

**Supplementary Material**

**Substantial underdiagnosis and underreporting: changes in reported HIV and AIDS cases in 31 provinces in China at the beginning of COVID-19**

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Figure S1. Monthly numbers, trends, and fitted negative binominal segmented regression models for HIV cases in China and 31 provinces from January 2017 to December 2020 (Total-Guangxi)

The green lines indicate the negative binominal segmented regression models. The orange lines indicate the counterfactual models. The grey shaded areas indicate the period during the COVID-19 pandemic, from January 2020 to December 2020. NPIs: non-pharmaceutical interventions.

Figure S2. Monthly numbers, trends, and fitted negative binominal segmented regression models for HIV cases in China and 31 provinces from January 2017 to December 2020 (Guizhou-Inner Mongolia)

The green lines indicate the negative binominal segmented regression models. The orange lines indicate the counterfactual models. The grey shaded areas indicate the period during the COVID-19 pandemic, from January 2020 to December 2020. NPIs: non-pharmaceutical interventions.

Figure S3. Monthly numbers, trends, and fitted negative binominal segmented regression models for HIV cases in China and 31 provinces from January 2017 to December 2020 (Jiangsu-Shandong)

The green lines indicate the negative binominal segmented regression models. The orange lines indicate the counterfactual models. The grey shaded areas indicate the period during the COVID-19 pandemic, from January 2020 to December 2020. NPIs: non-pharmaceutical interventions.

Figure S4. Monthly numbers, trends, and fitted negative binominal segmented regression models for HIV cases in China and 31 provinces from January 2017 to December 2020 (Shanghai-Zhejiang)

The green lines indicate the negative binominal segmented regression models. The orange lines indicate the counterfactual models. The grey shaded areas indicate the period during the COVID-19 pandemic, from January 2020 to December 2020. NPIs: non-pharmaceutical interventions.

Figure S5. Monthly numbers, trends, and fitted negative binominal segmented regression models for AIDS cases in China and 31 provinces from January 2017 to December 2020 (Total-Guangxi)

The green lines indicate the negative binominal segmented regression models. The orange lines indicate the counterfactual models. The grey shaded areas indicate the period during the COVID-19 pandemic, from January 2020 to December 2020. NPIs: non-pharmaceutical interventions.

Figure S6. Monthly numbers, trends, and fitted negative binominal segmented regression models for AIDS cases in China and 31 provinces from January 2017 to December 2020 (Guizhou-Inner Mongolia)

The green lines indicate the negative binominal segmented regression models. The orange lines indicate the counterfactual models. The grey shaded areas indicate the period during the COVID-19 pandemic, from January 2020 to December 2020. NPIs: non-pharmaceutical interventions.

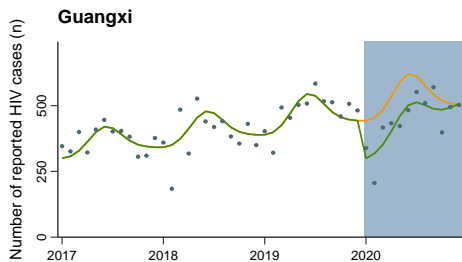
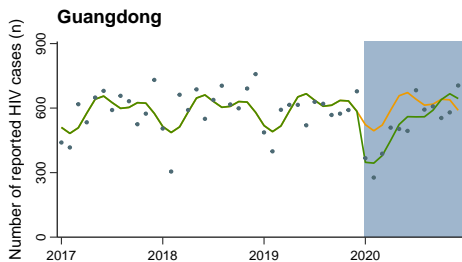
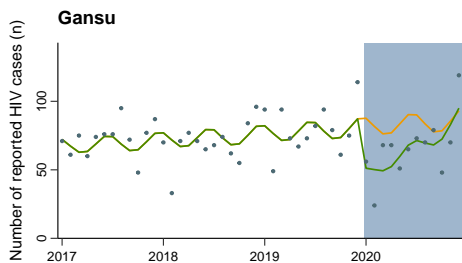
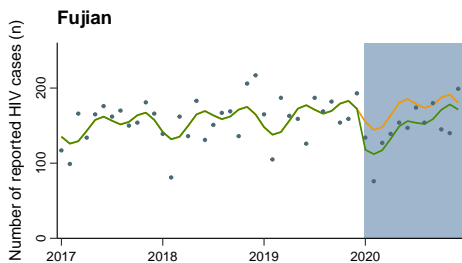
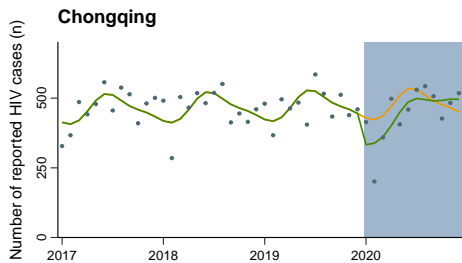
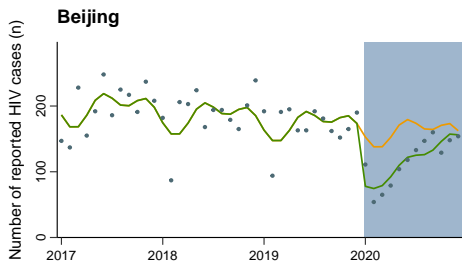
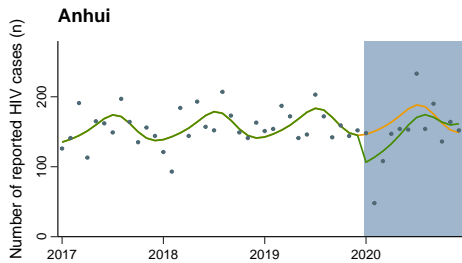
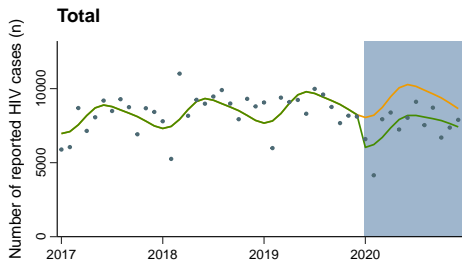
Figure S7. Monthly numbers, trends, and fitted negative binominal segmented regression models for AIDS cases in China and 31 provinces from January 2017 to December 2020 (Jiangsu-Shandong)

The green lines indicate the negative binominal segmented regression models. The orange lines indicate the counterfactual models. The grey shaded areas indicate the period during the COVID-19 pandemic, from January 2020 to December 2020. NPIs: non-pharmaceutical interventions.

Figure S8. Monthly numbers, trends, and fitted negative binominal segmented regression models for AIDS cases in China and 31 provinces from January 2017 to December 2020 (Shanghai-Zhejiang)

The green lines indicate the negative binominal segmented regression models. The orange lines indicate the counterfactual models. The grey shaded areas indicate the period during the COVID-19 pandemic, from January 2020 to December 2020. NPIs: non-pharmaceutical interventions.

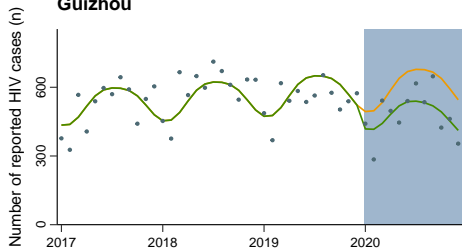
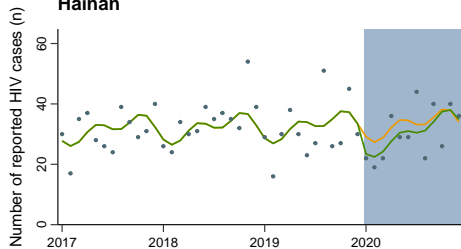
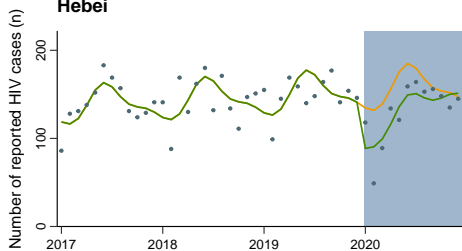
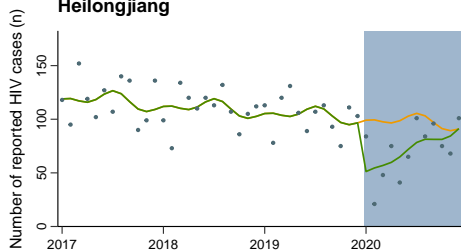
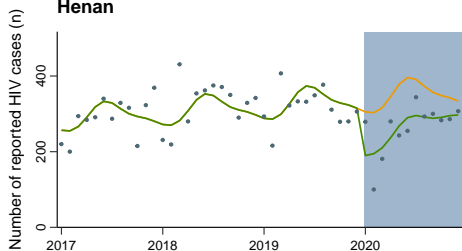
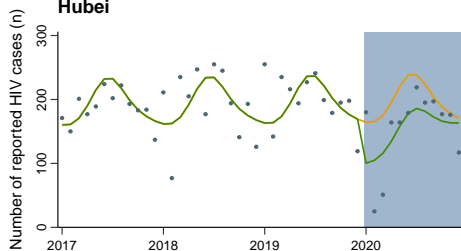
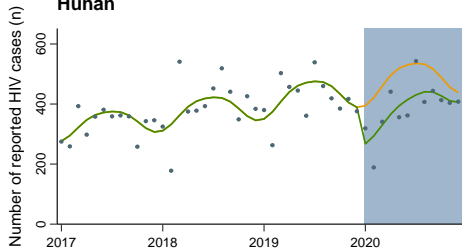
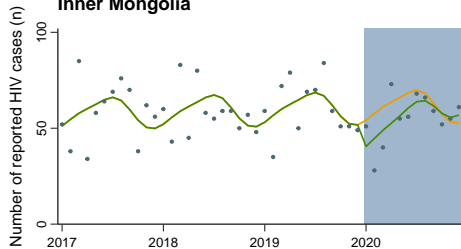
— Counterfactual scenario — Modelled trend — During NPIs



— Counterfactual scenario

— Modelled trend

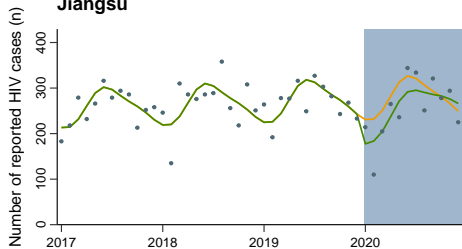
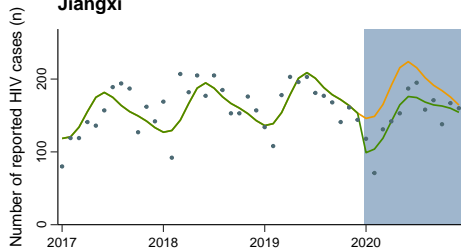
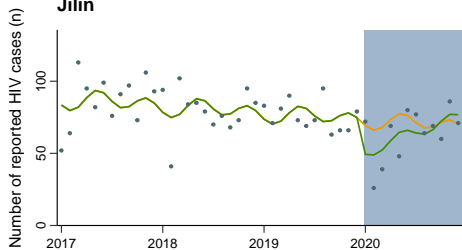
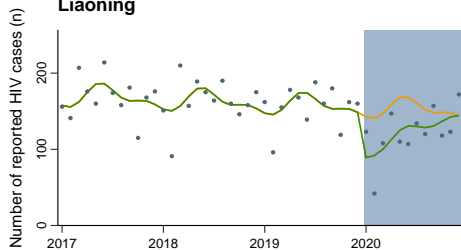
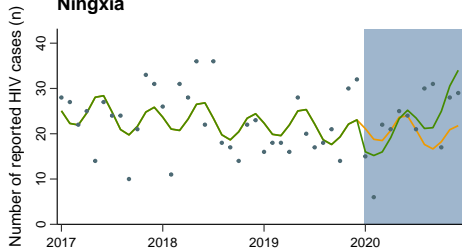
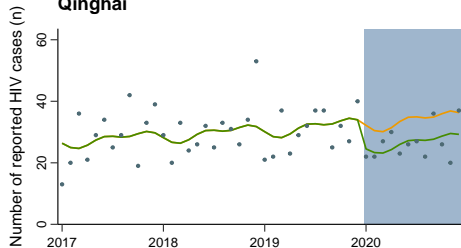
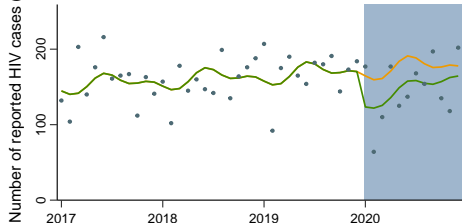
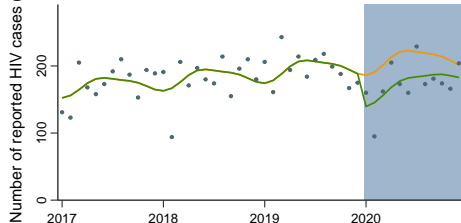
■ During NPIs

**Guizhou****Hainan****Hebei****Heilongjiang****Henan****Hubei****Hunan****Inner Mongolia**

— Counterfactual scenario

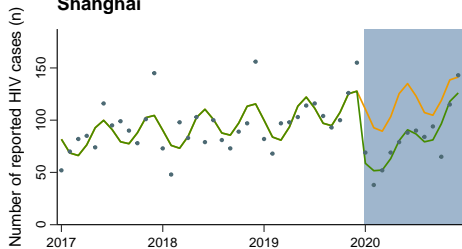
— Modelled trend

■ During NPIs

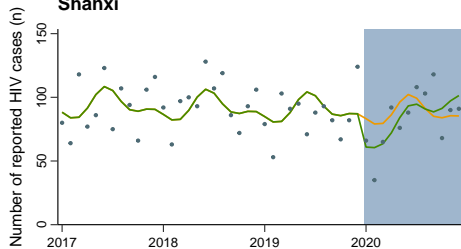
**Jiangsu****Jiangxi****Jilin****Liaoning****Ningxia****Qinghai****Shaanxi****Shandong**

— Counterfactual scenario — Modelled trend ■ During NPIs

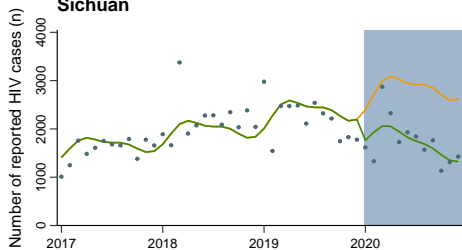
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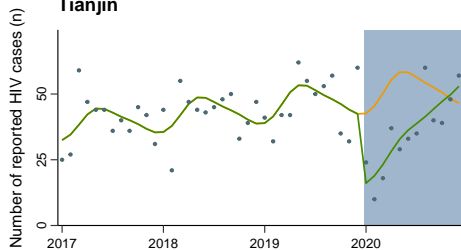
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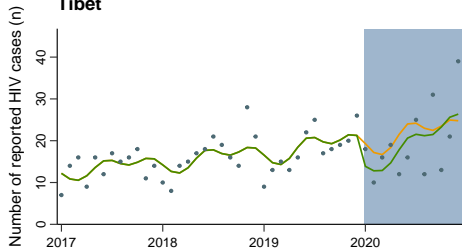
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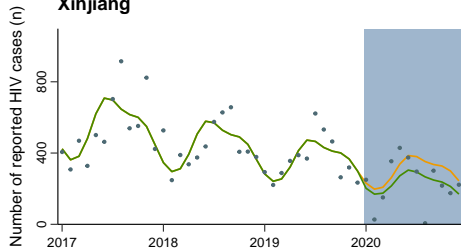
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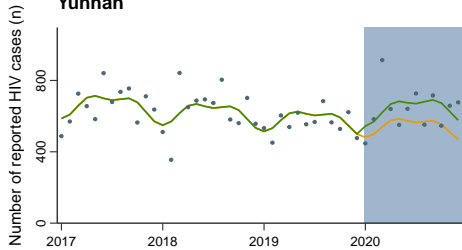
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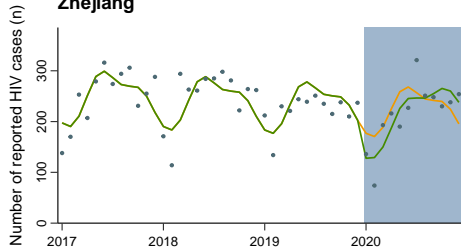
### Xinjiang



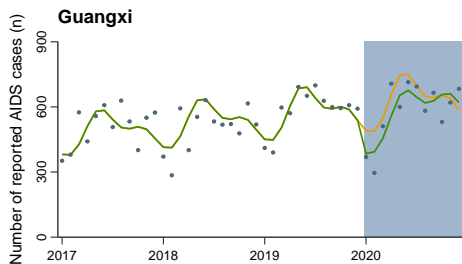
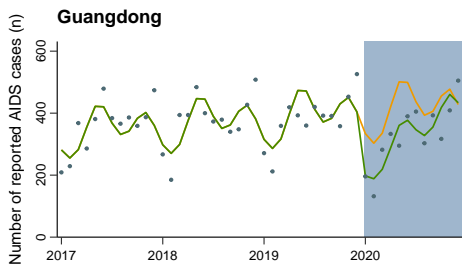
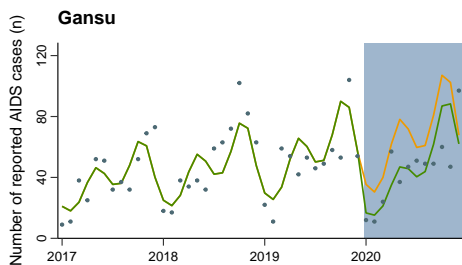
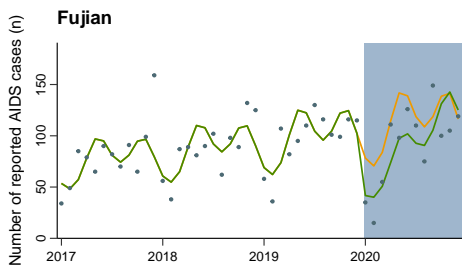
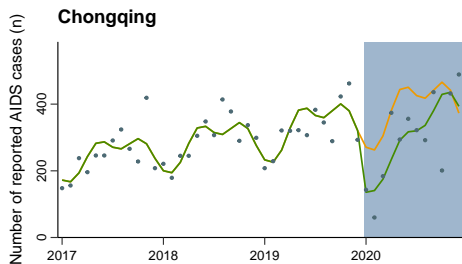
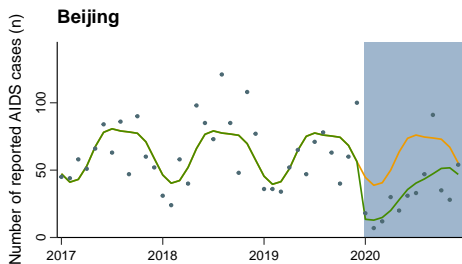
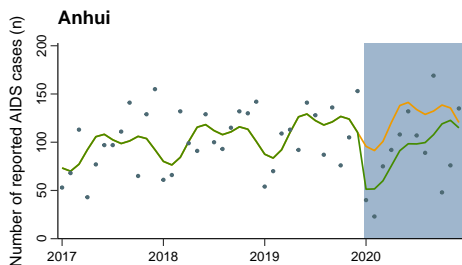
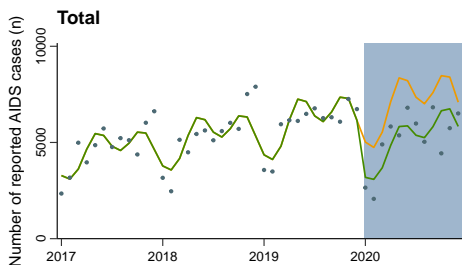
### Yunnan



### Zhejiang



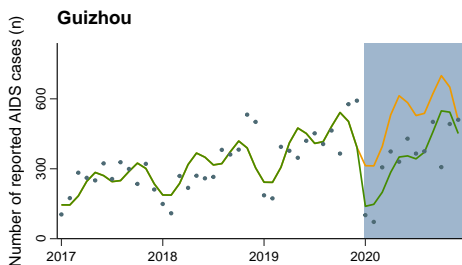
— Counterfactual scenario — Modelled trend — During NPIs



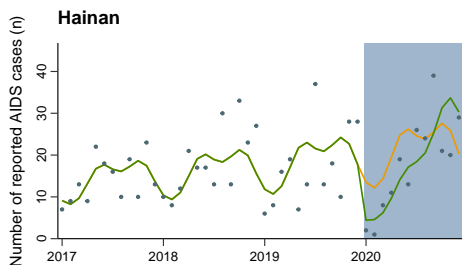


— Counterfactual scenario — Modelled trend — During NPIs

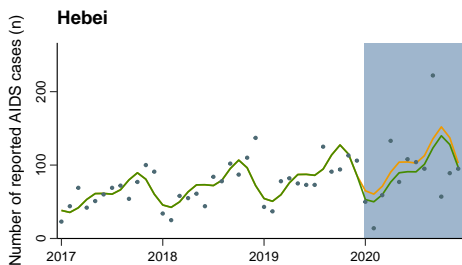
### Guizhou



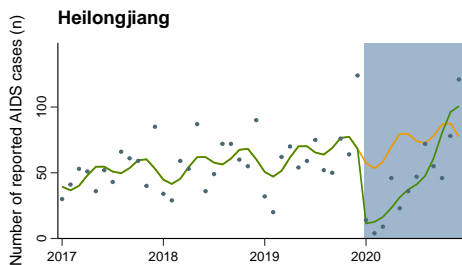
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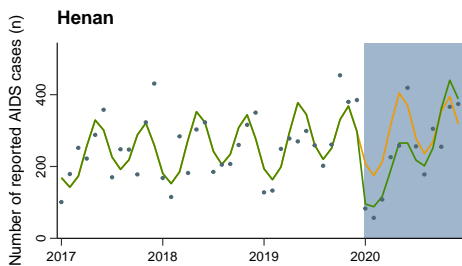
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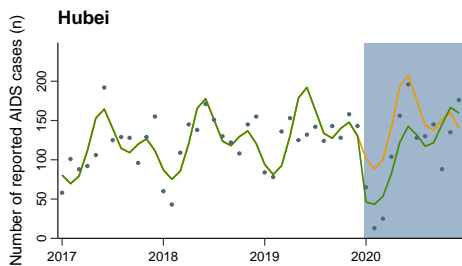
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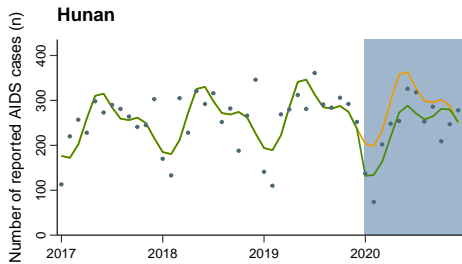
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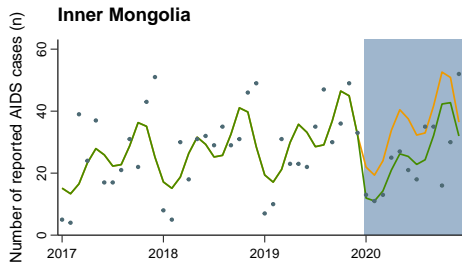
### Hubei



### Hunan



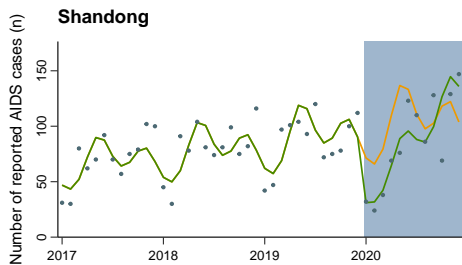
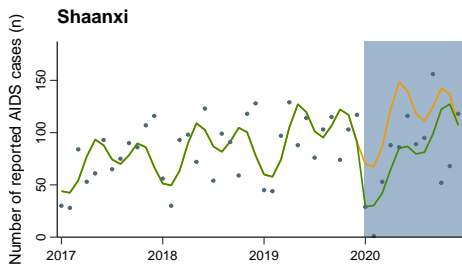
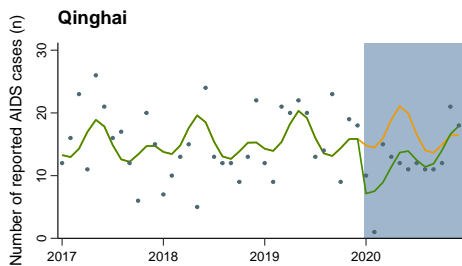
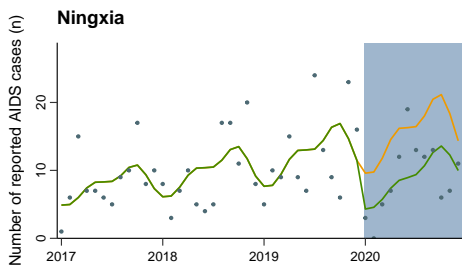
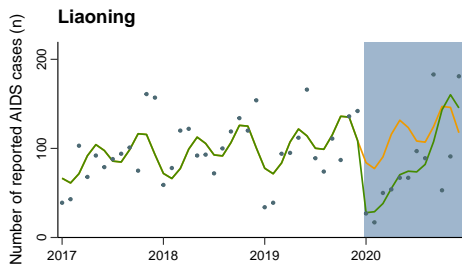
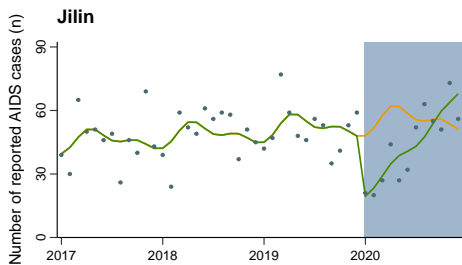
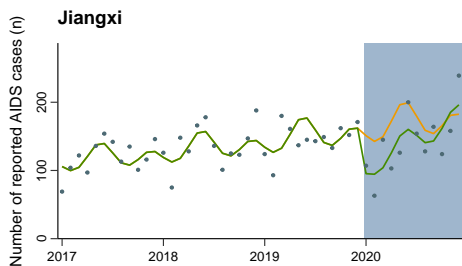
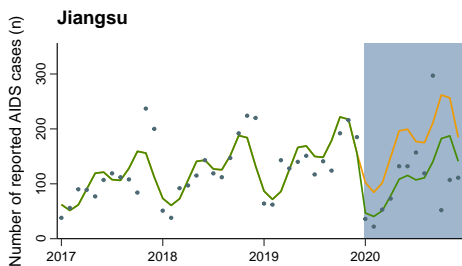
### Inner Mongolia



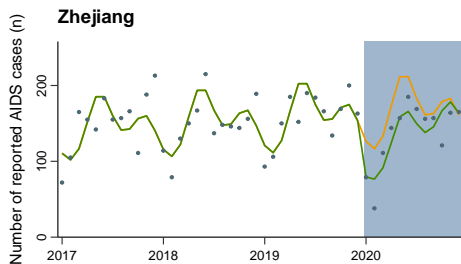
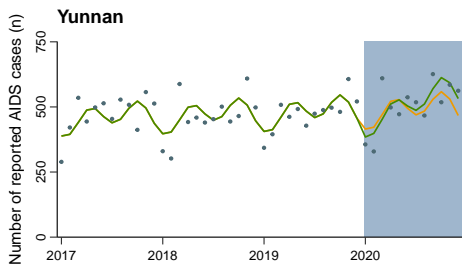
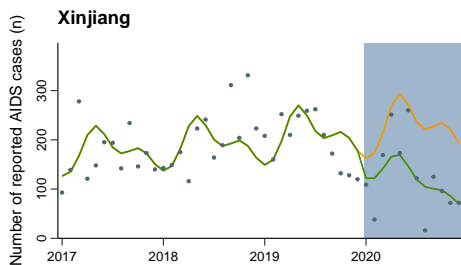
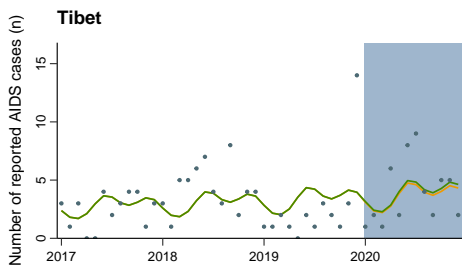
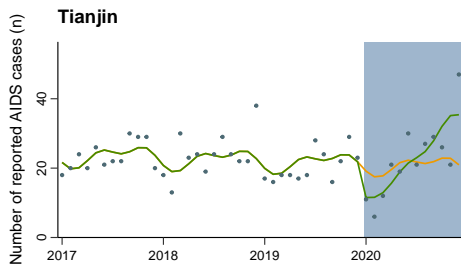
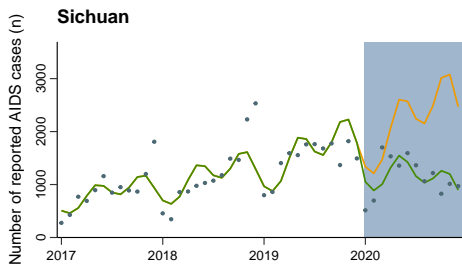
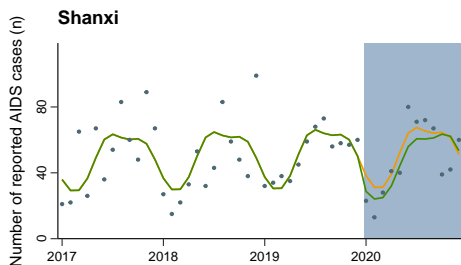
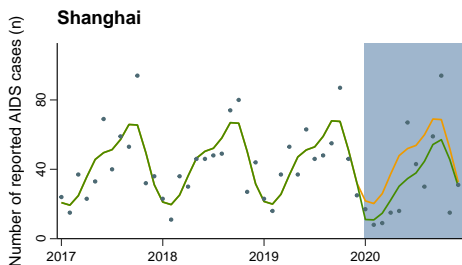
— Counterfactual scenario

— Modelled trend

■ During NPIs



— Counterfactual scenario — Modelled trend ■ During NPIs



## Supplementary material file S1

### Formula 1

$$\log Y_t = b_0 + b_1(t - T) + b_2x + b_3x(t - T)$$

Where  $Y_t$  is the outcome variable at time  $t$ ,  $t$  represents the elapsed time since the start of the study,  $x$  is a dummy variable indicating the implementation of COVID-19 related NPIs, and  $T$  is the center time.

**Formula 2** 
$$\log Y_t = b_0 + b_1(t - T) + b_2x + b_3x(t - T) + b_4 \sin\left(\frac{2\pi t}{12}\right) + b_5 \cos\left(\frac{2\pi t}{12}\right) + b_6 \sin\left(\frac{4\pi t}{12}\right) + b_7 \cos\left(\frac{4\pi t}{12}\right)$$

Where  $\sin\left(\frac{2\pi t}{12}\right)$ ,  $\cos\left(\frac{2\pi t}{12}\right)$ ,  $\sin\left(\frac{4\pi t}{12}\right)$ ,  $\cos\left(\frac{4\pi t}{12}\right)$  are two sine/cosine pairs of Fourier terms used to adjust the seasonality.

### Formula 3

$$\log Y_t = b_0 + b_1(t - T) + b_4 \sin\left(\frac{2\pi t}{12}\right) + b_5 \cos\left(\frac{2\pi t}{12}\right) + b_6 \sin\left(\frac{4\pi t}{12}\right) + b_7 \cos\left(\frac{4\pi t}{12}\right)$$

Table S1 Prediction of HIV cases and AIDS cases in January 2020 based on the counterfactual model.

Region	HIV cases			AIDS cases		
	Actual number	Predicted number (95% CI)	Estimated underreported number (95% CI)	Actual number	Predicted number (95% CI)	Estimated underreported number (95% CI)
Total	6590	8798.398(7798.817 to 9924.699)	2208.398(1208.817 to 3334.699)	2653	4177.953(3580.297 to 4885.820)	1524.953(927.297 to 2232.820)
Anhui	148	203.576(170.901 to 242.226)	55.576(22.901 to 94.226)	40	74.627(48.077 to 115.942)	34.627(8.077 to 75.942)
Beijing	111	218.075(189.744 to 250.564)	107.075(78.744 to 139.564)	18	59.406(46.272 to 76.271)	41.406(28.272 to 58.271)
Chongqing	414	533.505(478.060 to 594.828)	119.505(64.060 to 180.828)	143	284.861(249.129 to 326.484)	141.861(106.129 to 183.484)
Fujian	134	176.084(161.058 to 192.253)	42.084(27.058 to 58.253)	35	65.666(49.716 to 86.849)	30.666(14.716 to 51.849)
Gansu	56	95.890(80.114 to 114.754)	39.89(24.114 to 58.754)	12	25.478(19.139 to 33.898)	13.478(7.139 to 21.898)
Guangdong	367	551.880(537.335 to 567.233)	184.88(170.335 to 200.233)	196	331.081(272.981 to 401.639)	135.081(76.981 to 205.639)
Guangxi	339	501.479(394.186 to 638.418)	162.479(55.186 to 299.418)	369	470.064(389.652 to 566.820)	101.064(20.652 to 197.820)
Guizhou	441	521.277(447.716 to 606.602)	80.277(6.716 to 165.602)	101	227.477(143.670 to 360.714)	126.477(42.670 to 259.714)
Hainan	22	27.397(24.554 to 30.513)	5.397(2.554 to 8.513)	2	6.098(4.454 to 8.368)	4.098(2.454 to 6.368)
Hebei	118	179.059(156.085 to 205.575)	61.059(38.085 to 87.575)	50	61.275(50.505 to 74.294)	11.275(0.505 to 24.294)
Heilongjiang	84	162.476(137.931 to 191.344)	78.476(53.931 to 107.344)	14	70.000(55.777 to 88.050)	56(41.777 to 74.050)

Henan	279	448.553(356.322 to 564.777)	169.553(77.322 to 285.777)	83	180.435(126.718 to 256.173)	97.435(43.718 to 173.173)
Hubei	180	295.082(229.299 to 380.550)	115.082(49.299 to 200.550)	65	143.488(127.202 to 161.692)	78.488(62.202 to 96.692)
Hunan	319	470.501(434.605 to 509.585)	151.501(115.605 to 190.585)	137	211.094(199.418 to 223.491)	74.094(62.418 to 86.491)
Inner Mongolia	51	68.091(62.195 to 74.561)	17.091(11.195 to 23.561)	13	23.853(20.000 to 28.446)	10.853(7.000 to 15.446)
Jiangsu	214	278.283(255.066 to 303.546)	64.283(41.066 to 89.546)	36	78.775(65.814 to 94.241)	42.775(29.814 to 58.241)
Jiangxi	118	174.041(144.785 to 209.220)	56.041(26.785 to 91.220)	107	169.572(142.098 to 201.887)	62.572(35.098 to 94.887)
Jilin	72	100.982(89.664 to 113.744)	28.982(17.664 to 41.744)	21	51.724(45.952 to 58.333)	30.724(24.952 to 37.333)
Liaoning	123	196.800(159.740 to 242.126)	73.8(36.740 to 119.126)	27	81.325(58.442 to 113.445)	54.325(31.442 to 86.445)
Ningxia	15	19.789(15.690 to 24.958)	4.789(0.690 to 9.958)	3	6.667(3.501 to 12.712)	3.667(0.501 to 9.712)
Qinghai	22	28.871(24.887 to 33.537)	6.871(2.887 to 11.537)	10	20.747(15.949 to 26.954)	10.747(5.949 to 16.954)
Shaanxi	177	236.000(189.507 to 294.020)	59(12.507 to 117.020)	29	69.880(44.753 to 109.023)	40.88(15.753 to 80.023)
Shandong	160	213.618(203.822 to 224.090)	53.618(43.822 to 64.090)	32	73.394(58.824 to 91.691)	41.394(26.824 to 59.691)
Shanghai	69	129.944(116.554 to 144.958)	60.944(47.554 to 75.958)	17	33.531(21.330 to 52.795)	16.531(4.330 to 35.795)
Shanxi	66	90.164(72.052 to 112.821)	24.164(6.052 to 46.821)	23	30.626(21.719 to 43.152)	7.626(-1.281 to 20.152)

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Sichuan	1616	2192.673(1855.339 to 2593.900)	576.673(239.339 to 977.900)	514	653.113(465.158 to 917.857)	139.113(-48.842 to 403.857)
Tianjin	24	63.660(59.701 to 67.989)	39.66(35.701 to 43.989)	11	18.272(15.737 to 21.195)	7.272(4.737 to 10.195)
Tibet	18	25.035(18.237 to 34.351)	7.035(0.237 to 16.351)	1	0.979(0.251 to 3.831)	-0.021(-0.749 to 2.831)
Xinjiang	250	285.388(192.160 to 423.729)	35.388(-57.840 to 173.729)	109	144.754(94.128 to 222.904)	35.754(-14.872 to 113.904)
Yunnan	447	394.876(339.408 to 459.404)	-52.124(-107.592 to 12.404)	356	384.449(342.308 to 431.515)	28.449(-13.692 to 75.515)
Zhejiang	136	188.366(151.448 to 234.483)	52.366(15.448 to 98.483)	79	125.596(116.176 to 135.739)	46.596(37.176 to 56.739)

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