The Day-of-the-Week Effect: A Study Across the Indiana Public Health Emergency Surveillance System

Ross Maciejewski, Stephen Rudolph, Shaun J. Grannis, David S. Ebert
Purdue University Regional Visualization and Analytics Center

OBJECTIVE

This paper investigates the existence of the day-of-the-week (DoW) effect across twenty-six hospitals within the Indiana Public Health Emergency Surveillance System (PHESS) [1]. We will consider both the impact of each DoW and the impact of individual hospitals.

BACKGROUND

Complex, highly parameterized data models are often used to detect syndromic outbreaks. Unfortunately, such models can pose greater maintenance challenges as parameter variations increase. As such, our work focuses on whether DoW effects may (or may not) show little variation across hospitals.

METHODS

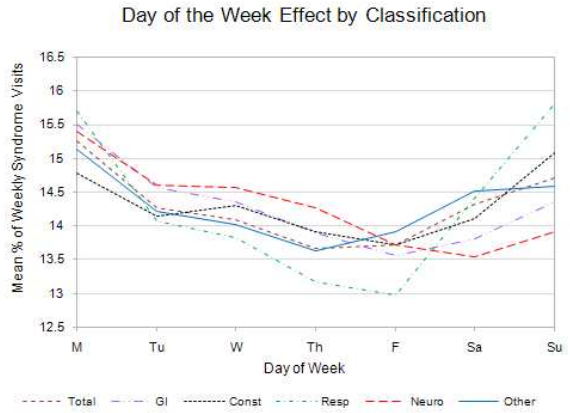
For this study, we analyzed the DoW effect across twenty-six hospitals during a two year period (1-1-2006 to 12-29-2007). Using emergency department chief complaints categorized by the CoCo classification system [2], we analyzed the DoW patterns across the daily patients seen with *gastro-intestinal*, *constitutional*, *respiratory*, *neurological* and *other* classifications of chief complaint as well as the total daily visits. To compare across hospitals, we normalized the counts by dividing by the weekly syndrome total using both a static seven days and a weekly moving average. The results of both normalizations yielded comparable results, as such; we report only the results of the counts normalized by a static seven day period. We utilized a multi-way ANOVA test for comparing the means of the observations across categories with respect to the hospital and DoW under the null hypothesis that the means of each category were equivalent.

RESULTS

In Table 1, we report the p and F values of our ANOVA testing. We find that looking at the data means across hospital yields no significant difference; however, when looking at the DoW as a variable, there is a significant ($p<.05$) difference among the data means. Furthermore, the interaction between the DoW and the hospitals is significant. As such, it becomes apparent that it is necessary to account for the DoW effect in syndromic surveillance. Further, in Figure 1, we plot the means of the DoW by chief complaint classification to highlight the weekly pattern.

Table 1: ANOVA Results

		Total	GI	Const	Resp	Neuro	Other
Hosp	p	1	1	1	1	1	1
	F	0.14	0	0.06	0.08	0.03	0.11
DoW	p	0	0	0	0	0	0
	F	234.2	40	15.86	112	23.67	109.6
Hosp*DoW	p	0	0	0	0	0	0
	F	17.13	3.1	2.65	4.22	2.17	11.47



CONCLUSIONS

The goal of this analysis was to determine whether DoW effects varied substantially or insignificantly across data sources. We found that visit rates by syndrome varied significantly by DoW Further, as can be seen in Figure 1, each syndrome has a unique DoW pattern. Therefore, this finding suggests that robust signal detection models must account for the DoW effect by syndrome.

REFERENCES

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[2] W. W. Chapman, J. N. Dowling, and M. M. Wagner. Classification of emergency department chief complaints into 7 syndromes: A retrospective analysis of 527,228 patients. *Annals of Emergency Medicine*, 46:445–455, November 2005

Further Information:
Ross Maciejewski, rmacieje@purdue.edu
www.purvac.org