

The Growth and Variation of Symptoms of Influenza-like Illness: An Application of the Linear Growth Curve Model in Syndromic Surveillance in Rural China

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Objective

To analyze the growth and variation of ILI reports using individual growth curve model.

Introduction

Symptoms of influenza-like illness (ILI) were reported daily by health workers via the integrated syndromic surveillance system in rural China (ISSC)(1).

Methods

The daily ILI related outpatient visits were collected from 167 healthcare units duration of one year from 05/01/2012 to 04/30/2013 in rural China. Linear growth curve model (LGM)(2) was applied to predict growth trajectory of ILI over 7 days (one week) in each healthcare unit. To describe the longitudinal growths and variations in weeks, Week 1 was set as the reference group whereas Week 2 to Week 52 was considered as dummy variables. The 7 days in a week (named as Day-of-week) was treated as a time variable. For the considerations of unobserved heterogeneity between the units, random effects on day-of-week were estimated, which allowed each healthcare unit having its own unique growth curve(3). In this study, an alarm would be generated if a 7-day's growth rate exceeded the threshold set by the 95% Confidence Interval (95%CI) of the growth rate in the healthcare unit. The analysis was processed using STATA and MLwiN(4).

Results

The fixed and random effects of the 52 weeks ILI surveillance data were reported in Table 1. On level 2, the random effect of day-of-week was equal to 0.0008 (95% CI 0.0002, 0.0014), which suggested that the growth rate within one week in each healthcare units could be differentiated. Figure 1 was an illustration of the modeling in a specific week – Week 23. The left is the line of reported ILI outpatient visits over 7 days in week 23 in three healthcare units and the right showed the predict growth curves and the 95% CI in the corresponding healthcare units.

Conclusions

The growth rate curves of ILI surveillance data might be useful for the early detection of influenza epidemic in rural China.

Table 1 Results of ILI related outpatient visits by linear growth curve model in healthcare units in 2 counties of Jiangxi Province, China

Fixed Effect	Coef.	SE	Z	P	95% CI
cons	-1.0798	0.1088	-9.9200	0.0000	-1.2931 -0.8665
day-of-week*	-0.0056	0.0041	-1.3800	0.1670	-0.0136 0.0024
week2	0.0813	0.0746	1.0900	0.2760	-0.0648 0.2274
week3	0.2562	0.0715	3.5800	0.0000	0.1160 0.3964
...
week52	-0.0312	0.0725	-0.4300	0.6670	-0.1733 0.1108
Random Effect					
Level-2		Estimate	SE		95% CI
var(cons)		1.4414	0.1624		1.1232-1.7597
cov(cons, day-of-week)		-0.0089	0.0051		-0.0188-0.0010
var(day-of-week)		0.0008	0.0003		0.0002-0.0014

*day-of-week: referred to the 7 days in a week (0 SUN /1 MON /2 TUE /3 WED /4 THU /5 FRI /6 SAT)

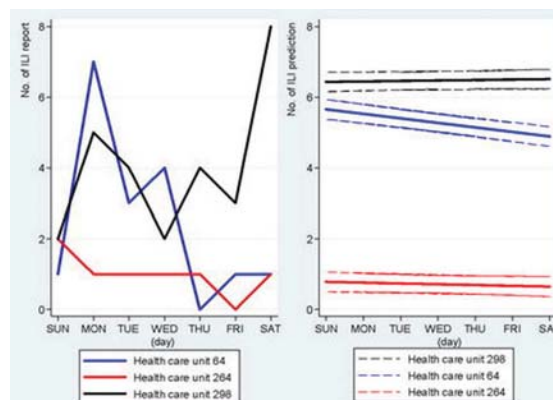


Figure 1: Growth curve of ILI outpatient visits in three healthcare units by linear curve model in week 23 in two counties of Jiangxi Province, China

Keywords

Syndromic surveillance; influenza-like illness; linear growth curve model

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