Technical Appendix

1. Poisson regression model

The following Poisson model was used to fit weekly influenza-like illness (ILI) for each age group separately:

$$\begin{cases} \mathrm{ILI_t} \sim \mathrm{Poisson}(\mu_t), \\ \ln(\mu_t) = \ln(Pt_t) + \beta_0 + \beta_1 Y_t + \beta_2 W_t + \beta_3 \sin\left(\frac{2\pi t}{52}\right) + \beta_4 \cos\left(\frac{2\pi t}{52}\right) + \beta_5 \sin\left(\frac{4\pi t}{52}\right) + \beta_6 \cos\left(\frac{4\pi t}{52}\right) + \varepsilon_t. \end{cases}$$

where $\varepsilon_t = \phi\varepsilon_{t-1} + \delta_t$, and $\delta_t \sim N(0,\tau^2)$. *t* is a sub-index for week number (*t*=1,2,3…416) and ILI_t is the number of ILI-related medical visits in week *t*, which is assumed to follow Poisson distribution. $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ denote intercept and coefficients. PT_t is the population size of the corresponding age group as reported in the 2010 Chinese Population Census; Y_t is a vector of dummy variables for each year y_{2008} (1–52 week), y_{2009} (53–104 week), y_{2010} (105–156 week), y_{2011} (157–208 week), y_{2012} (209–260 week), y_{2013} (261–312 week), y_{2014} (313–364 week), y_{2015} (365–416 week); $\sin\left(\frac{2\pi t}{52}\right)$, $\cos\left(\frac{2\pi t}{52}\right)$, $\sin\left(\frac{4\pi t}{52}\right)$, and $\cos\left(\frac{4\pi t}{52}\right)$ are sinusoidal terms to account for seasonal patterns in the number of ILI-related visits; W_t are dummy variables for the two weeks before, the four weeks during and the four weeks after the winter school breaks in each year.

2. Bootstrap method to construct 95% confidence intervals for IRRs

We assumed that if there were no school holidays, the ILI occurrences during the holiday weeks would be similar to ILI occurrences ±4 weeks surrounding the holiday weeks. Therefore, we randomly chose the ILI data points within the 4-week window 1000 times for each age group and constructed the 95% confidence intervals for ILI incidence rate ratio (IRR) of schoolchildren to adults. We consistently found that the observed IRRs during the school holidays were lower than the bootstrapped confidence intervals.

Table S1. Descriptions for dummy variables W_t

Notation	Description
w_1 w_2 w_3 w_4	1st ,2nd, 3rd, 4th week in winter break
$wafter_1$ $wafter_2$ $wafter_3$ $wafter_4$	1st ,2nd, 3rd, 4th week immediately after winter breaks
$wbefore$	1st and 2nd week before winter breaks
$other$	Other week than weeks mentioned above

Table S2. Age-specific ϕ fitted by generalized linear model and 95% confidence intervals.

	Age 0–4	Age 5–14	Age 15-24	Age 25–59	Age ≥60
ϕ	0.90	0.86	0.83	0.89	0.62
(95%CI)	(0.82-0.95)	(0.75-0.91)	(0.75-0.88)	(0.79-0.94)	(0.53-0.70)

Table S3. ILI incidence rate ratios (IRRs) of schoolchildren to adults during four-week periods surrounding winter/summer breaks, by age group, Beijing, 2008–2015.

Holiday	Age group	ILI Incidence Rate Ratio(95% CI)			***P*** value*	
		Before school break	During school break	After school Break	Before to During	During to After
Winter	5–14					
	25–59	6.81 (6.65-6.98)	9.95 (9.61-10.3)	14.9 (14.3-15.6)	<0.001	<0.001
	≥60	8.02 (7.51-8.58)	9.20 (8.67-9.76)	13.3 (12.1-14.7)	<0.001	<0.001
	15–24					
	25–59	1.12 (1.06-1.19)	1.03 (0.98-1.09)	1.33 (1.22-1.45)	<0.001	<0.001
	≥60	1.24 (1.14-1.34)	0.96 (0.89-1.03)	1.30 (1.16-1.47)	<0.001	<0.001
Summer	5–14					
	25–59	23.5 (22.4-24.6)	17.0 (16.5-17.6)	21.1 (20.1-22.1)	<0.001	<0.001
	≥60	19.4 (17.4-21.7)	14.3 (13.6-15.1)	19.5 (17.4-21.9)	<0.001	<0.001
	15–24					
	25–59	1.63 (1.48-1.79)	1.41 (1.34-1.48)	1.71 (1.56-1.88)	0.002	<0.001
	≥60	1.47 (1.29-1.67)	1.19 (1.11-1.27)	1.62 (1.42-1.85)	0.018	<0.001

*Small ***P*** values indicate that the incidence rate ratio for the period before the break is significantly higher than that for the period during the break (or the incidence rate ratio for the period during the break is significantly higher than that for the period after the break).

Figure S1. Time series of weekly total outpatient visits in Xicheng District, Beijing China from 2008 to 2015.