

A Bayesian change point analysis of prevalence rates of chronic diseases by gender and race

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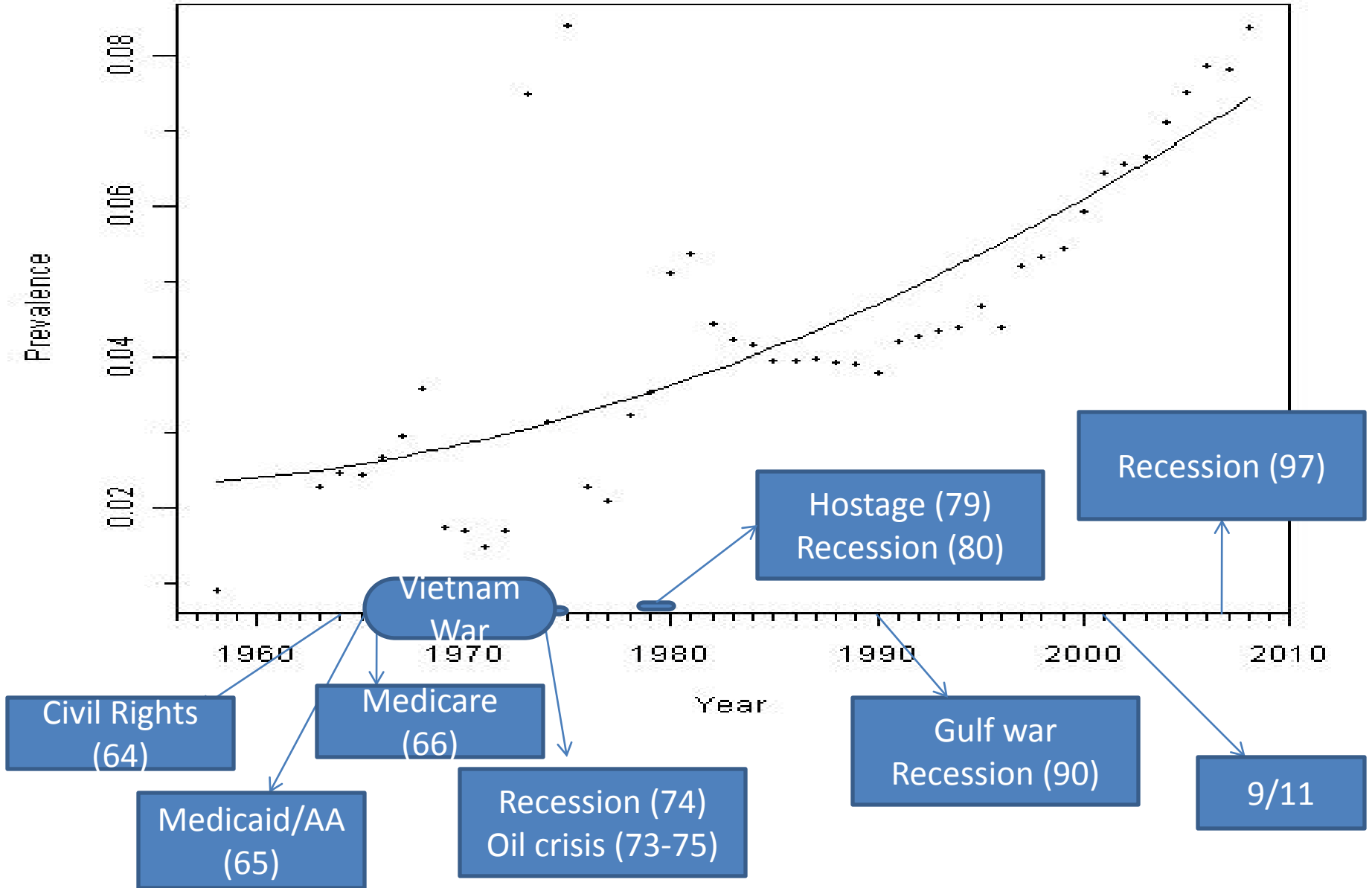
Setup

- Need for assessing the health of the nation cannot be understated
- NCHS has been in the forefront of collecting data needed
- A look back on one such long series
 - National Health Interview Survey (as it is currently known)
 - Began in 1957
 - Limited Data available prior to 1962
- Relate the prevalence information to time line of our history

Data

- Diseases
 - Diabetes (1957-1959, 1962-2008)
 - Asthma and Hypertension (1962-2008)
- Populations
 - Overall
 - Male/Female
 - White/Black
- Time line
 - Important events (health and economic)
- The analysis is preliminary

Prevalence of Diabetes



Model

$p_t = \text{Estimate for year } t$

$P_t = \text{Population value}$

$v_t = \text{sampling variance}$

$n_e = p_t(1 - p_t) / v_t$

$$\pi(\alpha, \sigma_b) \propto 1$$

$$\sin^{-1} \sqrt{p_t} \sim N(\theta_t = \sin^{-1} \sqrt{P_t}, n_e^{-1} / 4)$$

$$\theta_t = \alpha_0 + \alpha_1 t + \alpha_2 t^2 + \sum_{j=1}^L b_j \{(t - k_j)_+\}^2$$

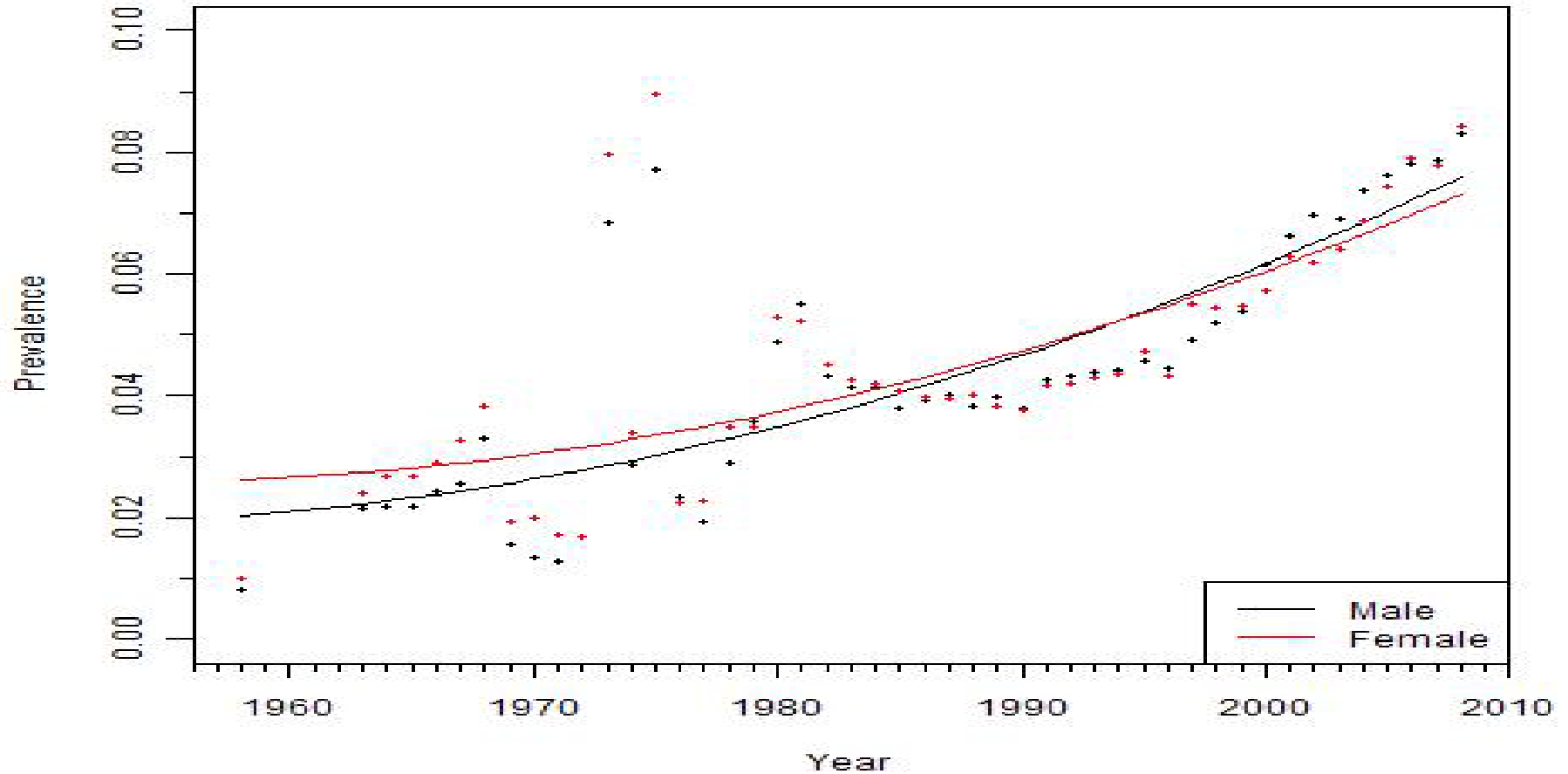
$$b_j \sim \text{iid } N(0, \sigma_b^2)$$

$$(t - k_j)_+ = \max(t - k_j, 0)$$

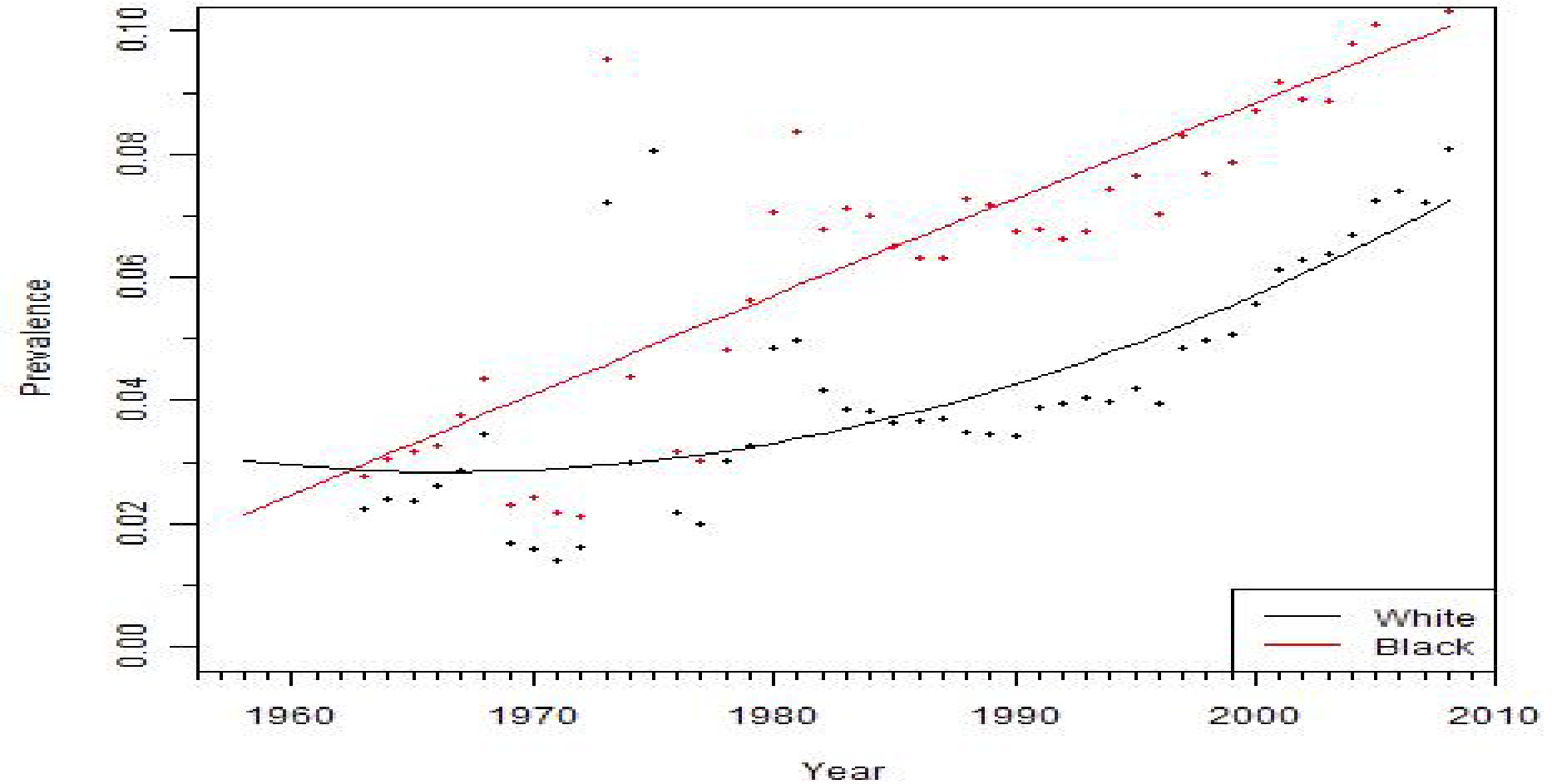
Analysis

- Fit the model using MCMC or MLE
- Calculate $E(P_t | Data)$
- Choose knots based on the time-line
- For this analysis choose 5 knots (1965, 1974, 1980, 1990, 2001)
- Modification (in progress)
 - Treat knots as unknown parameters and estimate them from the data

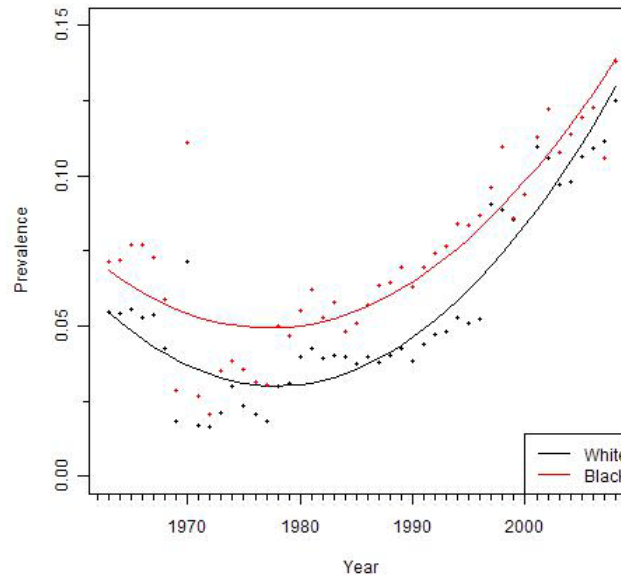
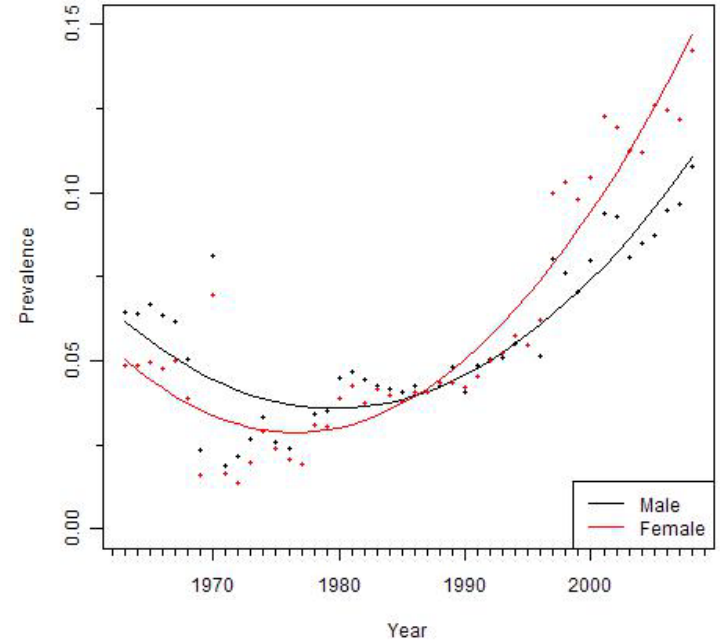
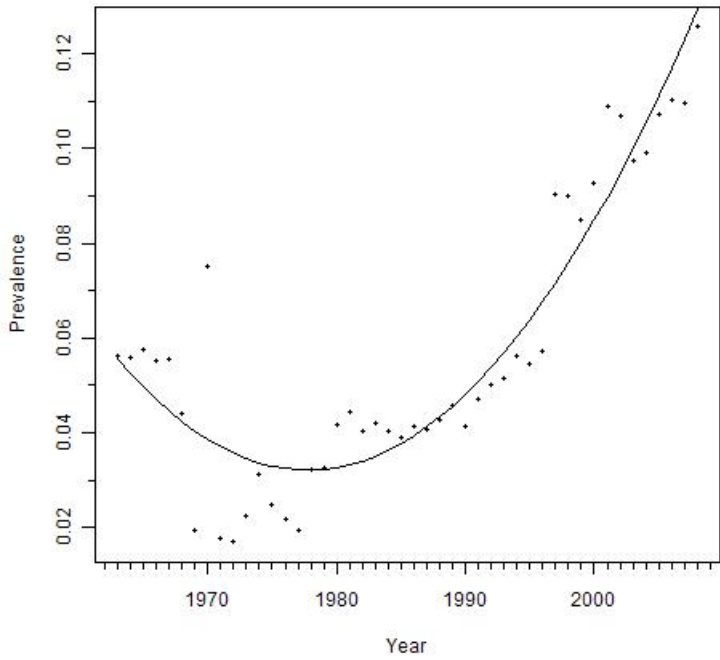
Diabetes by Gender



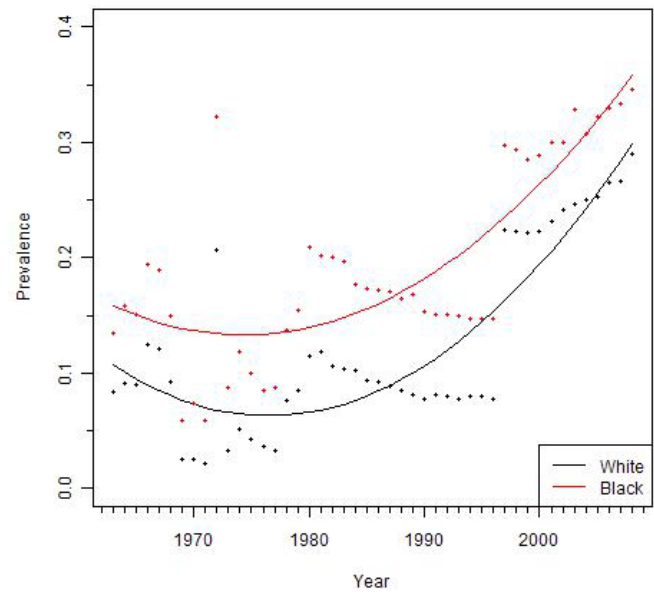
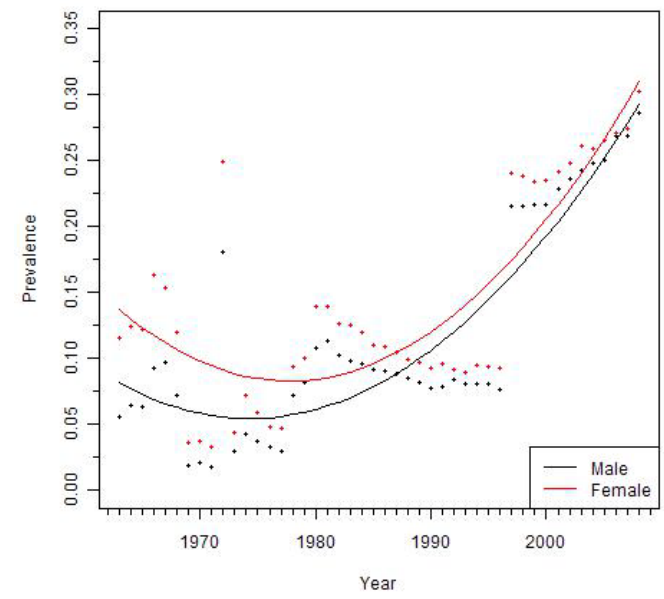
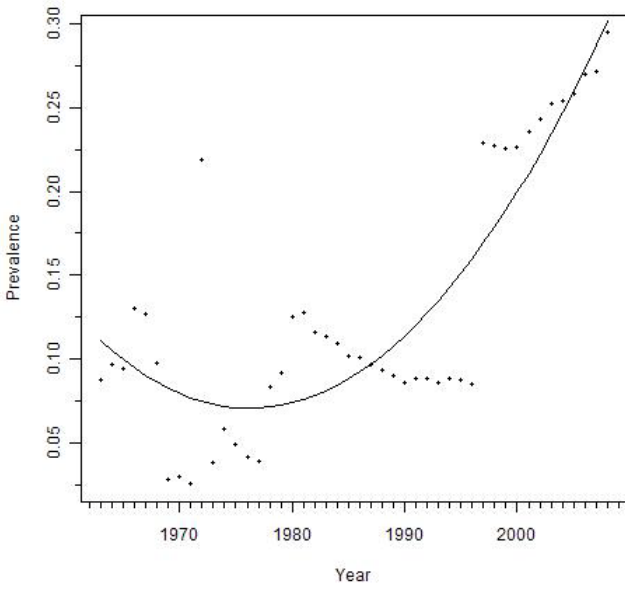
Diabetes by Race



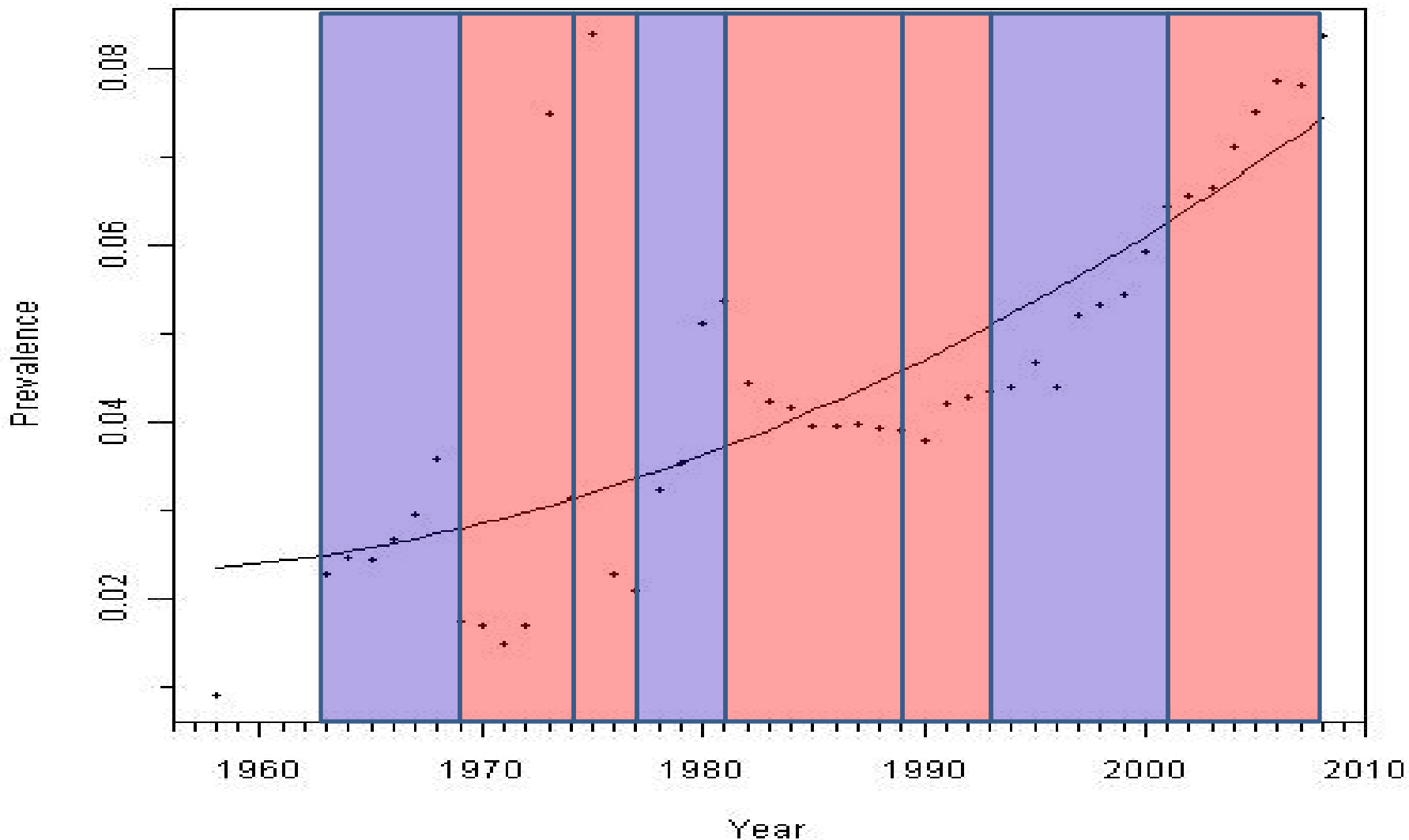
Prevalence rates of Asthma



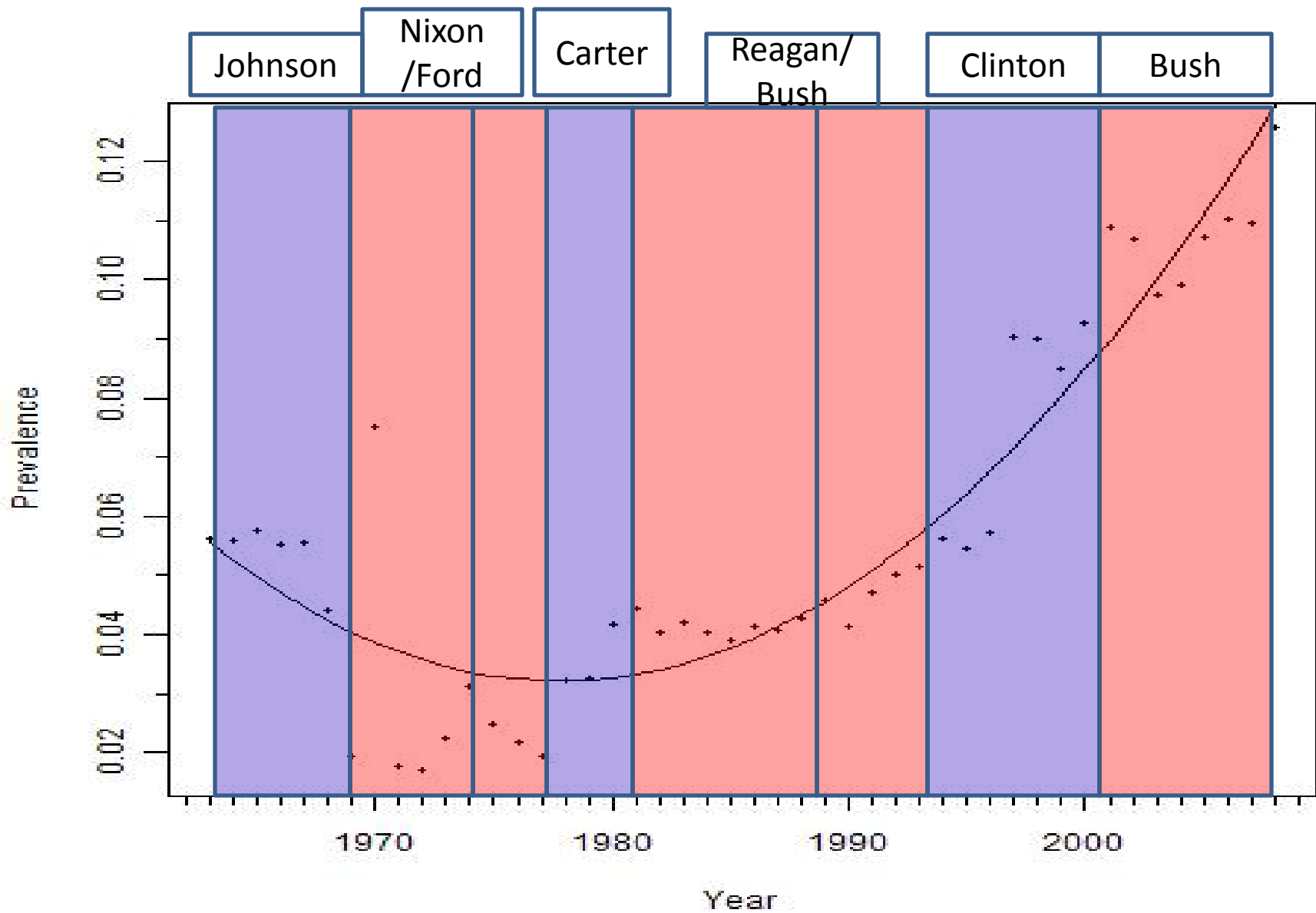
Prevalence rates of Hypertension



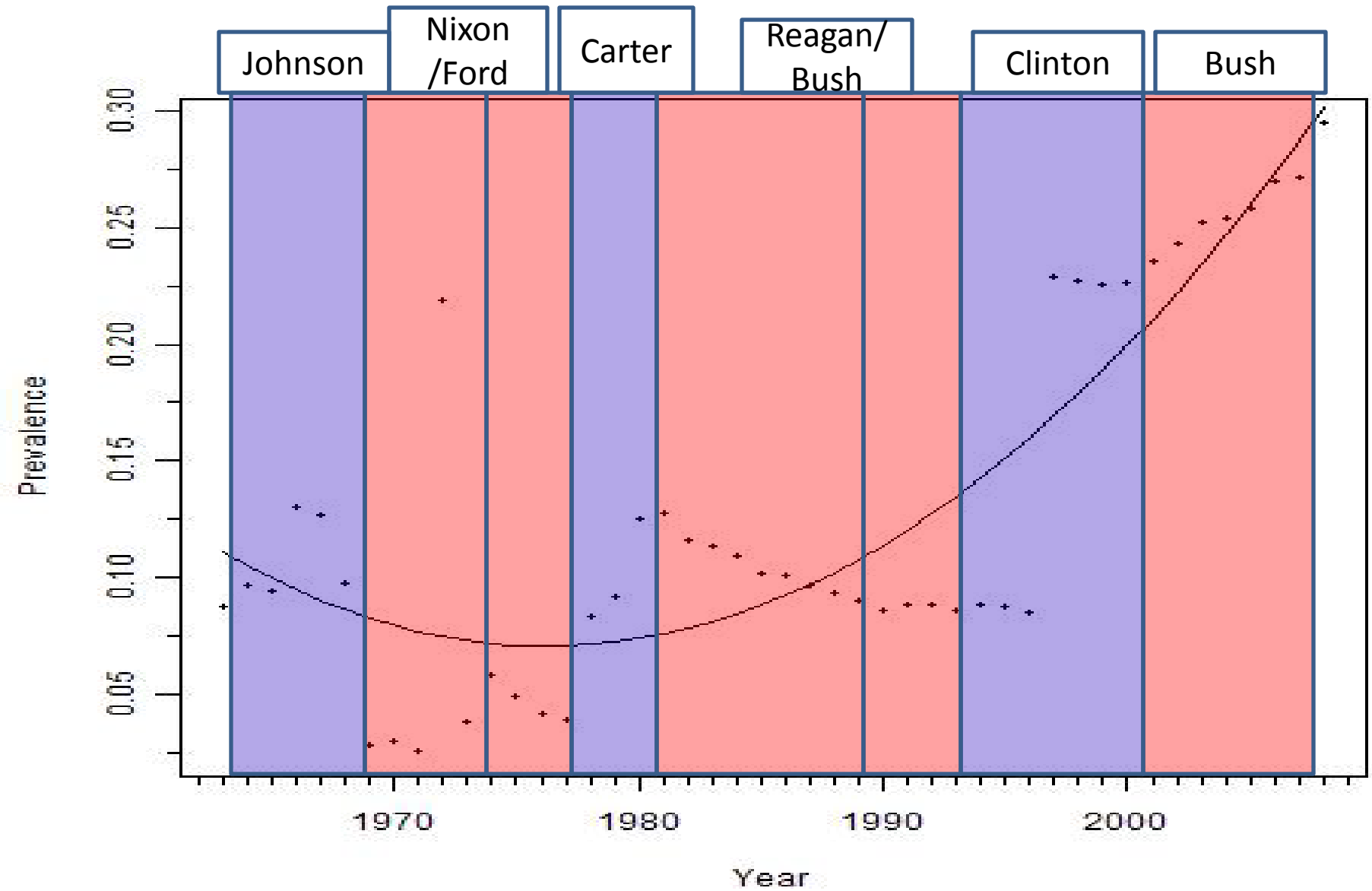
Diabetes by administration



Asthma



Hypertension



Issues and Concerns

- Major design changes, instruments, definitions etc
 - Reflecting such changes in the model development
- Any policy change takes time to have an impact.
Incorporation of time lag in the model
- Outliers
- Regardless of these concerns:
 - Persistent differences between race
 - Lessening of differences between men and women

Discussion

- Relating the time series data to important epics/events can be useful to understand potential effects of policy/cultural changes
- Investigation of health disparities across various subpopulations
- Subgroups can be determined based on economic, social, cultural aspects of the society
- Useful exercise for any democratic society to look at the health of the nation
- Thank you NCHS, for this great data source!!