Vaccine Safety Detection: Opportunities and Challenges
Goal

To detect dodgy vaccines as soon as possible
What is a dodgy vaccine?

“Unusually high” incidence

7-day rate: DTP
What is unusually high incidence?

Use prior experience?

Limited by:

- Actual experience / staff availability
- Ability to process a lot of information consistently over time
- Must track many vaccines
Can this be automated?

Partially.

Use statistical modelling:
- Automatically **define** and **detect** unusually high incidence
- BUT “unusual” may not be clinically significant

At least we get a powerful screener…much time saved
Modelling Challenge: Different-looking time series

7-day rate: Flu

7-day rate: DTP
Modelling Challenge: The effect of unusual events

7-day rate: Flu
Modelling Challenge: Different data sources

- Therefore different outcomes
- Therefore we require different models

Example:
- Prescription rates (Medicine Insight) vs GP re-presentation rates (MAGNET)

- How to “stitch these together”?
  (Short answer: Probability is the common ground)
Challenges

- Dodgy vaccine = unusually high incidence = ambiguous
- Vaccines change over time

Data:
- Patchy over time and geography
- Yet the total is voluminous and diverse
- Access & security (tech)

Modelling challenges
- Model different-looking time series (e.g. Flu vs DTP)
- The effect of previous unusual events
- Create different models then stitch them together
Opportunities

- Many cheap, large data sources (high sensitivity)
- Computational power is cheap and abundant
- Analyses can be done and disseminated quickly (near real time) via the web
- The anomaly detection literature is vast
- The language of probability can be used to:
  - Mitigate the effect of previous unusual events
  - Stitch together results from different models (and thus different data sources) to get higher sensitivity
  - Mitigate the risk of multiple comparisons