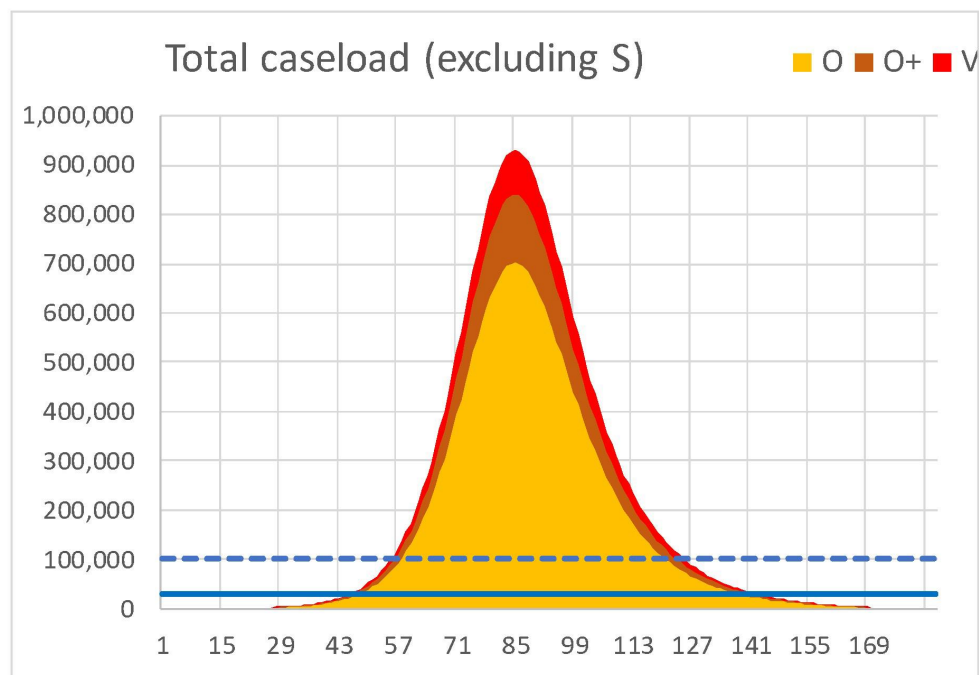




# With Mitigation at the 66% Level

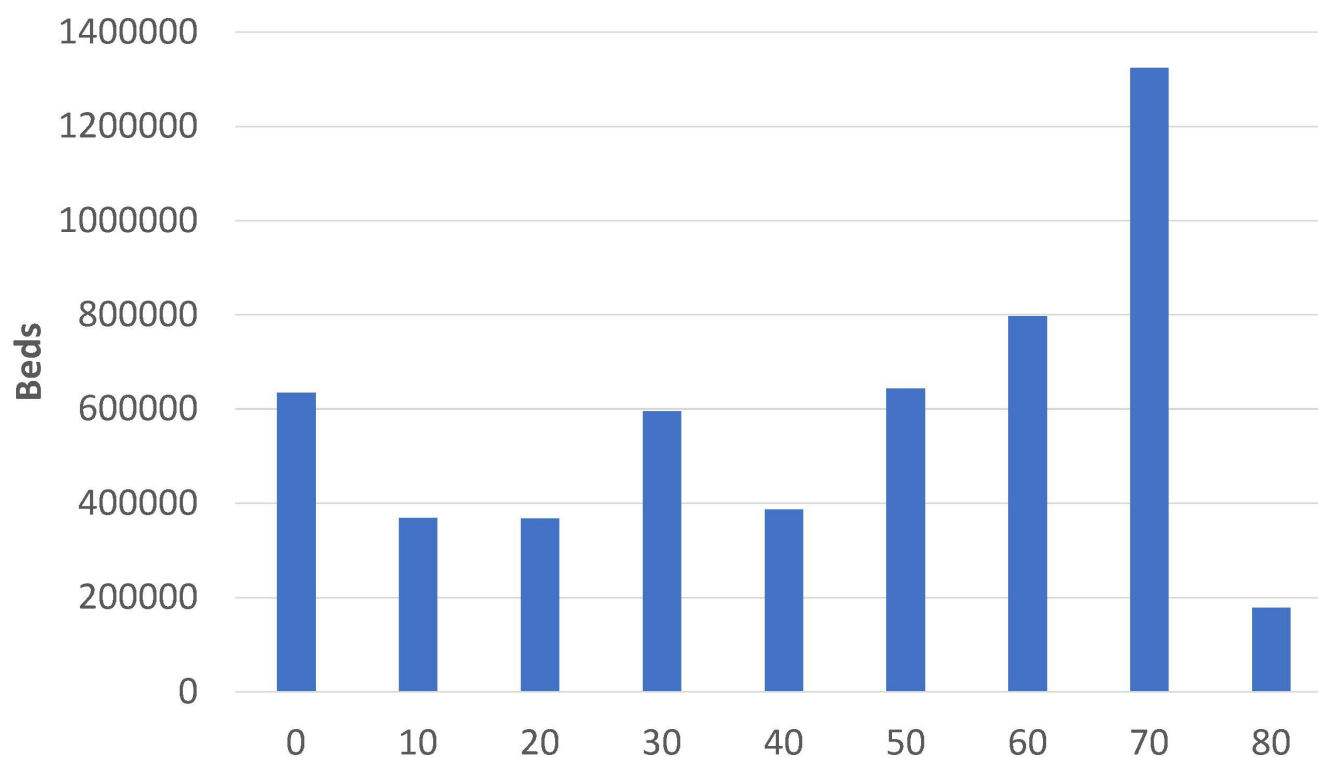
Week	Ave no. of new symptomatic cases per day	New hospital admissions per day	Caseload (average per day) in:						Recovered patients	Number of deaths (avg per day)	Number of deaths (cumulative total)
			S	O	O+	V	All beds	All settings			
1	473	10	1,514	15	3	1	19	1,533	6	0	2
2	1,239	80	7,281	217	43	24	283	7,565	59	4	27
3	3,037	198	21,235	676	133	77	885	22,120	398	11	106
4	7,433	485	54,722	1,711	336	197	2,244	56,966	2,021	29	309
5	18,700	1,191	136,761	4,219	828	489	5,537	142,298	7,417	72	810
6	30,400	2,740	295,732	10,215	2,006	1,187	13,408	309,140	21,486	174	2,025
7	41,748	4,060	505,988	18,303	3,594	2,192	24,089	530,077	54,872	315	4,234
8	56,979	5,566	769,066	26,889	5,279	3,290	35,458	804,524	128,125	468	7,512
9	77,116	7,580	1,088,796	37,619	7,386	4,650	49,655	1,138,451	266,292	658	12,121
10	103,192	10,227	1,488,259	51,560	10,123	6,403	68,086	1,556,345	483,049	905	18,453
11	136,007	13,630	2,000,176	69,616	13,669	8,664	91,949	2,092,124	789,010	1,223	27,011
12	175,719	17,867	2,648,693	92,531	18,168	11,536	122,235	2,770,928	1,206,779	1,626	38,395
13	221,267	22,924	3,444,600	120,705	23,699	15,088	159,492	3,604,092	1,769,288	2,124	53,265
14	269,784	28,614	4,378,258	153,857	30,208	19,299	203,365	4,581,623	2,516,439	2,712	72,251
15	316,303	34,517	5,409,217	190,588	37,420	24,013	252,021	5,661,239	3,492,063	3,367	95,822
16	354,252	39,966	6,458,755	228,075	44,780	28,896	301,751	6,760,506	4,738,667	4,041	124,106
17	376,979	44,138	7,412,736	262,162	51,473	33,440	347,075	7,759,811	6,288,927	4,660	156,726
18	379,954	46,273	8,140,213	288,080	56,562	37,036	381,678	8,521,891	8,154,401	5,141	192,711
19	362,555	45,940	8,525,877	301,714	59,239	39,128	400,080	8,925,958	10,313,985	5,407	230,563
20	328,327	43,207	8,504,762	300,928	59,084	39,382	399,395	8,904,157	12,706,703	5,418	268,489
21	283,545	38,616	8,083,118	286,258	56,204	37,797	380,259	8,463,377	15,233,821	5,177	304,727
22	235,005	32,971	7,335,184	260,597	51,166	34,685	346,448	7,681,633	17,772,483	4,732	337,851
23	188,224	27,068	6,378,262	228,115	44,788	30,558	303,462	6,681,724	20,197,786	4,156	366,941
24	146,668	21,514	5,338,831	193,026	37,899	25,970	256,895	5,595,726	22,405,583	3,524	391,611
25	111,857	16,664	4,324,047	158,721	31,163	21,396	211,280	4,535,327	24,327,877	2,901	411,916
26	83,919	12,651	3,406,805	127,433	25,020	17,168	169,622	3,576,426	25,936,827	2,328	428,214
Total	30,174,777	3,630,878	n/a	n/a	n/a	n/a	n/a	n/a	n/a	428,214	n/a
Daily Peak	382,103	46,545	8,585,211	303,780	59,644	39,585	402,973	8,988,184	n/a	5,456	n/a
Day of peak	120	126	133	133	133	134	133	133	n/a	134	n/a

# Unmitigated vs mitigated hospital caseload





Age breakdown of peak week bed occupancy





## Mitigation options

	Stopping mass gatherings	Closure of schools and universities, for 13 weeks	Home isolation of symptomatic cases, for 13 weeks, when enacted early	Voluntary household quarantine, for 13 weeks, when enacted early	Social distancing of those over 65 years of age, for 13 weeks	Reduction of total cases	Reduction of total deaths	Reduction of peak cases	Reduction of peak deaths	Reduction in peak critical care bed demand	Reduction in peak hospital bed demand	Delay in peak cases (weeks)
Interventions activated	✓					5%	2%	14%	19%	18%	16%	0
		✓				6%	2%	21%	14%	16%	17%	1
			✓			7%	11%	22%	27%	27%	26%	2
				✓		8%	12%	22%	28%	30%	27%	1
		✓	✓	✓		10%	9%	54%	49%	49%	51%	6
					✓	6%	30%	9%	34%	30%	22%	0
			✓		✓	13%	37%	27%	52%	49%	41%	2
			✓	✓	✓	14%	37%	44%	60%	59%	57%	3
Assumptions		✓	✓		✓	17%	33%	58%	68%	66%	63%	3
		✓	✓	✓	✓	14%	27%	59%	67%	66%	63%	7
	Includes shutting, in order of significance, bars/pubs, restaurants, cinemas, night clubs, sporting fixtures, places of worship and theatre. These represent about 12m contact hours of activity per day, or 5.3% of all hours outside home, school or work. Assuming a 3-fold higher risk of transmission than other activities, preventing them might reduce transmission outside household, school or work contacts by 16%	Schools assumed to completely close, 25% of universities remain open. Household contact rates for student families increased by 50% during closure. Contacts outside the household increase by 25% during closure.	65% of symptomatic cases withdraw to the home for 7 days, reducing non household contacts by 75%. Household contacts unchanged.	Following the identification of a symptomatic case in the household, all other household members withdraw to the home for 14 days. Household contacts double during quarantine, all contact outside the household are reduced by 75%. 50% of households are assumed to comply with the policy.	75% compliance with policy. Those who do comply reduce contacts in schools or workplaces by 50%, increase household contact rates by 25%, but reduce all other contacts by 75%. This policy implies cessation of all activities outside the household (including social contact between different households) bar the essentials. Policy would need to include rigorous infection control in care/nursing homes.							



# Beds We Can Free Up

## Non-Critical Care Beds

### **Elective beds which can be freed\***

5,796 day case beds.

12,219 ordinary admission beds (these are not available on day zero but released over the course of a week)

*\*focussing on Adults and using 21+ days from DTA to admission as our non-urgency proxy*

### **Other beds which can be freed**

5,000 DToCs

*subject to finding step down facilities. Can be added as little or no overlap between DToC patients (usually emergency admissions) and the non-urgent electives.*

Total = **23,000** (could be increased to 25,000 if non-urgency proxy set at 14+ days)

## Critical Care Beds

Currently have 4,000 Adult beds, 500 Child beds and just over 1,400 neo-natal beds/cots.

*It is presumed that the child and neo-natal beds are difficult/impossible to repurpose.*

Analysis from ICNARC suggests that:

11% of capacity is used by patients admitted direct from theatre following elective/scheduled surgery

28.1% of capacity is used by patients admitted with a lower requirement for organ support (admissions that did not receive advanced respiratory support, advanced cardiovascular support, liver support, renal support, neurological support at any time during their stay).

Therefore **39.1%** of CC capacity could be freed

Possibility of 3,000 additional capacity through repurposing ventilation equipment from theatres (some trade-off expected as this would consume some of the freed up ordinary beds)