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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: Leske S, Kõlves K, Crompton D, Arensman E, de Leo D. Real-time suicide mortality data from police reports in Queensland, Australia, during the COVID-19 pandemic: an interrupted time-series analysis.*Lancet Psychiatry* 2020; published online Nov 16. http://dx.doi.org/10.1016/S2215-0366(20)30435-1.

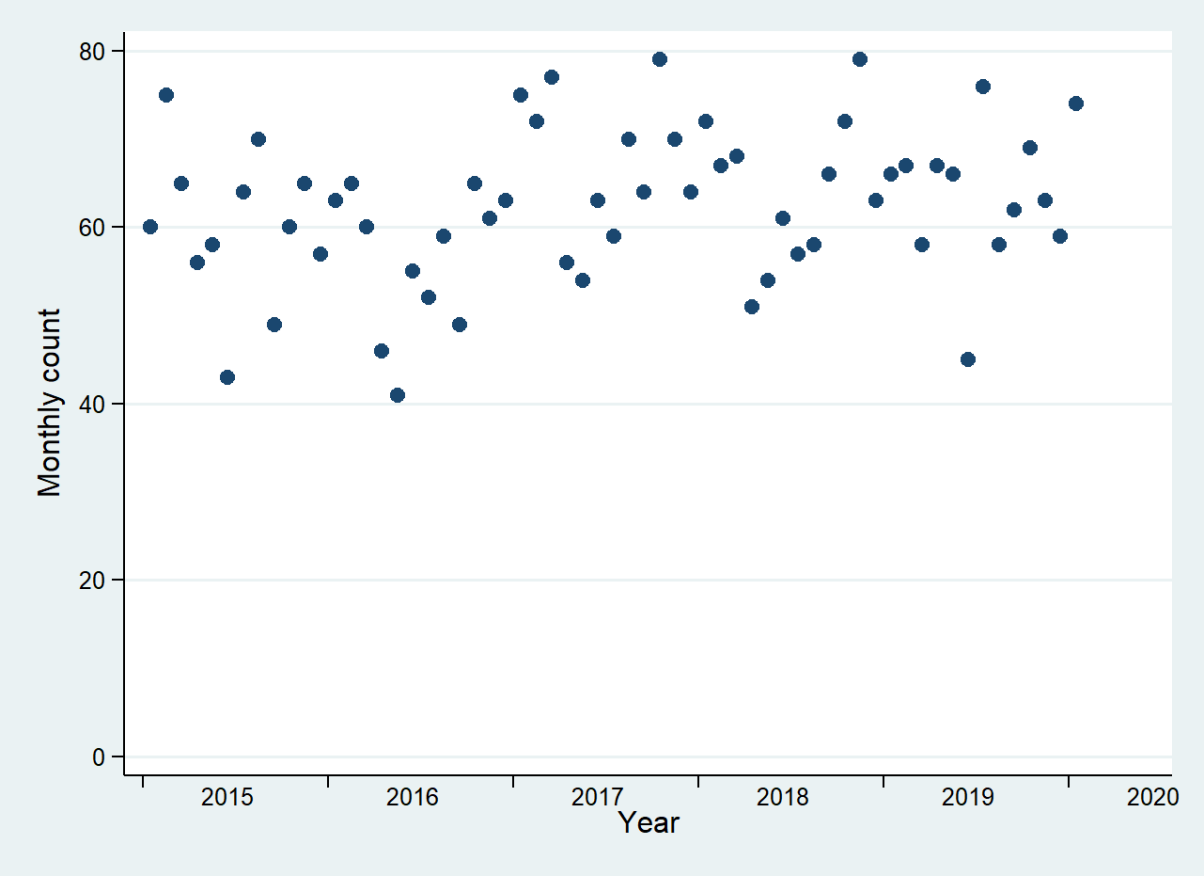
Appendix

Supplementary material 1: Descriptive statistics for suspected suicide counts and rates in Queensland, Jan 1, 2015, to Jan 31, 2020.

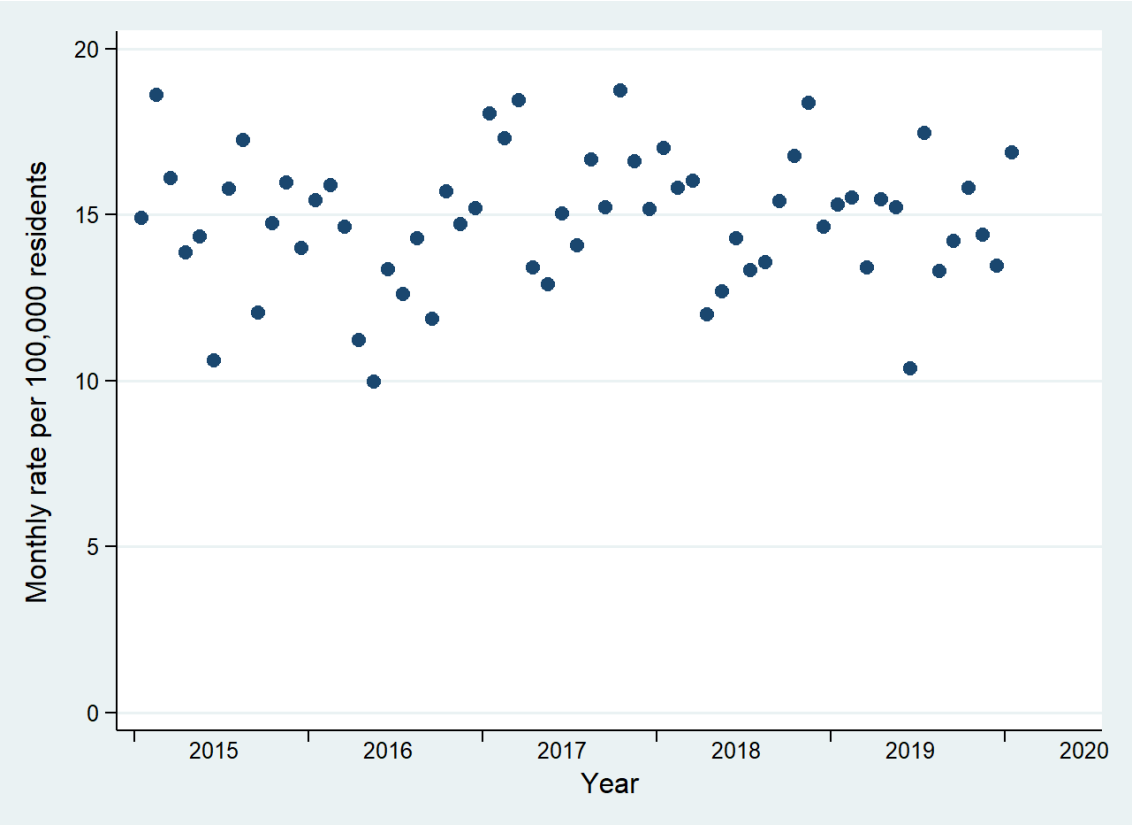
Season	Observations (months)	Mean	Dispersion	Minimum	Maximum
Counts			***SD***		
Summer	16	66·38	5·75	57	75
Autumn	15	58·47	9·17	41	77
Winter	15	59·33	8·85	43	76
Spring	15	64·87	8·66	49	79
Rate per 100,000			***95% CI***		
Summer	16	15·82	14·88–16·80	13·48	18·61
Autumn	15	13·98	13·08–14·94	9·98	18·47
Winter	15	14·14	13·22–15·10	10·36	17·47
Spring	15	15·38	14·44–16·39	11·86	18·76

Note. *SD* = Standard deviation. 95% CI = 95% Confidence intervals, calculated with Byar's method using: https://fingertips.phe.org.uk/documents/PHE%20Tool%20for%20common%20PH%20Stats%20and%20CIs.xlsx

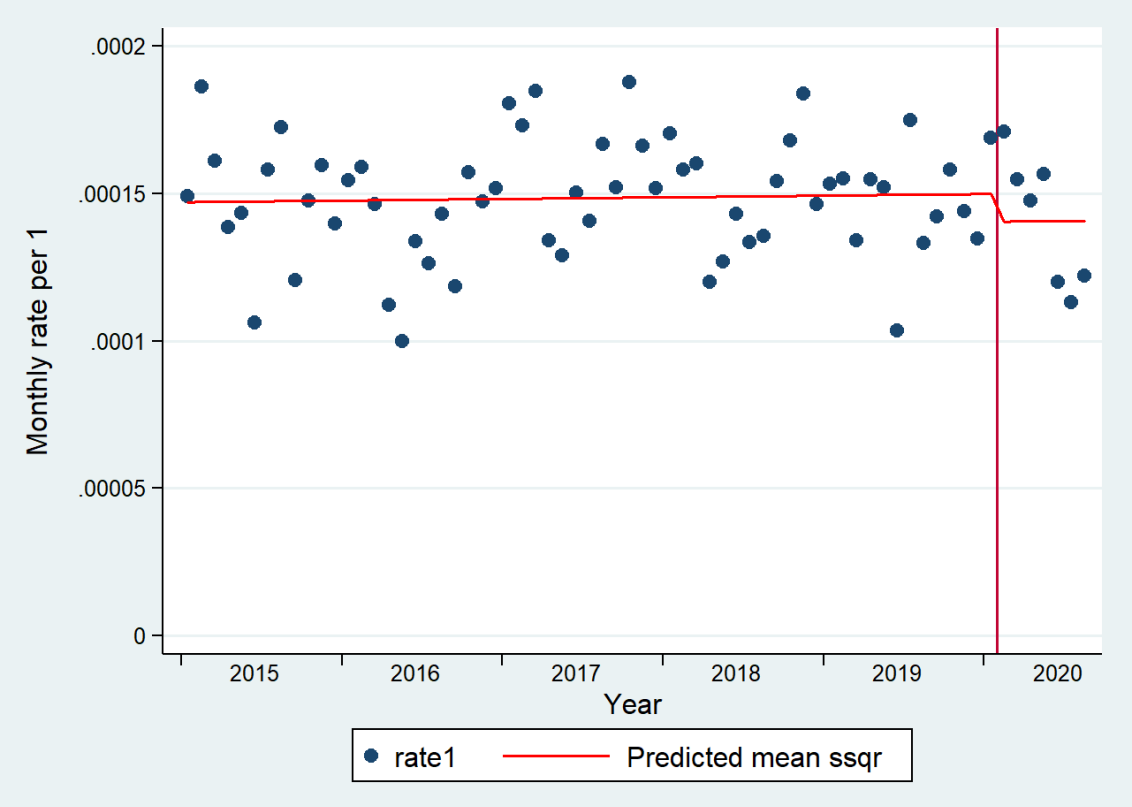
Supplementary material 2: Suspected suicides of Queensland residents, Jan 1 2015 – Jan 31 2020.



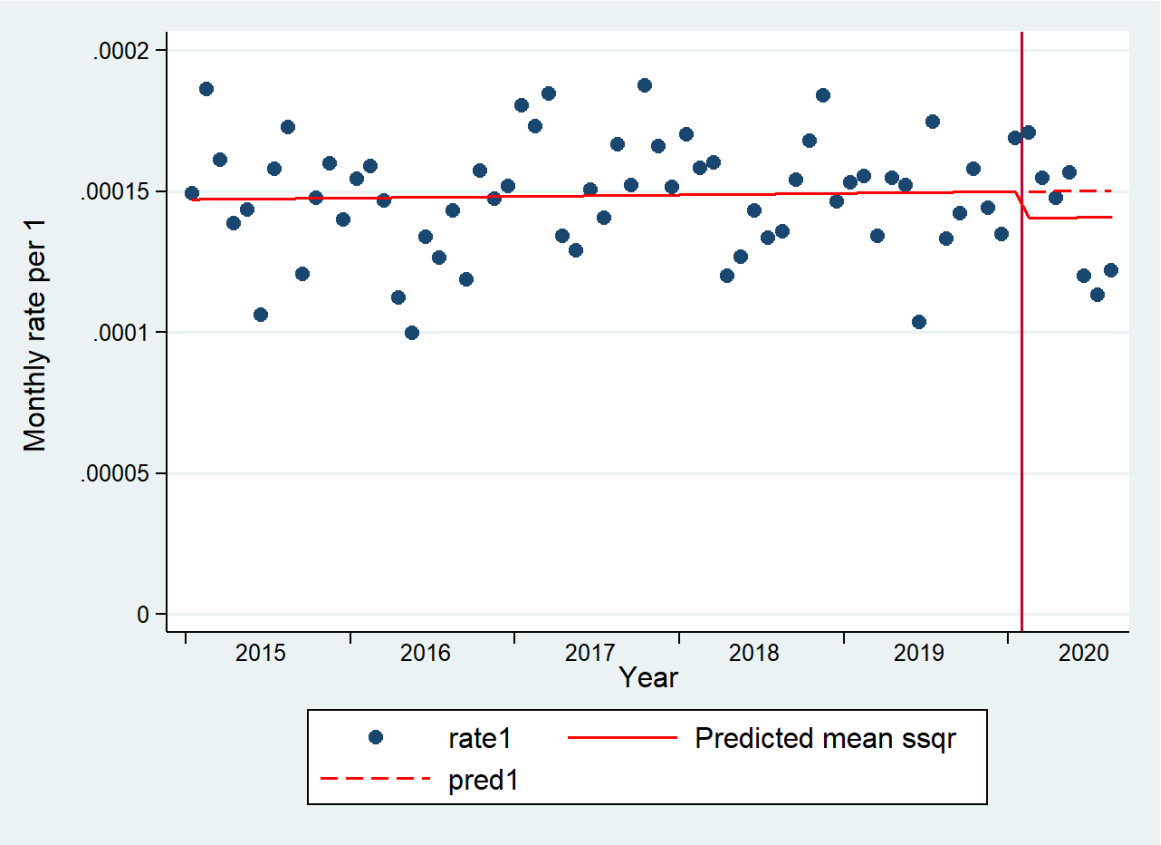
Supplementary material 3: Monthly rate of suspected suicides per 100,000 Queensland residents, Jan 1 2015 – Jan 31 2020.



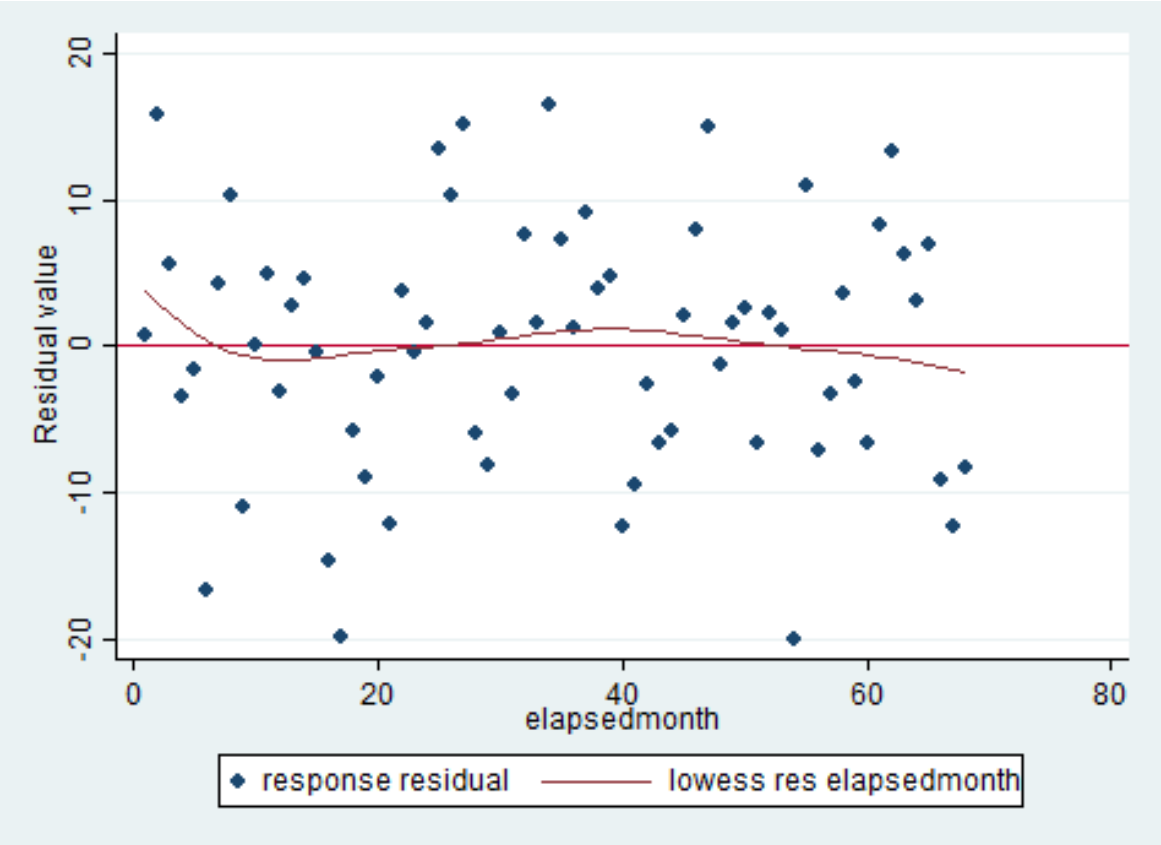
Supplementary material 4: Suspected suicide rate per one Queensland resident (same scale as count), Jan 1 2015 – Aug 31 2020.



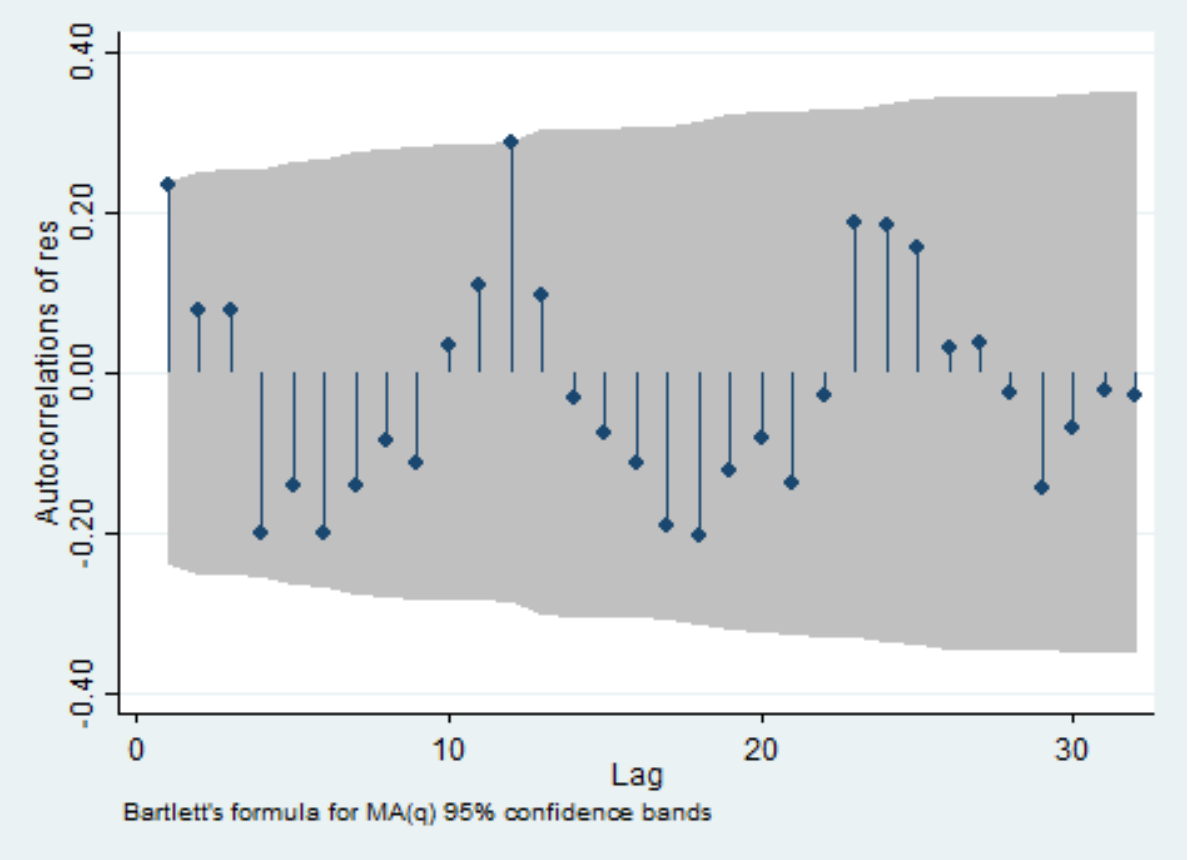
Supplementary material 5: Suspected suicide rate per one Queensland resident (same scale as count), counterfactual (dashed line) added, Jan 1 2015 – Aug 31 2020.



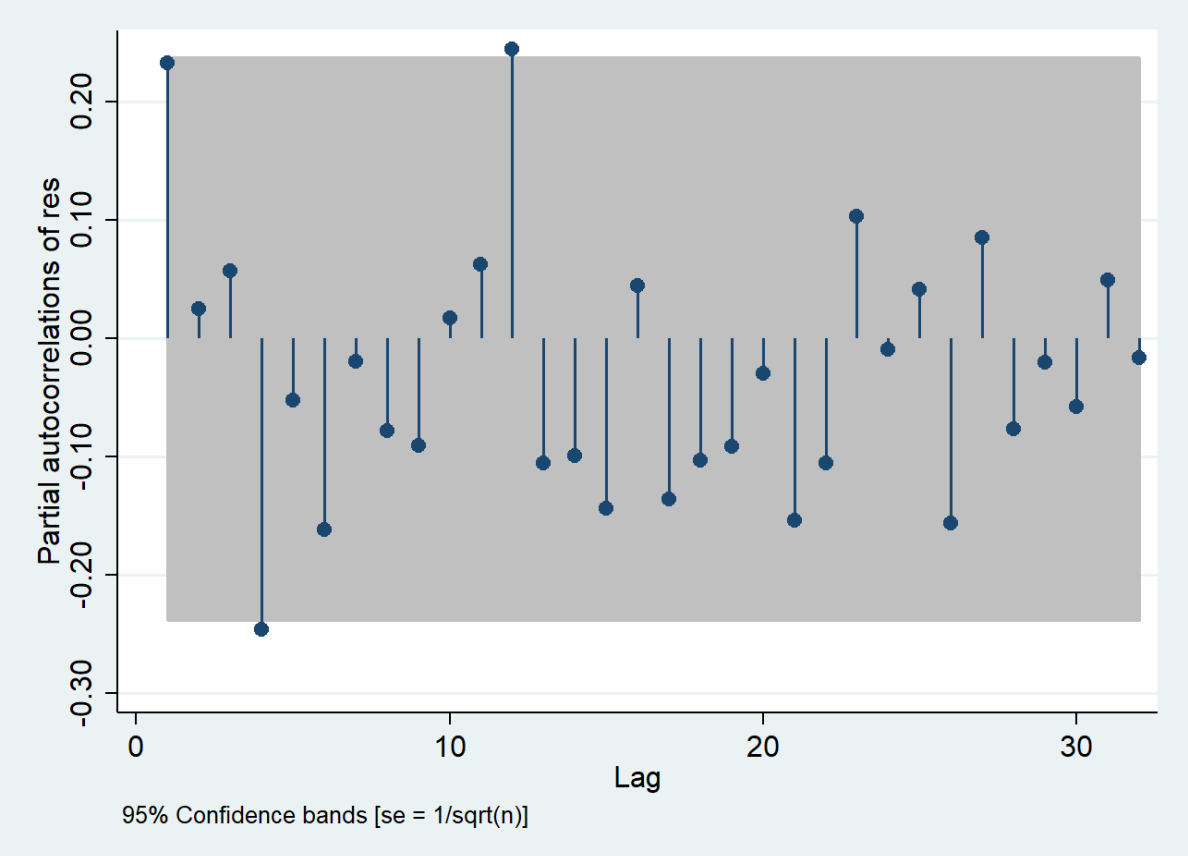
Supplementary material 6: Plot of residuals against time.



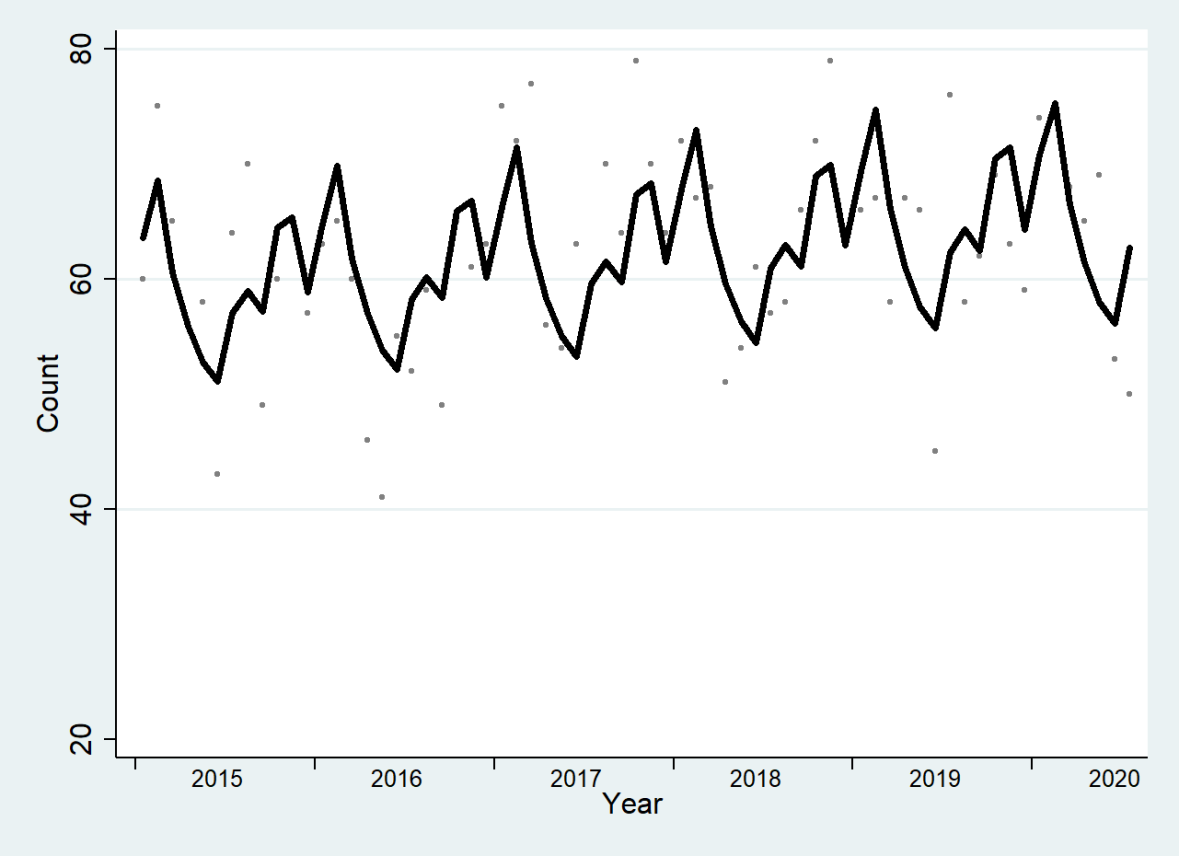
Supplementary material 7: Autocorrelation of residuals at lags.



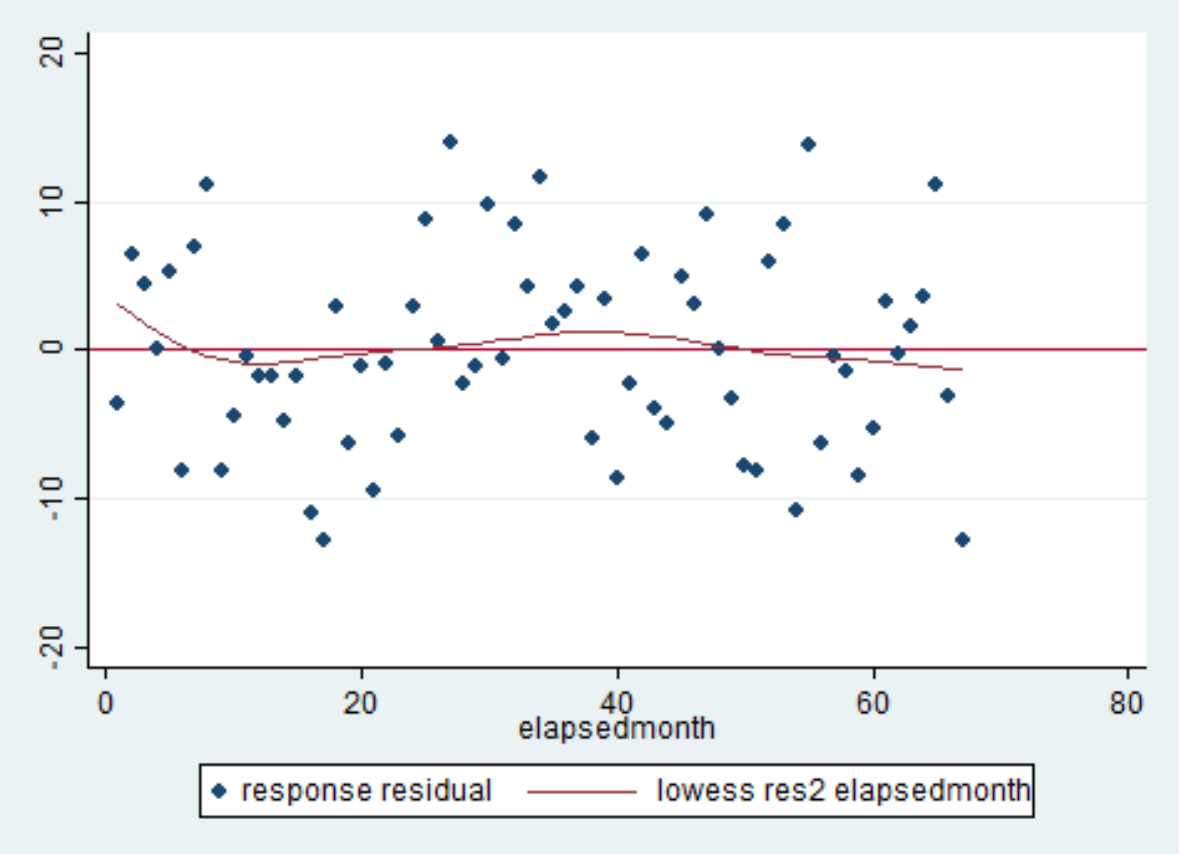
Supplementary material 8: Partial autocorrelation of residuals at lags



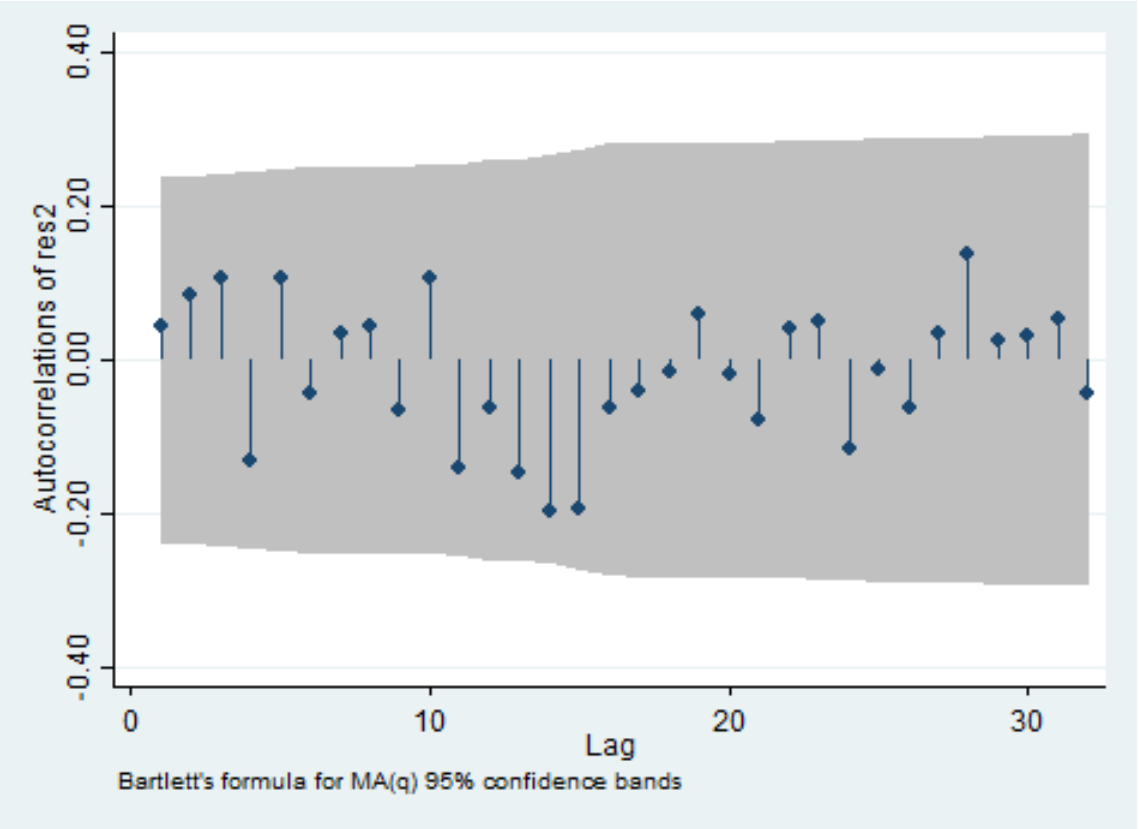
Supplementary material 9: Sine/cosine functions (Fourier series).



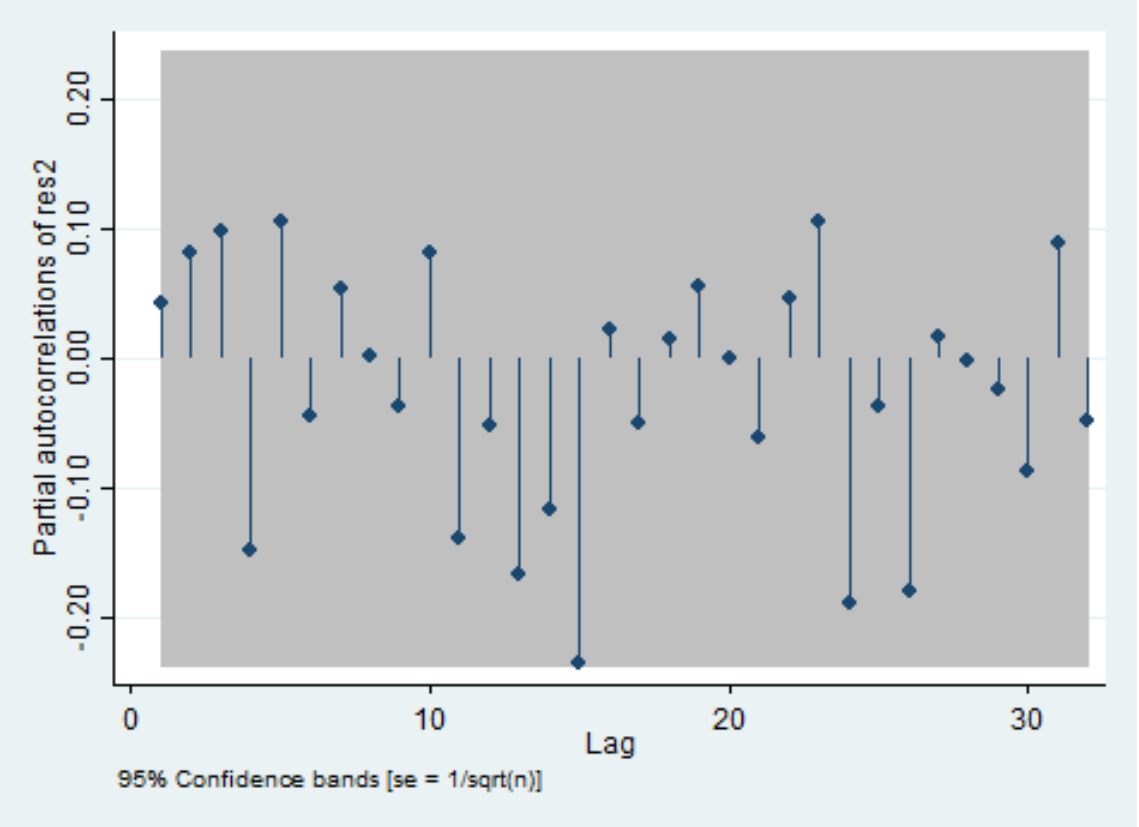
Supplementary material 10: Response residuals with Sine/cosine functions (Fourier series) in the model.



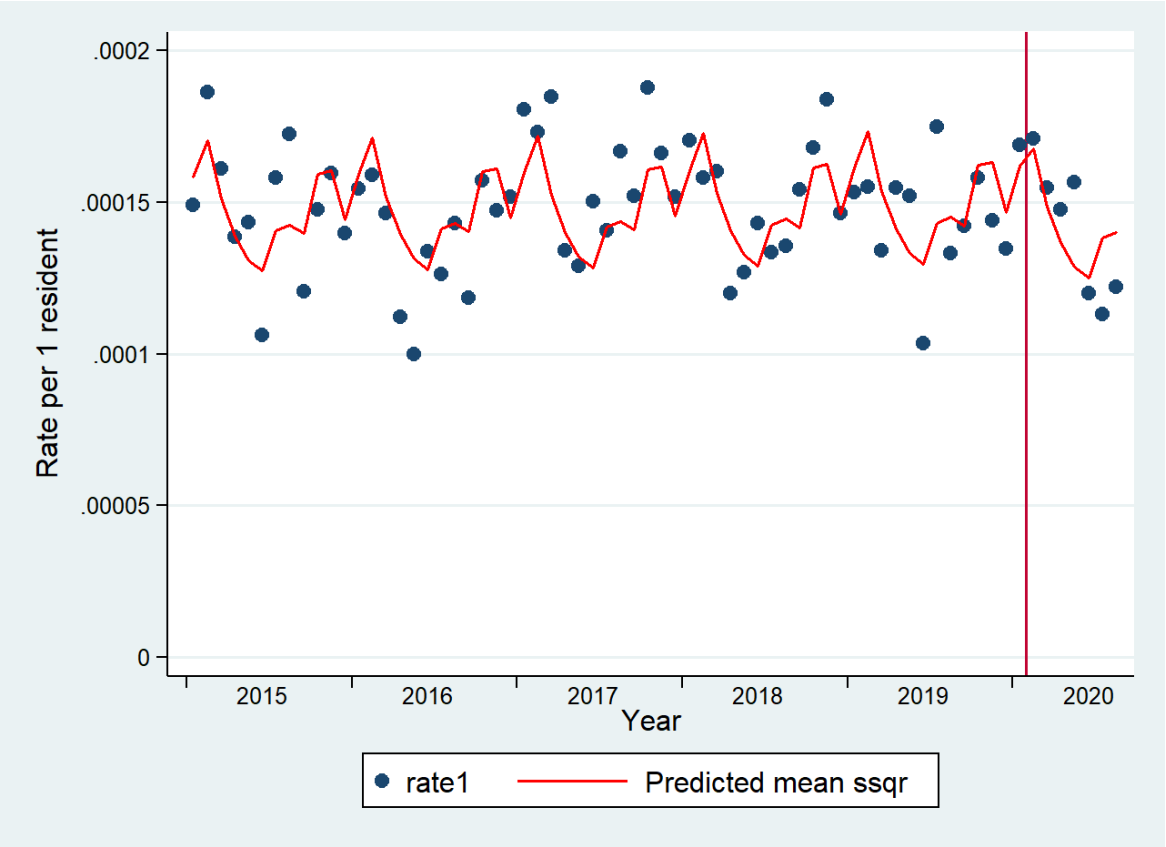
Supplementary material 11: Autocorrelation of residuals with Sine/cosine functions (Fourier series) in the model.



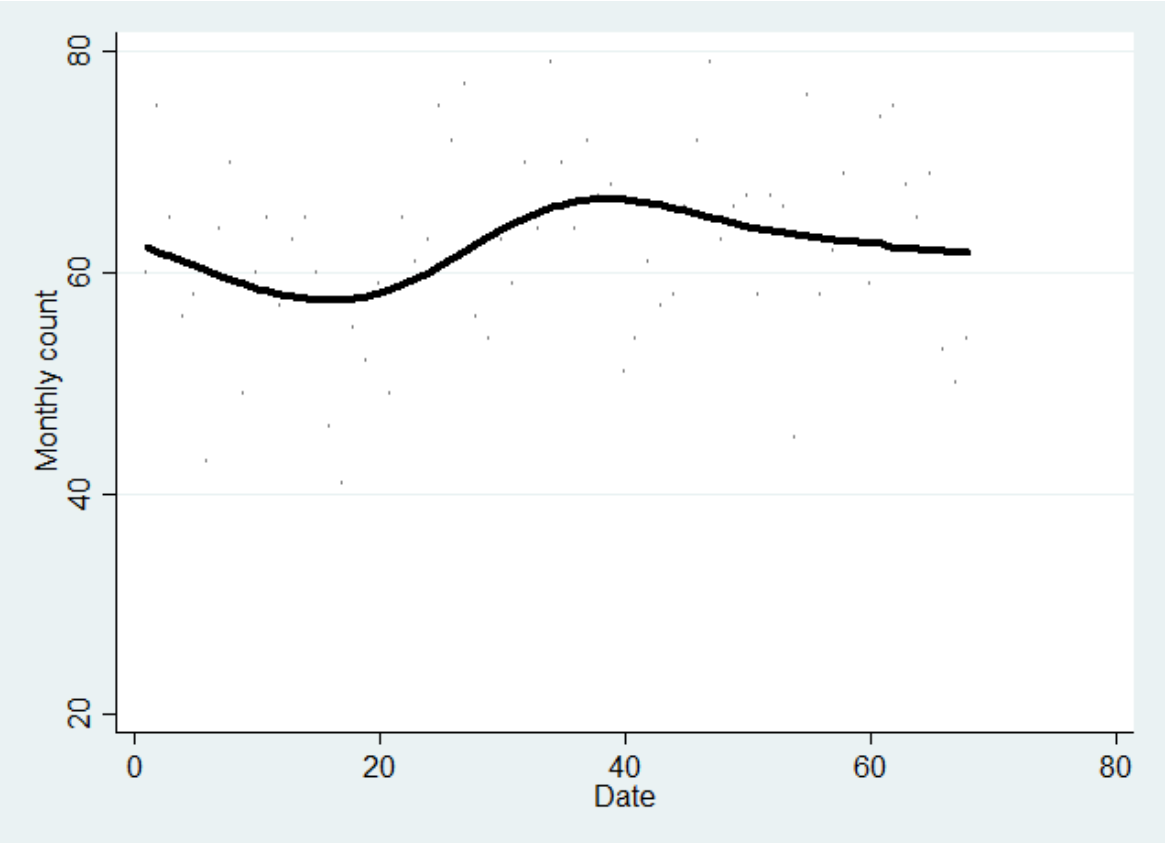
Supplementary material 12: Partial autocorrelation of residuals with Sine/cosine functions (Fourier series) in the model.



Supplementary material 13: Suspected suicide rate per one Queensland resident (same scale as count), seasonally-adjusted model, Jan 1 2015 – Aug 31, 2020.



Supplementary material 14: Flexible cubic spline model.



Supplementary material 15: Models assessing the impact of the COVID-19 Public Health Emergency Declaration on suspected suicide rates.

Model	Variables	RR	OIM *SE*	z	*p*	95% CI LL	95% CI UL
Unadjusted Poisson regression model	Post-COVID-19	0·94	0·06	-1·10	0·27	0·83	1·05
	Elapsed months	1·00	0·00	0·34	0·73	1·00	1·00
	Constant	0·00	0·00	-265·29	0·00	0·00	0·00
	Log of population	1·00	(offset)				
Poisson regression model with scale parameter set to X2 to account for overdispersion.	Post-COVID-19	0·94	0·06	-1·00	0·32	0·82	1·06
	Elapsed months	1·00	0·00	0·31	0·76	1·00	1·00
	Constant	0·00	0·00	-241·78	0·00	0·00	0·00
	Log of population	1·00	(offset)				
Poisson regression model with scale parameter set to X2 and adjusted for seasonality with Fourier terms (1 fundamental, 3 harmonic)	Post-COVID-19	0·96	0·06	-0·67	0·50	0·86	1·08
	Cosine term 1	1·10	0·02	4·47	0·00	1·05	1·14
	Cosine term 2	0·97	0·02	-1·72	0·09	0·93	1·01
	Cosine term 3	0·97	0·02	-1·59	0·11	0·93	1·01
	Cosine term 4	0·96	0·02	-2·09	0·04	0·92	1·00
	Sine term 1	1·01	0·02	0·65	0·52	0·97	1·05
	Sine term 2	1·02	0·02	1·14	0·26	0·98	1·06
	Sine term 3	0·97	0·02	-1·31	0·19	0·94	1·01
	Sine term 4	1·00	0·02	-0·22	0·82	0·96	1·04
	Elapsed months	1·00	0·00	0·42	0·68	1·00	1·00
	Constant	0·00	0·00	-283·42	0·00	0·00	0·00
	Log of population	1·00	(offset)				
Poisson regression model with scale parameter set to X2, adjusted for seasonality with Fourier terms and pre-exposure trends with restricted cubic splines	Post-COVID-19	1·02	0·11	0·19	0·85	0·83	1·25
	Cosine term 1	1·10	0·02	4·65	0·00	1·06	1·15
	Cosine term 2	0·97	0·02	-1·62	0·10	0·93	1·01
	Cosine term 3	0·97	0·02	-1·53	0·13	0·93	1·01
	Cosine term 4	0·96	0·02	-2·10	0·04	0·92	1·00
	Sine term 1	1·01	0·02	0·39	0·70	0·97	1·05
	Sine term 2	1·02	0·02	1·09	0·28	0·98	1·06
	Sine term 3	0·97	0·02	-1·33	0·18	0·94	1·01
	Sine term 4	1·00	0·02	-0·20	0·84	0·96	1·03
	Spline 1	0·99	0·01	-1·42	0·16	0·98	1·00
	Spline 2	1·06	0·03	1·90	0·06	1·00	1·13
	Spline 3	0·84	0·08	-1·88	0·06	0·70	1·01
	Spline 4	1·21	0·16	1·45	0·15	0·94	1·55
	Elapsed months	1·00	(omitted)				
	Constant	0·00	0·00	-153·69	0·00	0·00	0·00
	Log of population	1·00	(offset)				
Poisson regression model with scale parameter set to X2, adjusted for seasonality with Fourier terms and pre-exposure trends with restricted cubic splines in men	Post-COVID-19	1·08	0·14	0·59	0·56	0·84	1·38
	Cosine term 1	1·12	0·03	4·48	0·00	1·07	1·18
	Cosine term 2	0·97	0·02	-1·04	0·30	0·93	1·02
	Cosine term 3	0·96	0·02	-1·51	0·13	0·92	1·01
	Cosine term 4	0·96	0·02	-1·58	0·11	0·92	1·01
	Sine term 1	1·01	0·03	0·31	0·76	0·96	1·06
	Sine term 2	1·05	0·03	1·86	0·06	1·00	1·10
	Sine term 3	0·98	0·02	-0·76	0·45	0·94	1·03
	Sine term 4	1·00	0·02	-0·06	0·96	0·95	1·05
	Spline 1	0·99	0·01	-1·28	0·20	0·98	1·00
	Spline 2	1·08	0·04	1·92	0·06	1·00	1·17
	Spline 3	0·80	0·09	-1·94	0·05	0·64	1·00
	Spline 4	1·27	0·20	1·51	0·13	0·93	1·73
	Elapsed months	1	(omitted)				
	Constant	0·00	0·00	-119·10	0·00	0·00	0·00
	Log of population	1·00	(offset)				
Poisson regression model with scale parameter set to X2, adjusted for seasonality with Fourier terms and pre-exposure trends with restricted cubic splines in women	Post-COVID-19	0·84	0·19	-0·77	0·44	0·53	1·32
	Cosine term 1	1·04	0·05	0·84	0·40	0·95	1·14
	Cosine term 2	0·94	0·04	-1·27	0·20	0·86	1·03
	Cosine term 3	0·99	0·04	-0·24	0·81	0·91	1·08
	Cosine term 4	0·95	0·04	-1·12	0·26	0·87	1·04
	Sine term 1	1·01	0·05	0·15	0·88	0·92	1·10
	Sine term 2	0·95	0·04	-1·28	0·20	0·87	1·03
	Sine term 3	0·95	0·04	-1·24	0·22	0·87	1·03
	Sine term 4	0·99	0·04	-0·32	0·75	0·91	1·07
	Spline 1	1·00	0·01	-0·38	0·71	0·97	1·02
	Spline 2	1·01	0·07	0·18	0·86	0·88	1·17
	Spline 3	0·98	0·20	-0·10	0·92	0·66	1·47
	Spline 4	1·01	0·29	0·03	0·98	0·57	1·77
	Elapsed months	1·00	(omitted)				
	Constant	0·00	0·00	-75·72	0·00	0·00	0·00
	Log of population	1·00	(offset)				

Notes. 95% CI LL and UL = 95% confidence interval lower limit and upper limit. Post-COVID-19 = After the public health emergency declaration on Jan 29 2020 (Suspected suicide rate in February onwards). RR: Rate ratio. OIM *SE*: observed information matrix standard errors. *p* = p-value.

Supplementary material 16: Sensitivity analyses assessing the impact of the COVID-19 Public Health Emergency Declaration on suspected suicide rates in negative binomial regressions

Model	Variables	RR	OIM SE	z	p	95% CI LL	95% CI UL
Negative binomial regression of the main analysis, adjusted for seasonality and non-linear trends.	Post-COVID-19	1·02	0·95	0·02	0·98	0·17	6·28
	Cosine term 1	1·10	0·20	0·54	0·59	0·78	1·56
	Cosine term 2	0·97	0·17	-0·18	0·85	0·68	1·37
	Cosine term 3	0·97	0·17	-0·17	0·86	0·69	1·37
	Cosine term 4	0·96	0·17	-0·25	0·80	0·68	1·35
	Sine term 1	1·01	0·18	0·05	0·96	0·71	1·44
	Sine term 2	1·02	0·18	0·14	0·89	0·73	1·44
	Sine term 3	0·97	0·17	-0·16	0·87	0·69	1·37
	Sine term 4	0·99	0·17	-0·04	0·97	0·71	1·39
	Spline 1	0·99	0·04	-0·17	0·86	0·91	1·08
	Spline 2	1·07	0·31	0·23	0·82	0·61	1·87
	Spline 3	0·83	0·68	-0·22	0·83	0·17	4·15
	Spline 4	1·21	1·39	0·17	0·87	0·13	11·47
	Elapsed months	1	(omitted)				
	Constant	0·00	0·00	-17·61	0·00	0·00	0·00
	Log of population	1	(offset)				
Negative binomial regression of the primary Poisson regression analysis, with scale parameter set to X2 to account for autocorrelation, adjusted for seasonality and non-linear trends	Post-COVID-19	1·02	0·11	0·19	0·85	0·83	1·26
	Cosine term 1	1·10	0·02	4·62	0·00	1·06	1·15
	Cosine term 2	0·97	0·02	-1·59	0·11	0·93	1·01
	Cosine term 3	0·97	0·02	-1·49	0·14	0·93	1·01
	Cosine term 4	0·96	0·02	-2·15	0·03	0·92	1·00
	Sine term 1	1·01	0·02	0·43	0·67	0·97	1·05
	Sine term 2	1·02	0·02	1·17	0·24	0·98	1·06
	Sine term 3	0·97	0·02	-1·37	0·17	0·94	1·01
	Sine term 4	0·99	0·02	-0·31	0·76	0·96	1·03
	Spline 1	0·99	0·01	-1·47	0·14	0·98	1·00
	Spline 2	1·07	0·04	1·94	0·05	1·00	1·14
	Spline 3	0·83	0·08	-1·90	0·06	0·69	1·01
	Spline 4	1·21	0·16	1·45	0·15	0·93	1·57
	Elapsed months	1·00	(omitted)				
	Constant	0·00	0·00	-151·46	0·00	0·00	0·00
	Log of population	1	(offset)				

Notes. 95% CI LL and UL = 95% confidence interval lower limit and upper limit. Post-COVID-19 = After the public health emergency declaration on Jan 29 2020 (Suspected suicide rate in February onwards). RR: Rate ratio. OIM *SE*: observed information matrix standard errors. *p* = p-value.

Supplementary material 17. Comma-separated dataset

year,month,elapsedmonth,covid19,ssqr,pop,pre_exposure,season,ssqr_men,ssqr_women,pop_men,pop_women,rate,logpop,rcspline1,rcspline2,rcspline3,rcspline4,rate_men,rate_women,logpop_men,logpop_women,rate1,pred,pred1,res,degrees,xb_fourier,fitted_fourier,res2,pred2,pred3,xb_rcspline,fitted_rcspline,cos_1,sin_1,cos_2,sin_2,cos_3,sin_3,cos_4,sin_4

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2019,5,53,0,66,433724.97,53,2,51,15,213789.75,220851.41,15.217016,12.980165,53,31.738247,11.291565,1.8029426,23.855213,6.7918968,12.272748,12.305245,15.217016,.00014950756,,1.1548703,1590,4.0554614,57.711784,8.288228,13.306081,14.868619,4.1524677,63.590733,-.86602539,.5,.5,-.86602539,1.4689571e-15,1,-.5,-.86602539

2019,6,54,0,45,434323.75,54,3,35,10,214062.75,221179.81,10.360934,12.981545,54,33.721298,12.285146,2.0920119,16.350346,4.5212083,12.274024,12.306731,10.360934,.00014955457,,-19.955101,1620,4.0299897,56.260334,-11.260327,12.953547,14.873955,4.1497626,63.418945,-1,1.1021821e-15,1,-2.2043643e-15,-1,6.8592601e-15,1,-4.4087286e-15

2019,7,55,0,76,434909.31,55,3,62,14,214322.34,221502.66,17.474907,12.982893,55,35.75988,13.317022,2.4002297,28.928389,6.320466,12.275236,12.308189,17.474907,.00014960162,,10.936852,1650,4.1299996,62.177902,13.822112,14.296746,14.879294,4.147306,63.263336,-.86602539,-.5,.5,.86602539,-1.2249563e-14,-1,-.5,.86602539

2019,8,56,0,58,435500.03,56,3,40,18,214584.56,221828.39,13.318025,12.98425,56,37.848446,14.383367,2.7256804,18.640671,8.1143808,12.276459,12.309659,13.318025,.00014964867,,-7.1719956,1680,4.1456337,63.157631,-5.1576214,14.502324,14.884635,4.145112,63.124695,-.5,-.86602539,-.5,.86602539,1,-3.4290111e-15,-.5,-.86602539

2019,9,57,0,62,436095.88,57,4,47,15,214849.39,222156.98,14.217057,12.985618,57,39.981434,15.480348,3.0664499,21.87579,6.7519822,12.277693,12.311139,14.217056,.00014969574,,-3.2817111,1710,4.1275868,62.028057,-.028049758,14.223486,14.889977,4.1431537,63.001194,-2.9397712e-15,-1,-1,5.8795424e-15,8.8193138e-15,1,1,-1.1759085e-14

2019,10,58,0,69,436644.06,58,4,51,18,215079.09,222474.81,15.802344,12.986874,58,42.153297,16.604136,3.4206231,23.712208,8.0908031,12.278761,12.31257,15.802345,.00014974283,,3.6156847,1740,4.2596984,70.788628,-1.7886356,16.211977,14.89532,4.1412802,62.88327,.5,-.86602539,-.5,-.86602539,-1,1.4209616e-14,-.5,.86602539

2019,11,59,0,63,437199.03,59,4,44,19,215312.27,222796.3,14.409913,12.988144,59,44.358479,17.750902,3.7862849,20.435436,8.5279694,12.279844,12.314013,14.409913,.00014978992,,-2.4880173,1770,4.2670374,71.310059,-8.3100729,16.310663,14.900666,4.1395898,62.777065,.86602539,-.5,.5,-.86602539,8.8217897e-15,-1,-.5,-.86602539

2019,12,60,0,59,437760.81,60,1,44,15,215548.88,223121.45,13.477679,12.989428,60,46.591427,18.916817,4.161521,20.413004,6.722796,12.280943,12.315472,13.47768,.00014983704,,-6.5927596,1800,4.1627212,64.246109,-5.2460999,14.67608,14.906014,4.1380534,62.680691,1,-1.2246468e-15,1,-2.4492936e-15,1,-1.0779368e-14,1,-4.8985872e-15

2020,1,61,0,74,438377.94,61,1,59,15,216166.02,223738.59,16.880411,12.990837,61,48.846588,20.098049,4.5444164,27.293837,6.7042522,12.283802,12.318233,16.880411,.00014988417,,8.2940598,1830,4.2622733,70.971138,3.0288656,16.189478,14.911365,4.1367555,62.599384,.86602539,.5,.5,.86602539,1.6169671e-14,1,-.5,.86602539

2020,2,62,1,75,438995.09,,,65,10,216783.16,224355.73,17.084473,12.992244,62,51.118412,21.290771,4.9330564,29.983879,4.4572072,12.286653,12.320988,17.084475,.0001405056,.00014993131,13.318715,1860,4.2977023,73.530647,1.4693533,16.749762,14.351927,4.1305614,62.212837,.5,.86602539,-.5,.86602539,-1,-6.8617360e-15,-.5,-.86602539

2020,3,63,1,68,439612.22,,,49,19,217400.31,224972.88,15.468178,12.993649,63,53.401337,22.491152,5.3255258,22.539066,8.4454622,12.289495,12.323735,15.468178,.00014054979,.00014997847,6.2125783,1890,4.1785607,65.271843,2.7281692,14.847589,14.357079,4.1293993,62.140583,-4.9047771e-16,1,-1,-9.8095542e-16,1.4714331e-15,-1,1,1.9619108e-15

2020,4,64,1,65,440229.38,,,47,18,218017.45,225590.02,14.76503,12.995051,64,55.689819,23.695362,5.7199097,21.557907,7.9790764,12.292331,12.326474,14.76503,.000140594,.00015002565,3.1063766,1920,4.0968146,60.148388,4.8516035,13.662965,14.362231,4.128263,62.070015,-.5,.86602539,-.5,-.86602539,1,-3.9188699e-15,-.5,.86602539

2020,5,65,1,69,440846.5,,,55,14,218634.59,226207.16,15.651707,12.996452,65,57.979225,24.900211,6.1146131,25.156128,6.1890173,12.295157,12.329206,15.651707,.00014063822,.00015007284,7.0001111,1950,4.037456,56.681961,12.318045,12.857522,14.367385,4.1271296,61.999699,-.86602539,.5,.5,-.86602539,-4.9016823e-15,1,-.5,-.86602539

2020,6,66,1,53,441463.66,,,37,16,219251.73,226824.3,12.005518,12.997851,66,60.268635,26.105061,6.5093164,16.87558,7.0539179,12.297976,12.331931,12.005519,.00014068246,.00015012003,-9.1062183,1980,4.0120034,55.257465,-2.2574642,12.516872,14.372542,4.1259947,61.929379,-1,4.8998251e-15,1,-9.7996503e-15,-1,4.8862075e-16,1,-1.9599301e-14

2020,7,67,1,50,442080.78,,,40,10,219868.88,227441.44,11.31015,12.999248,67,62.558041,27.30991,6.9040198,18.192661,4.3967361,12.300787,12.334648,11.31015,.00014072671,.00015016725,-12.212553,2010,4.112062,61.072517,-11.072512,13.814791,14.377701,4.1248565,61.858929,-.86602539,-.5,.5,.86602539,-5.8789236e-15,-1,-.5,.86602539

2020,8,68,1,54,442697.94,,,44,10,220486.02,228058.58,12.197933,13.000643,68,64.84745,28.514759,7.2987232,19.955914,4.3848386,12.30359,12.337358,12.197933,.00014077098,.0001502145,-8.3190098,2040,4.1277342,62.037197,-8.0371943,14.013439,14.382861,4.1237178,61.788532,-.5,-.86602539,-.5,.86602539,1,2.9416283e-15,-.5,-.86602539

Supplementary material 17: Stata code for all analyses

This analysis adapts syntax from:

Bernal JL, Cummins S, Gasparrini A. Interrupted time series regression for the evaluation of public health interventions: A tutorial. International Journal of Epidemiology 2017; 46: 348-355. https://doi.org/10.1093/ije/dyw098

Bhaskaran K, Gasparrini A, Hajat S, Smeeth L, Armstrong B. Time series regression studies in environmental epidemiology. International Journal of Epidemiology 2013; 42: 1187-1195. https://doi.org/10.1093/ije/dyt092

```
**********

* Descriptive analyses *

**********


*scatterplot of pre-exposure counts:


twoway (scatter ssqr elapsedmonth) if covid19==0, title("Suspected suicides of Queensland residents, Jan 1 2015 – Jan 31 2020") ytitle(Monthly count) yscale(range(0 .)) ylabel(#5, labsize(small) angle(horizontal)) ///

xtick(0.5(12)60.5) xlabel(6"2015" 18"2016" 30"2017" 42"2018" 54"2019" 66"2020", noticks labsize(small)) xtitle(Year)


*creation of seasons variable:

label define seasonl 1 "Summer" 2 "Autumn" 3 "Winter" 4 "Spring"


label values season season1


*We converted the counts into a suspected suicide rate and examined a scatter plot of the pre-exposure rate:

gen rate = ssqr/pop*10^5


*descriptive statistics for seasonality variable:

bysort season: summ ssqr

bysort season: summ rate


twoway (scatter rate elapsedmonth) if covid19==0, title("Monthly rate of suspected suicides per 100000 Queensland residents, Jan 1 2015 – Jan 31 2020") ytitle(Monthly rate per 100000 residents) yscale(range(0 .)) ylabel(#5, labsize(small) angle(horizontal)) ///

xtick(0.5(12)60.5) xlabel(6"2015" 18"2016" 30"2017" 42"2018" 54"2019" 66"2020", noticks labsize(small)) xtitle(Year)
```

*Summary statistics for before and after the exposure:

summ, detail

bysort covid19: summ ssqr

bysort covid19: summ rate

****

* Poisson regression model *

****

/* We chose a level change nd we also use a Poisson model as we are using count data

We modelled the count data directly (rather than the rate which doesn't follow a Poisson distribution)

We then used the age-standardised estimated resident population (log transformed) as an offset variable to transform back to rates */

*log transform the population:

gen logpop = log(pop)

*Checking for overdispersion

tabstat ssqr, statistics(mean var)

*we hypothesised a level change in that while suicide mortality usually decreases going into winter, COVID-19 might create a 'harvest' effect by bringing forward some suicides that would have occurred later, thus making the change level instead of a decrease.

*Poisson regression with the outcome (ssqr). Time and population offset also in model. First run without scale parameter set to x2

glm ssqr covid19 elapsedmonth, family(poisson) link(log) offset(logpop) eform

glm ssqr covid19 elapsedmonth, family(poisson) link(log) offset(logpop) scale(x2) eform

*We generated predicted values based on the model to create a plot of the model:

predict pred, nooffset

*We transformed rate to be in the same scale as the count in the model */

gen rate1 = ssqr/pop

*We then plotted this in a scatter graph:

twoway (scatter rate1 elapsedmonth) (line pred elapsedmonth, lcolor(red)) , title("Suspected suicide rate per one Queensland resident (same scale as count), Jan 1 2015 – Aug 31 2020") ///

ytitle(Monthly rate per 1) yscale(range(0 .)) ylabel(#5, labsize(small) angle(horizontal)) ///

xtick(0.5(12)60.5) xlabel(6"2015" 18"2016" 30"2017" 42"2018" 54"2019" 66"2020", noticks labsize(small)) xtitle(Year) ///

xline(61.5)

*Generate the counterfactual by removing the effect of the exposure (_b[covid19]) for the post-exposure period.

```
gen pred1 = pred/exp(_b[covid19]) if covid19==1

*Add the counterfactual to the plot

twoway (scatter rate1 elapsedmonth) (line pred elapsedmonth, lcolor(red)) (line pred1 elapsedmonth, lcolor(red) lpattern(dash)),
title("Suspected suicide rate per 1 Queensland resident, Jan 1 2015 – Aug 31 2020") ///

ytitle(Monthly rate per 1) yscale(range(0 .)) ylabel(#5, labsize(small) angle(horizontal)) ///

xtick(0.5(12)60.5) xlabel(6"2015" 18"2016" 30"2017" 42"2018" 54"2019" 66"2020", noticks labsize(small)) xtitle(Year) ///

xline(61.5)

* (b) Model checking and autocorrelation

*Check the residuals by plotting against time

predict res, r

twoway (scatter res elapsedmonth)(lowess res elapsedmonth),yline(0) ytitle(Residual value)

*Further check for autocorrelation by examining the autocorrelation and partial autocorrelation functions

tsset elapsedmonth

ac res

pac res, yw

* (c) Adjusting for seasonality.

*Periodic functions (Fourier terms):

* We installed the "circular" package.

*we created a degrees variable for time divided by the number of time points in a year (12 for months in this instance)

gen degrees=(elapsedmonth/12)*360

*we then selected the number of sine/cosine pairs to include per Bhaskaran et al., 2013 - with 3 harmonics:

fourier degrees, n(4)

*(b) Added to the model to capture the seasonality:

glm ssqr covid19 cos* sin* elapsedmonth, family(poisson) link(log) offset(logpop) scale(x2) eform

*(c) Plot the raw outcome data and the fitted model over time per Bhaskaran et al. 2013.

predict xb_fourier, xb

gen fitted_fourier =exp(xb_fourier)
```

```
graph twoway scatter ssqr elapsedmonth, msize(tiny) mc(gs8) ylabel(20 40 60 80) ///
    || line fitted_fourier elapsedmonth, lc(black) lw(thick) xtick(0.5(12)60.5) xlabel(6"2015" 18"2016" 30"2017" 42"2018" 54"2019" 66"2020", noticks labsize(small)) xtitle(Year) ytitle(Count) ///
    name(fourier, replace) legend(off) title("Sine/cosine functions (Fourier series)")

*we again checked for autocorrelation
predict res2, r

twoway (scatter res2 elapsedmonth)(lowess res2 elapsedmonth),yline(0) ytitle(Residual value)
tsset elapsedmonth
ac res2
pac res2, yw

*predict seasonally adjusted model**
predict pred2, nooffset

*Plot of seasonally adjusted model**
twoway (scatter rate1 elapsedmonth) (line pred2 elapsedmonth, lcolor(red)), title("Suspected suicide rate per 1 Queensland resident (same scale as count), seasonally-adjusted model, Jan 1 2015 – Aug 31 2020") ///
ytitle(Rate per 1 resident) yscale(range(0 .)) ylabel(#5, labsize(small) angle(horizontal)) ///
xtick(0.5(12)60.5) xlabel(6"2015" 18"2016" 30"2017" 42"2018" 54"2019" 66"2020", noticks labsize(small)) xtitle(Year) ///
xline(61.5)

/*We plotted a straight line as if all months were the average to produce a 'deseasonalised' trend to more clearly see the change graphically in the seasonally-adjusted model. */

egen avg_cos_1 = mean(cos_1)
egen avg_sin_1 = mean(sin_1)
egen avg_cos_2 = mean(cos_2)
egen avg_sin_2 = mean(sin_2)
egen avg_cos_3 = mean(cos_3)
egen avg_sin_3 = mean(sin_3)
egen avg_cos_4 = mean(cos_4)
egen avg_sin_4 = mean(sin_4)

drop cos* sin*

rename avg_cos_1 cos_1
rename avg_sin_1 sin_1
rename avg_cos_2 cos_2
rename avg_sin_2 sin_2
rename avg_cos_3 cos_3
```

```
rename avg_sin_3 sin_3

rename avg_cos_4 cos_4

rename avg_sin_4 sin_4


*We then added this to the plot as a dashed line

predict pred3, nooffset


twoway (scatter rate1 elapsedmonth) (line pred2 elapsedmonth, lcolor(red)) (line pred3 elapsedmonth, lcolor(red) lpattern(dash)),
title("Suspected suicide rate per 1 Queensland resident, Jan 1 2015 – Aug 31 2020") ///

ytitle(Rate per 1 resident) yscale(range(0 .)) ylabel(#5, labsize(small) angle(horizontal)) ///

xtick(0.5(12)60.5) xlabel(6"2015" 18"2016" 30"2017" 42"2018" 54"2019" 66"2020", noticks labsize(small)) xtitle(Year) ///

xline(61.5)


*We expressed this per 100,000 Queensland residents, in keeping with the literature.


foreach var of varlist rate1 pred2 pred3 {

replace `var' = `var' * 10^5

}


twoway (scatter rate1 elapsedmonth) ///

(line pred2 elapsedmonth, lcolor(red)) ///

(line pred3 elapsedmonth, lcolor(red) lpattern(dash)), ///

ytitle("Suspected suicide rate per 100 000 Queensland residents") yscale(range(0 20)) ylabel(#5, labsize(small) angle(horizontal)) ///

xtick(0.5(12)60.5) xlabel(6 "2015" 18 "2016" 30 "2017" 42 "2018" 54 "2019" 66 "2020", noticks labsize(small)) ///

xtitle(Year) xline(61.5) ///

legend(label(1 "Observed suspected suicide rate") label(2 "Seasonally-adjusted rate per 100 000 Queensland residents") ///

label(3 "Unadjusted rate per 100 000 Queensland residents") order(1 3 2) cols(1))


*Flexible spline function to account for non-linearities in pre-exposure trends:

*(a) We created a basis for the spline from the pre-exposure period with five equally spaced reference points

mkspline rcspline = elapsedmonth, cubic

*(b) Fit in the model

glm ssqr covid19 rcspline* elapsedmonth, family(poisson) link(log) offset(logpop) scale(x2) eform


*(c) Plot the raw outcome data and the fitted model over time

predict xb_rcspline, xb


gen fitted_rcspline =exp(xb_rcspline)


graph twoway scatter ssqr elapsedmonth, msize(tiny) mc(gs8) ylabel(20 40 60 80) ///

        || line fitted_rcspline elapsedmonth, lc(black) lw(thick) xtitle(Date) ytitle(Monthly count) ///
```

```
    name(spline, replace) legend(off) title("Flexible cubic spline model")

*We restored the Fourier terms that we previously changed:
drop cos* sin*
fourier degrees, n(4)

*We tested the model with Fourier terms and restricted cubic splines:
glm ssqr covid19 cos* sin* rcspline* elapsedmonth, family(poisson) link(log) offset(logpop) scale(x2) eform

*Stratification of main analysis by sex:

*We converted male and female counts into suspected suicide rates:
gen rate_men = ssqr_men/pop_men*10^5
gen rate_women = ssqr_women/pop_women*10^5

*We then used the age-standardised estimated resident population (log transformed) as an offset variable to transform back to rates */

*log transform the population:
gen logpop_men = log(pop_men)
gen logpop_women = log(pop_women)

*main analysis:
glm ssqr_men covid19 cos* sin* rcspline* elapsedmonth, family(poisson) link(log) offset(logpop_men) scale(x2) eform
glm ssqr_women covid19 cos* sin* rcspline* elapsedmonth, family(poisson) link(log) offset(logpop_women) scale(x2) eform

*Sensitivity analyses:

*Negative binomial regression of main analysis:
glm ssqr covid19 cos* sin* rcspline* elapsedmonth, family(nbinomial 1) link(log) offset(logpop) eform
*Adjusted for potential autocorrelation:
glm ssqr covid19 cos* sin* rcspline* elapsedmonth, family(nbinomial 1) link(log) scale(x2) offset(logpop) eform

*Analysis of motives/triggers for suspected suicides for pre-COVID period vs post-COVID period:

*2015 to 2019 average vs 2020 proportions for recent or pending unemployment:
csi 32 184 402 2879, tb exact

*2015 to 2019 average vs 2020 proportions for financial problems:
csi 41 304 393 2759, tb exact

*2015 to 2019 average vs 2020 proportions for relationship breakdown:
```

csi 95 719 339 2344, tb exact

*2015 to 2019 average vs 2020 proportions for domestic violence:

csi 24 137 410 2926, tb exact

Supplementary material 19: The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data.

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
Title and abstract					
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	1	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	1, 2 2 Not applicable
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	4		
Objectives	3	State specific objectives, including any prespecified hypotheses	4		
Methods					
Study Design	4	Present key elements of study design early in the paper	4		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4-5		
Participants	6	*(a) Cohort study* - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up *Case-control study* - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls *Cross-sectional study* - Give the eligibility criteria, and the sources and methods of selection of participants *(b) Cohort study* - For matched studies, give matching criteria and number of exposed and unexposed *Case-control study* - For matched studies, give matching criteria and the number of controls per case	Not applicable Not applicable Not applicable Not applicable Not applicable	RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided. RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided. RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.	5 Not yet published Not applicable
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	5-6	RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	5
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement).	5 5 (same data source)		

		Describe comparability of assessment methods if there is more than one group			
Bias	9	Describe any efforts to address potential sources of bias	5		
Study size	10	Explain how the study size was arrived at	5		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	5-6		
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) *Cohort study* - If applicable, explain how loss to follow-up was addressed *Case-control study* - If applicable, explain how matching of cases and controls was addressed *Cross-sectional study* - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses	6, not applicable for confounding 5 Not applicable Not applicable Not applicable Supplementary materials		
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database population used to create the study population. RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	5 5
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	Not applicable
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (*e.g.*, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	Not applicable	RECORD 13.1: Describe in detail the selection of the persons included in the study (*i.e.*, study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	5
Descriptive data	14	(a) Give characteristics of study participants (*e.g.*, demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) *Cohort study* - summarise follow-up time (*e.g.*, average and total amount)	Table 1 Not applicable Not applicable		

Outcome data	15	*Cohort study* - Report numbers of outcome events or summary measures over time *Case-control study* - Report numbers in each exposure category, or summary measures of exposure *Cross-sectional study* - Report numbers of outcome events or summary measures	Not applicable Not applicable 6 (outcome events)		
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	6 Not applicable		
Other analyses	17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	7 and supplementary materials.		
Discussion					
Key results	18	Summarise key results with reference to study objectives	7		
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	8	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over time, as they pertain to the study being reported.	8
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	7-8		
Generalisability	21	Discuss the generalisability (external validity) of the study results	8		
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	6		
Accessibility of protocol, raw data, and programming code		..		RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	9

*Reference: Benchimol EI, Smeeth L, Guttmann A, Harron K, Moher D, Petersen I, Sørensen HT, von Elm E, Langan SM, the RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. PLoS Medicine 2015; 12: e1001885.