HEALTH

Early Detection of the Flu Season Using the DC Department of Health's Syndromic Surveillance System

Michael Stoto, Beth Ann Griffin, Arvind K. Jain,
John Davies-Cole, Chevelle Glymph, Garret Lum,
Gebreyesus Kidane, and Samuel Washington

APHA, Washington, November, 2007

Introduction

- Syndromic surveillance involves
  - Collection and monitoring of syndrome-related data
  - Application of statistical detection algorithms to detect a change or trend indicating
    - Bioterrorist attack
    - Beginning of seasonal flu, or pandemic
- Research questions
  - Regarding seasonal flu in Washington DC,
    - Which combinations of data in the DC ER SS system are most sensitive?
    - How quickly do they alert, compared to other sources of information?

DC DOH's ER SS System

- Emergency Room Syndromic Surveillance System
  - Since 9/12/01, DC DOH has collected data on a daily basis from hospital ERs
  - Part of regional surveillance system including suburban Maryland and Northern Virginia
- Hospitals report number of patients with particular chief complaint
  - Respiratory -- Neurological
  - Gastrointestinal -- Sepsis
  - Unspecified infection -- Death
  - Rash -- Other
- Data for this presentation through June 2006
  - 7 hospitals with relatively complete data

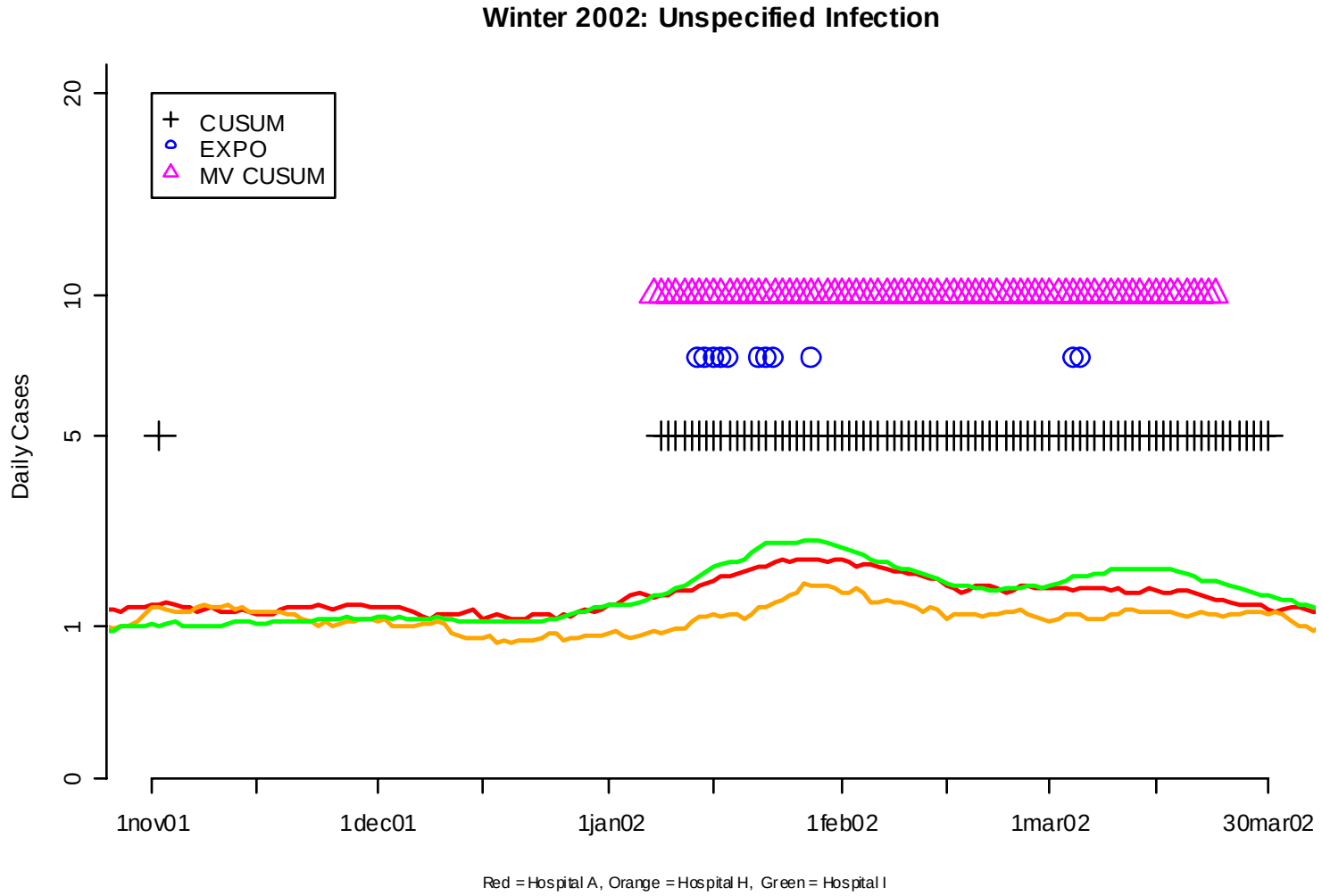
Detection algorithms

- CUSUM (CUmulative SUMmation)
  - $C_t = \max [C_{t-1} + (y_t - \mu) - k, 0]$ Alarm if $C_t > h$
- CUSUM EXPO (mean-adjusted)
  - Exponentially Weighted Moving Average (EWMA)
    - $z_t = \lambda y_t + (1-\lambda) z_{t-1}$
  - $C_t = \max [C_{t-1} + (y_t - z_t) - k, 0]$ Alarm if $C_t > h$
- Multivariate (MV) CUSUM (Stoto et al., 2006)

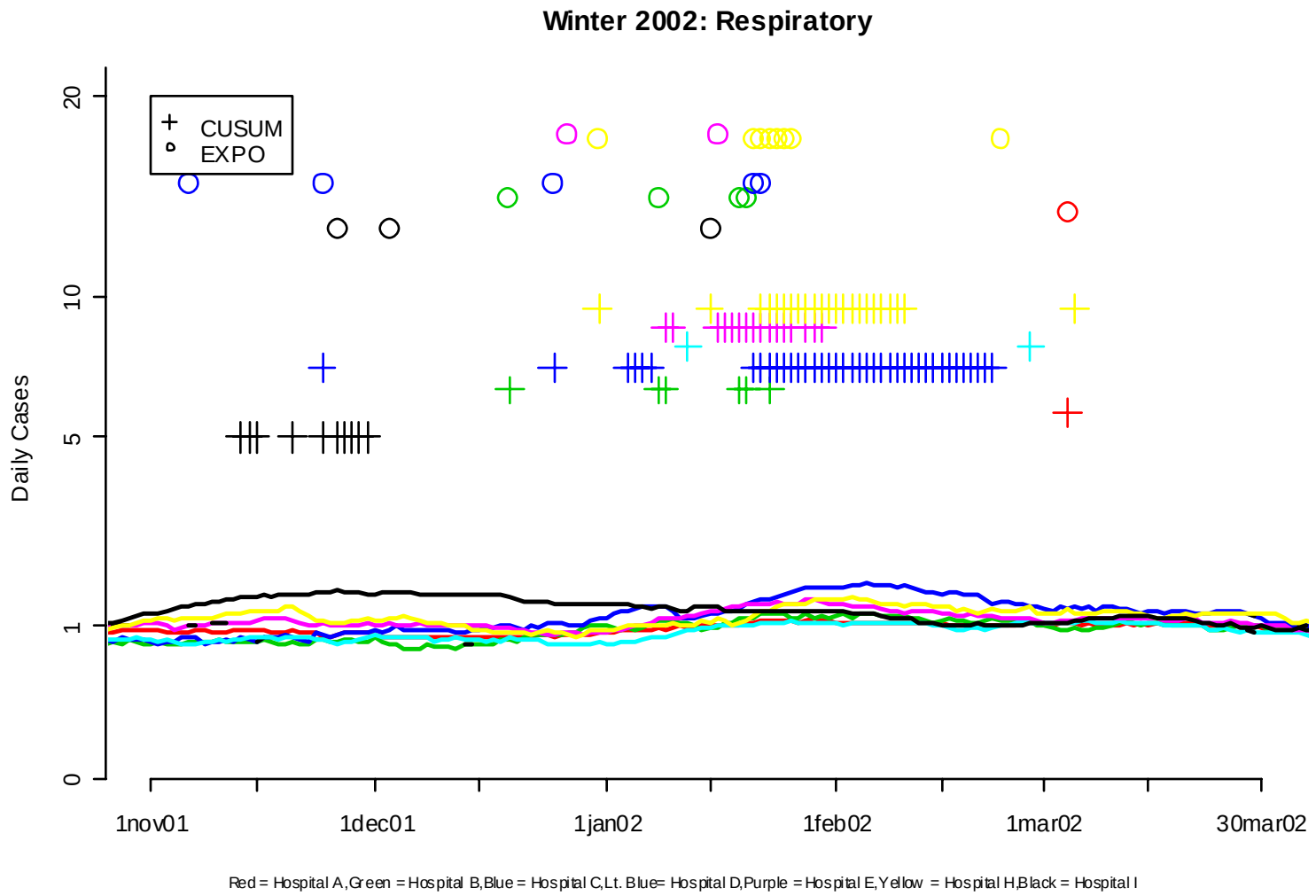
Preliminary results

- Adjust false positive rates to account for multiple streams to >1 stream
- Fine-tuned CUSUM, CUSUM EXPO, and MV CUSUM algorithms using 2-pronged approach
  - Simulation studies
  - Compare to known outbreaks
- Results
  - In general, MV CUSUM performs better than CUSUM and CUSUM EXPO
  - In one setting (3 streams unspecified infection), CUSUM EXPO outperformed MV CUSUM

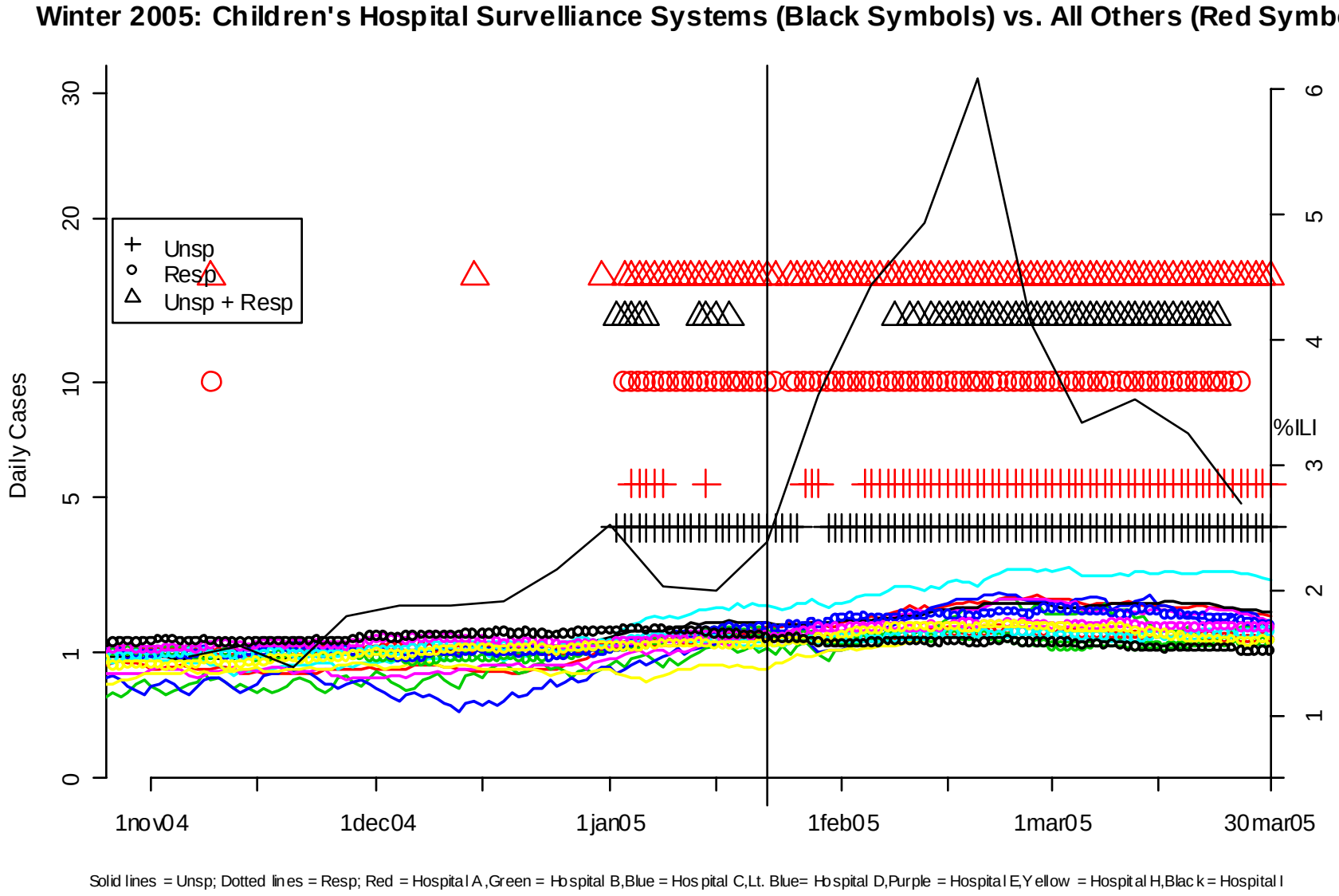
Winter 2002: Unspecified Infection



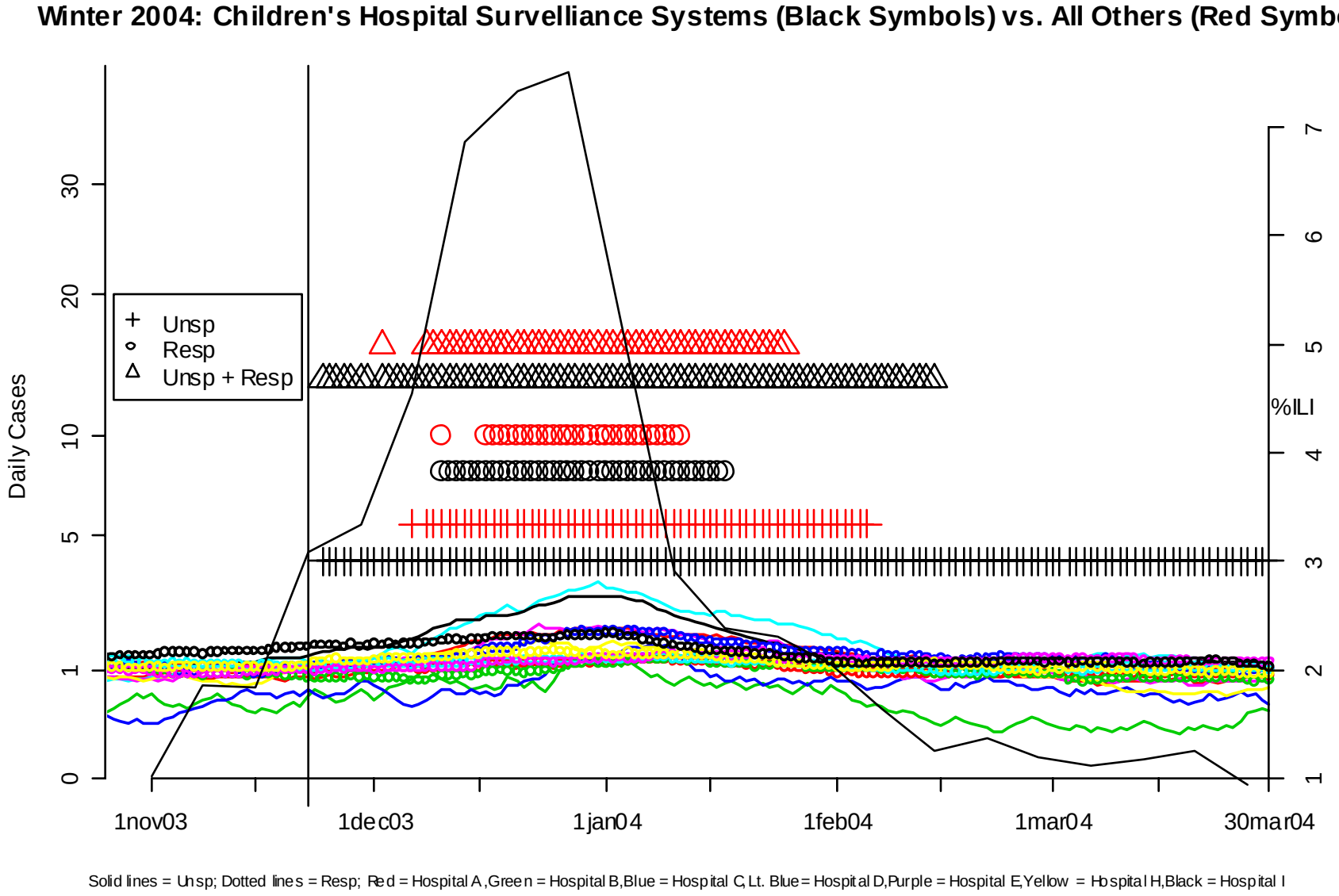
Winter 2002: Respiratory



Winter 2005: Children's unspecified and respiratory and CDC sentinel physicians



Winter 2004: Children's unspecified and respiratory and CDC sentinel physicians



Early Detection of the Flu Season by DC ER Syndromic Surveillance

	Winter 2002	Winter 2004	Winter 2005	Winter 2006
CDC sentinel physicians	Jan 26 +26	Nov 22	Jan 22 +20	Feb 4
Children's Hospital	Dec 31	Nov 24 +2	Jan 2	Feb 27 +23
All other hospitals	Jan 4 +4	Dec 8 +14	Jan 4 +2	--

Conclusions

- In detecting the start of the influenza season using the DC ER SSS …
- "Unspecified infection" cases most effective
  - "Respiratory" cases provide information, but not beyond that in unspecified infection
- Children's National Medical Center more sensitive than
  - Other hospitals alone
  - Multivariate analysis of 6 or 7 hospitals
- Analysis of unspecified infection cases from Children's performs well compared to CDC sentinel physician surveillance