

Indirect age- and sex-standardisation of COVID-19-related mortality rates for the prison population of England and Wales

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Summary

This paper estimates a standardised mortality ratio (SMR) for death due to COVID-19 among people in prisons in England and Wales between 1 March 2020 and 26 February 2021. Over this period, prisons in England and Wales reported 121 deaths related to COVID-19. The SMR is 3.33 (95% C.I. 2.77–3.98), meaning there were 3.33 times more deaths among people in prisons than expected given the age and sex of the population.

Introduction

This paper accompanies a Spotlight article in *Lancet Respiratory Medicine* outlining the case for early vaccination of people in prisons and prison staff (REFERENCE). The UK, like many countries, has had higher rates of COVID-19 infection amongst people in prisons than the general population throughout the pandemic. There were over 10,000 confirmed positive COVID-19 cases amongst people in prisons up to end January 2021.¹

Relative numbers of cases should be treated with caution due to potentially different case ascertainment.

We therefore used indirect standardisation² to compare the COVID-19 mortality rate among people in prisons with that in the general population, accounting for the age and sex structure of people in prisons.

Data sources

General population estimates. We used the most recent ONS general populations (June 2019) for England and Wales, published on NomisWeb.³

COVID-19 deaths in the general population. We used Office for National Statistics data for occurrences of deaths (i.e. the actual date of death) involving COVID-19 (deaths where COVID-19 is mentioned on the death certificate).⁴

Prison population size. We used the prison population (all types of custody) published in Offender Management Statistics Quarterly.⁵

COVID-19 deaths in people in prisons. We used the Her Majesty's Prison and Probation Service (HMPPS) COVID-19 Summary tables (data to 31 January 2021, with data for February collated from weekly HMPPS reports)¹. We used the number COVID-19-related deaths, defined as deaths within 28 days of a positive test or where COVID-19 was confirmed post-mortem, and/or where it was assessed as a contributory factor. Although COVID-19 was not necessarily the main cause of death in all of these cases, the general population ONS data similarly includes individuals where COVID-19 was mentioned on the death certificate but was not necessarily the main cause of death.

Data analysis

We estimated the proportion of the general population who died each month in each age- and sex-group, then applied these proportions to the prison population to estimate the number of expected deaths each month.

The oldest age group in prison population data is '70+'. We therefore did the following sensitivity analyses of the expected (general population) mortality rate in this group:

- Base scenario: mortality rate for 70-79 year-olds in the general population
- Low scenario: mortality rates for 70-74 year-olds in the general population.
- High scenario: mortality rates for all 70+ year-olds in the general population.

These rates affect the denominator in the SMR so a low 'expected' mortality rate translates to a higher SMR.

We estimated the number of 'expected' deaths ('E') among people in prisons, had they experienced the same mortality rates as people of the same age and sex in the general population of England and Wales.

We then compared this with the observed number of deaths among people in prisons ('O'), determined their ratio (Standardised Mortality Ratio = O/E), and calculated exact Poisson 95% confidence intervals using R version 4.0.3.

Results

There were 121 deaths amongst people in prisons related to COVID-19 from March 2020 to February 2021. Given the age and sex structure of this population, we expected 36.3 deaths over this period; this gave an SMR of 3.33 (95% C.I. 2.77–3.98).

The sensitivity analyses showed that these findings are sensitive to different assumptions about the distribution in age of the 2% of people in prisons population who are aged 70 and over. The SMRs were 2.42 (95% C.I. 2.01–2.90) when we applied reference mortality rates for the whole general population aged 70+, and 3.71 (95% C.I. 3.08–4.43) when we applied reference mortality rates for 70-74 year-olds.

Table 1: Number of deaths related to COVID-19 in the general population of England and Wales

	2020										2021	
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Male												
15-24	5	12	3	0	1	0	0	2	3	1	9	9
25-29	7	19	6	1	0	0	1	3	3	6	14	7
30-39	34	70	17	8	0	3	3	10	28	15	98	42
40-49	86	267	68	23	16	5	10	31	93	67	294	132
50-59	291	921	244	99	26	19	24	106	331	228	911	478
60-69	635	1,922	525	195	47	33	57	301	886	591	1,987	1,045
70-74	585	1,714	548	194	49	30	67	304	900	565	1,767	824
70-79	1,342	4,096	1,321	491	118	82	149	742	2,124	1,376	4,075	1,840
70+	3,606	12,901	4,603	1,694	399	229	427	2,012	6,420	4,495	12,677	5,381
Female												
15-24	7	4	2	1	0	0	0	0	4	2	6	2
25-29	6	11	1	0	0	0	0	1	5	2	11	6
30-39	19	55	13	6	2	3	3	7	18	11	58	30
40-49	68	142	50	23	3	6	5	17	69	45	180	106
50-59	164	465	123	45	13	10	14	60	191	174	584	255
60-69	303	968	304	116	33	27	36	146	443	355	1,232	592
70-74	280	918	321	142	48	15	34	155	495	362	1,181	487
70-79	680	2,379	857	351	101	36	82	402	1,270	879	2,811	1,205
70+	2,307	11,035	4,972	1,750	383	205	314	1,592	5,324	3,972	12,613	5,339

Table 2: Deaths related to COVID-19 per million in the general population of England and Wales

	Population estimate	2020										2021	
		Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Male													
15-24	3,576,081	1	3	1	0	0	0	0	1	1	0	3	3
25-29	2,039,665	3	9	3	0	0	0	0	1	1	3	7	3
30-39	3,937,345	9	18	4	2	0	1	1	3	7	4	25	11
40-49	3,720,131	23	72	18	6	4	1	3	8	25	18	79	35
50-59	3,949,699	74	233	62	25	7	5	6	27	84	58	231	121
60-69	3,062,502	207	628	171	64	15	11	19	98	289	193	649	341
70-74	1,416,786	413	1,210	387	137	35	21	47	215	635	399	1,247	582
70-79	2,376,998	565	1,723	556	207	50	34	63	312	894	579	1,714	774
70+	3,600,327	1,002	3,583	1,278	471	111	64	119	559	1,783	1,248	3,521	1,495
Female													
15-24	3,576,081	2	1	1	0	0	0	0	0	1	1	2	1
25-29	2,039,665	3	5	0	0	0	0	0	0	2	1	5	3
30-39	3,937,345	5	14	3	2	1	1	1	2	5	3	15	8
40-49	3,720,131	18	38	13	6	1	2	1	5	19	12	48	28
50-59	3,949,699	42	118	31	11	3	3	4	15	48	44	148	65
60-69	3,062,502	99	316	99	38	11	9	12	48	145	116	402	193
70-74	1,416,786	198	648	227	100	34	11	24	109	349	256	834	344
70-79	2,376,998	286	1,001	361	148	42	15	34	169	534	370	1,183	507
70+	3,600,327	641	3,065	1,381	486	106	57	87	442	1,479	1,103	3,503	1,483

Table 3: Number of people in prisons in England and Wales

	2020										2021	
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Male												
15-24	13,343			12,343			12,243			12,052		
25-29	13,817			13,858			13,287			13,045		
30-39	24,725			24,764			24,146			24,193		
40-49	14,001			14,178			13,704			13,797		
50-59	8,222			8,179			7,944			7,890		
60-69	3,252			3,279			3,161			3,181		
70+	1,780			1,766			1,674			1,669		
Female												
15-24	396			356			333			317		
25-29	549			517			476			452		
30-39	1,346			1,354			1,161			1,192		
40-49	871			856			793			784		
50-59	415			409			367			347		
60-69	100			107			102			101		
70+	26			24			23			24		

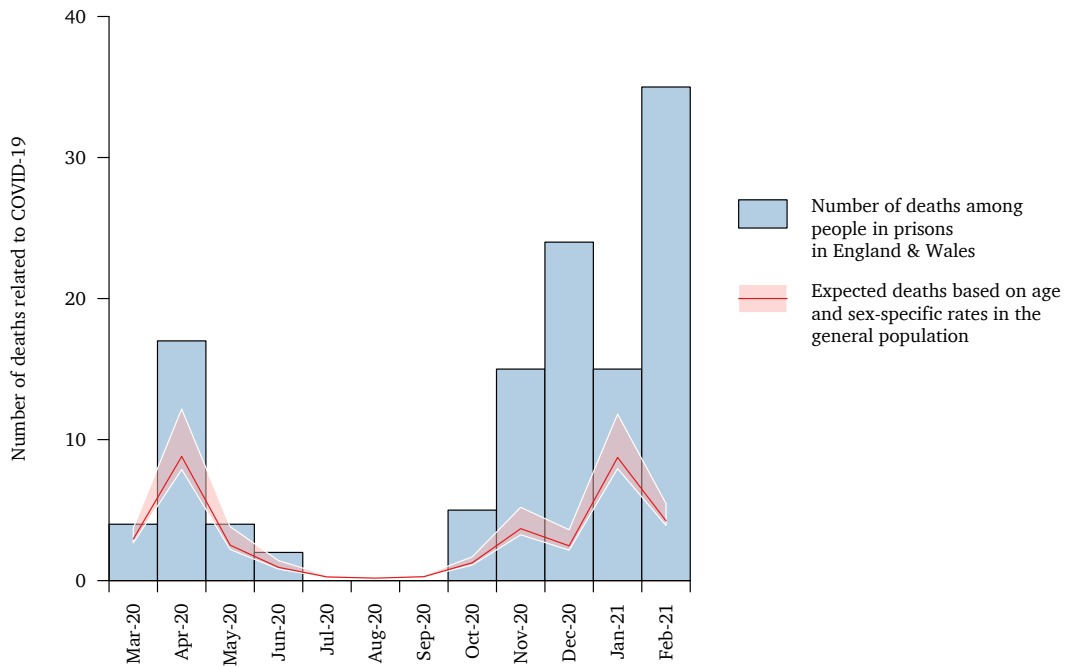
Table 4: Expected number of deaths (x1000) related to COVID-19 among people in prisons in England and Wales, based on mortality rates in the general population

	2020										2021	
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Male												
15-24	19	45	11	0	3	0	0	7	10	3	30	30
25-29	47	129	41	7	0	0	7	20	20	38	90	45
30-39	214	440	107	50	0	19	18	61	172	92	602	258
40-49	324	1,005	256	88	61	19	37	114	343	248	1,090	490
50-59	606	1,917	508	205	54	39	48	213	666	455	1,820	955
60-69	674	2,041	557	209	50	35	59	311	914	614	2,064	1,085
70-74	735	2,153	688	242	61	37	79	359	1,063	666	2,082	971
70-79	1,005	3,067	989	365	88	61	105	523	1,496	966	2,861	1,292
70+	1,783	6,378	2,276	831	196	112	199	935	2,985	2,084	5,877	2,494
Female												
15-24	1	0	0	0	0	0	0	0	0	0	1	0
25-29	2	3	0	0	0	0	0	0	1	0	2	1
30-39	6	19	4	2	1	1	1	2	5	3	18	9
40-49	16	33	12	5	1	1	1	4	15	9	38	22
50-59	17	49	13	5	1	1	1	6	18	15	51	22
60-69	10	32	10	4	1	1	1	5	15	12	41	20
70-74	5	17	6	2	1	0	1	3	8	6	20	8
70-79	7	26	9	4	1	0	1	4	12	9	28	12
70+	17	80	36	12	3	1	2	10	34	26	84	36

Table 5: Summary of observed and expected deaths related to COVID-19 among people in prisons in England and Wales

		Observed deaths	Expected deaths (base)	Expected deaths (low)	Expected deaths (high)	
2020	Mar	4	2.9	2.7	3.7	
	Apr	17	8.8	7.9	12.2	
	May	4	2.5	2.2	3.8	
	Jun	2	0.9	0.8	1.4	
	Jul	0	0.3	0.2	0.4	
	Aug	0	0.2	0.2	0.2	
	Sep	0	0.3	0.3	0.4	
	Oct	5	1.3	1.1	1.7	
	Nov	15	3.7	3.2	5.2	
	Dec	24	2.5	2.2	3.6	
	2021	Jan	15	8.7	7.9	11.8
		Feb	35	4.2	3.9	5.5
Total		121	36.3	32.6	49.9	
SMR (95% C.I.)			3.33 (2.77-3.98)	3.71 (3.08-4.43)	2.42 (2.01-2.90)	

Figure 1: Observed and expected deaths related to COVID-19 among people in prisons in England and Wales



References

- 1 Her Majesty's Prison and Probation Service. HMPPS COVID-19 statistics: January 2021. 2021. <https://www.gov.uk/government/statistics/hmpps-covid-19-statistics-january-2021> (accessed March 3, 2021).
- 2 Curtin L, Klein R. Direct standardization (age-adjusted death rates). 1995. <https://www.cdc.gov/nchs/data/statnt/statnt06rv.pdf> (accessed Feb 20, 2021).
- 3 Nomis - official labour market statistics. Population estimates - local authority based by single year of age. 2021. <https://www.nomisweb.co.uk/> (accessed March 3, 2020).
- 4 Office for National Statistics. Deaths registered weekly in England and Wales by age and sex: covid-19. 2021. <https://www.ons.gov.uk/datasets/weekly-deaths-age-sex/editions/covid-19/versions/20> (accessed March 8, 2021).
- 5 HM Prison Service. Offender management statistics quarterly: January to March 2020. 2020. <https://www.gov.uk/government/statistics/offender-management-statistics-quarterly-january-to-march-2020--2> (accessed March 3, 2020).