

A Novel Application of Surveillance Algorithms in Childhood Immunization Program Monitoring

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OBJECTIVE

In this paper we investigate the use of the CUSUM algorithm on retrospective MMR and Pentacel (DTaP-IPV-Hib) immunization data to determine if this type of surveillance tool is useful for measuring changes in immunization rates.

BACKGROUND

Immunization coverage rates are an important measure for public health agencies to monitor for programmatic success as well as a population health indicator. It is imperative to keep immunization rates above a certain level for the routine childhood immunizations in order to keep outbreaks of vaccine preventable diseases at a minimum. In the past, sudden and prolonged decreases of MMR immunization due to fears of vaccine safety have led to widespread outbreaks of measles and mumps in the UK. Historically, immunization rates have been measured on a yearly basis, often months or years after year end. This delay in reporting means little can be done to improve the situation if rates drop from month to month or year to year. A surveillance tool is currently under development that will allow the calculation of immunization rates in near real time; however a value defining an unacceptable drop in immunization rates has yet to be quantified. The value of using automated algorithms such as the CUSUM, moving averages and the EARS algorithms may be a solution to this problem.

MATERIALS AND METHODS

The Alberta immunization and adverse events registry (IMMARI) is used for routine immunization reporting. At this time, the registry has complete immunization records for five of the nine provincial regions. The 4 unrepresented regions are expected to be online by the fall of 2007. This preliminary analysis utilized the two-sided CUSUM procedure in SAS® to determine if the counts for MMR and Pentacel delivery in Region 21 (Chinook) had ever dropped below

the minimum acceptable level ($h=3$) over a 36 month period (Jan 2004-June 2006).

RESULTS

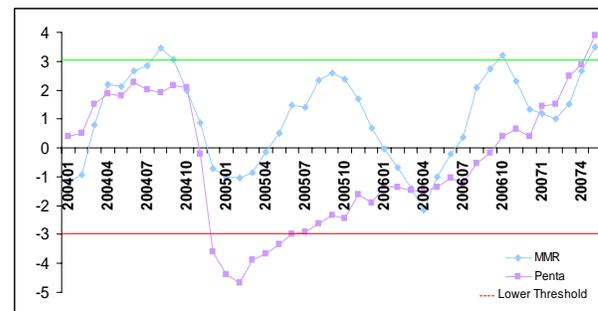


Figure 1. Two-sided CUSUM charts for MMR and Pentacel for Jan 2004 – June 2006

Preliminary analysis with the CUSUM algorithm showed that at no time in the study period did the MMR immunization counts drop below the lower threshold for this particular region. The counts for Pentacel however did have a significant and sustained drop beginning in December of 2004. This was to be expected as there was a documented province wide shortage of Pentacel vaccine in 2004/2005.

CONCLUSIONS

The CUSUM algorithm did perform adequately in this preliminary analysis. It was able to detect the significant drop in Pentacel immunization when the vaccine shortage was documented. We will consider other commonly used alerting tools, such as the moving averages and EARS algorithms, in the near future. Most would require some modification in order to alert when the lower threshold was crossed as opposed to an upper threshold which is more typical for disease surveillance. This adaptation should be fairly simple and further investigation is planned.

A second issue needing consideration with this type of data is the optimal time span to measure across. Here we have used monthly counts, however measuring counts on a bi monthly or quarterly basis may suffice. At this time adequate retrospective data is lacking to test this.