

Syndromic Surveillance of Gastroenteritis Using Medication Sales in France

Camille Pelat, MSc (1,2), Clément Turbelin, MD (1,2), Pierre-Yves Boëlle, PhD (1,2), Bruno Lambert, PhD (3), Alain-Jacques Valleron, PhD (1,2)

(1) INSERM UMR-S 707, (2) Université Pierre et Marie Curie, (3) IMS-Health France

OBJECTIVE

This study examines how medication sales data can detect gastroenteritis epidemics in France.

BACKGROUND

The interest of medication sales data in Syndromic Surveillance is well recognized (1, 2). In France, where a real-time computerized surveillance system of frequent communicable diseases based on Sentinel general practitioners (SGPs) provides since 1984 a gold standard to evaluate other indicators (3), it has been shown that medication sales provided early alerts for influenza (4). Gastroenteritis surveillance relies in France on the surveillance of acute diarrhea by the SGPs in the general population, since 1991. The main objective of this study is to validate, at a national level, new indicators based on medication sales data to facilitate the detection of gastroenteritis epidemics.

METHODS

Weekly medication sales of 13,000 pharmacies (>50% of French pharmacies), collected by IMS-Health France, from 2000 week 36 till 2008 week 24, aggregated by week and therapeutic classes (Eph-MRA ATC, level 4) were analyzed.

Hierarchical clustering was used to identify therapeutic classes related to gastroenteritis: a hierarchical tree was constructed with the 581 available classes plus the weekly incidence of acute diarrheas. The sub-tree containing the incidence of acute diarrheas was considered. All therapeutic classes present in this sub-tree were evaluated as possible candidates for the outbreak detection.

CUSUM charts were used to detect epidemic outbreaks. For each therapeutic class, an alert was defined when the CUSUM statistic exceeded a predefined control limit. Sensitivity, specificity and lead time were computed for each class. For this purpose, gold standard was defined as the beginning of the outbreak of clinical cases, as monitored by SGPs, using a periodic regression method (5). An alert triggered during the two weeks preceding the gold standard was considered true. The first year was used to adjust the CUSUM parameters for each therapeutic class. The method was then applied as in real-time over the 7 remaining years. A global alert at threshold n was defined when at least n classes triggered an alert. All possible thresholds were evaluated.

RESULTS

Using the hierarchical tree, we identified 8 candidate classes: plain antispasmodics and anticholinergics (A3A), gastroprokinetics (A3F), antiemetics and antinauseants (A4A9), intestinal anti-infective anti-diarrheals (A7A), intestinal absorbant anti-diarrheals (A7B), anti-diarrheal micro-organisms (A7F), motility inhibitors (A7H), and all other anti-diarrheals (A7X).

Cross-correlation coefficients between the 8 classes and incidence of acute diarrheas ranged from 0.5 (A7F) to 0.78 (A7H). Best lag was 0 week for all, except for A3F where it was 1 week (incidence ahead from sales). The class that maximized sensitivity + specificity was A7A (sens. 100%, spe. 91%, average lead time -0.1 week, ahead from incidence). The class that gave the best balance between sensitivity, specificity and lead time, maximizing sens. + spe. - 0.25 * lead time, was A7F (sens. 100%, spec. 62%, average lead time -1.7 weeks).

A global alert indicator was created by combining the alerts of the 8 therapeutic classes. The best balance between sensitivity, specificity and lead time was obtained when the rule was to trigger a global alert if at least 4 of the 8 classes triggered an alert. For this global alert indicator, sensitivity was 100%, specificity 91% and average lead time -0.4 week.

CONCLUSIONS

Time series of medications sales are a robust data source for monitoring in real time seasonal gastroenteritis in France. The algorithm we have validated at the national level will be used at local levels to detect epidemics in places with few (or none) SGPs.

REFERENCES

- [1] Das D, Metzger K, Heffernan R, et al. Monitoring over-the-counter medication sales for early detection of disease outbreaks--New York City. *MMWR Morb Mortal Wkly Rep.* 2005 Aug 26;54 Suppl:41-6.
- [2] Wagner MM, Tsui FC, Espino J, et al. National Retail Data Monitor for public health surveillance. *MMWR Morb Mortal Wkly Rep.* 2004 Sep 24;53 Suppl:40-2.
- [3] Valleron AJ, Bouvet E, Garnerin P, et al. A computer network for the surveillance of communicable diseases: the French experiment. *Am J Public Health.* 1986 Nov;76(11):1289-92.
- [4] Vergu E, Grais RF, Sarter H, et al. Medication sales and syndromic surveillance, France. *Emerg Infect Dis.* 2006 Mar;12(3):416-21.
- [5] Pelat C, Boelle PY, Cowling BJ, et al. Online detection and quantification of epidemics. *BMC Med Inform Decis Mak.* 2007;7:29.

Further Information: Camille Pelat, pelat@u707.jussieu.fr