Temporal Trends in HIV Incidence in Baltimore City

An Ecologic Analysis of the Needle Exchange Program

Jana Jordan, MPH Candidate

Agenda

- Highlight the background behind HIV/AIDS and the Needle Exchange Program in Baltimore City
- Identify the research question and the public health significance of the study
- Discuss the methodology and statistical analysis used to address the research question
- Present the results and discuss limitations, interpretations, and conclusions

Background

- **Baltimore, MD has the second highest reported AIDS rate among major metropolitan areas in the U.S.**
  - In 2005, there were 40.4 cases per 100,000 people
- **Injection drug use was the leading risk factor for HIV infection from 1994 - 2004:**
  - Accounted for 60% of incident HIV and AIDS cases reported in 1994

Source: Maryland AIDS Administration

Background

- **In 1994, a needle exchange program (NEP) was established in Baltimore to address the HIV epidemic among injection drug users**
- **The program has been repeatedly evaluated in areas such as:**
  - Facilitating drug treatment and health service utilization for clients
  - Associations with crime trends
  - Effect on volume of discarded needles

Research Question

- **The primary goal of the needle exchange program is to reduce IDU associated HIV incidence**
- **However, the association between the NEP and HIV incidence rates in Baltimore has not been studied**
- **This type of analysis is needed in order to comprehensively evaluate program outcomes**

Has the Needle Exchange Program had an effect on HIV incidence rates in Baltimore City?

Methodology

- **Performed an ecologic analysis of the association between the Needle Exchange Program and HIV incidence rates in Baltimore City using:**
  - HIV incidence data broken down by zip code
  - Number and location of NEP exchange sites
  - NEP enrollment data
  - 2000 census estimates
- **Two outcomes were assessed to evaluate NEP effect:**
  - Change in HIV incidence from 1995 - 2006
  - Change in IDU associated HIV incidence from 1995 - 2006

Methodology

- **NEP exposure was defined and analyzed in two distinct ways**
- **Out of the 28 zip codes with reported cases of HIV between 1995 - 2006:**
  - Zip codes with a needle exchange site established prior to 2006 were considered exposed (NEP location analysis)

    OR
  - Zip codes with an average of 0.15% of the adult population enrolled in the program each year were considered exposed (NEP usage analysis)

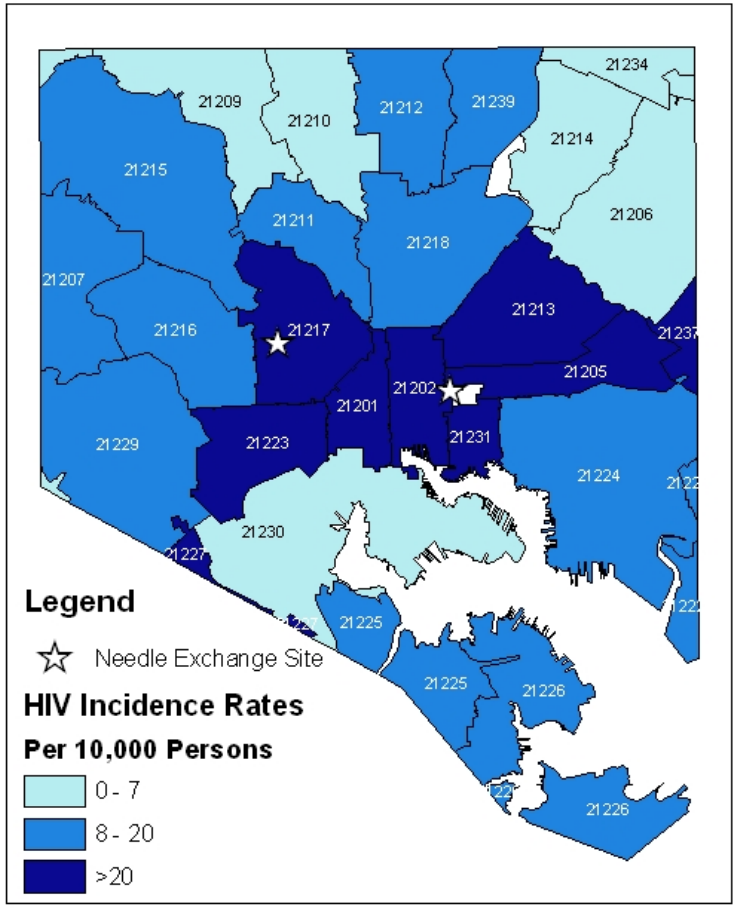
Statistical Analysis

- **Negative binomial regression was used to model the number of HIV and IDU associated HIV cases as separate outcomes**
- **The base model included:**
  - Dichotomized NEP exposure variable
  - Centered year variable
  - An interaction term to allow for changes in incidence rate ratios over time
- **An overall assessment of temporal trends in HIV incidence at the city level was also performed**

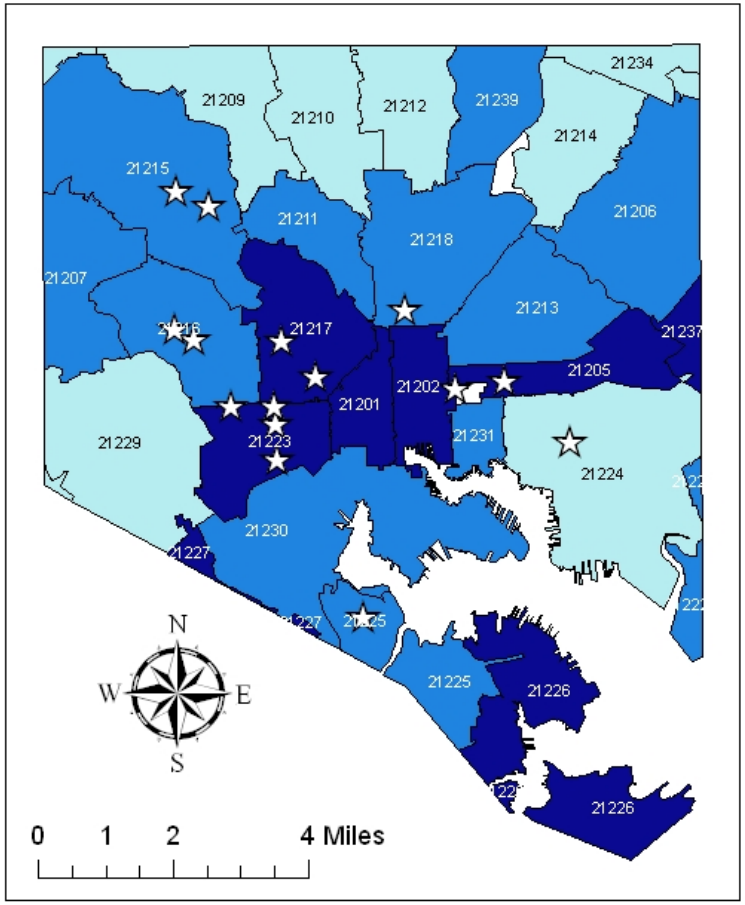
HIV incidence rates declined 3.3% annually

Temporal Trends in HIV Incidence in Baltimore, MD

1995



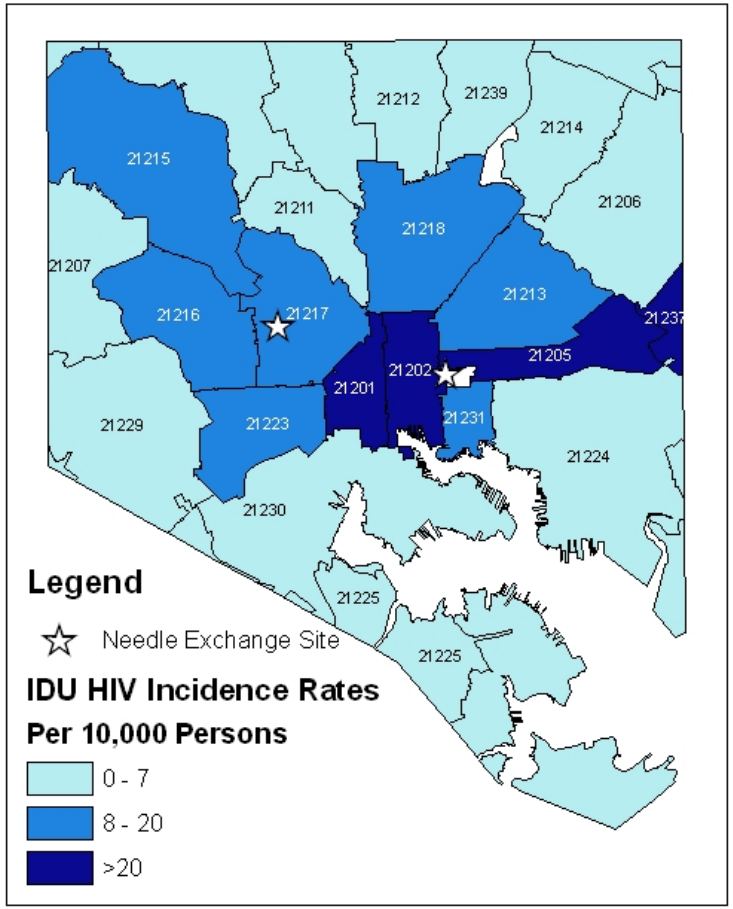
2006



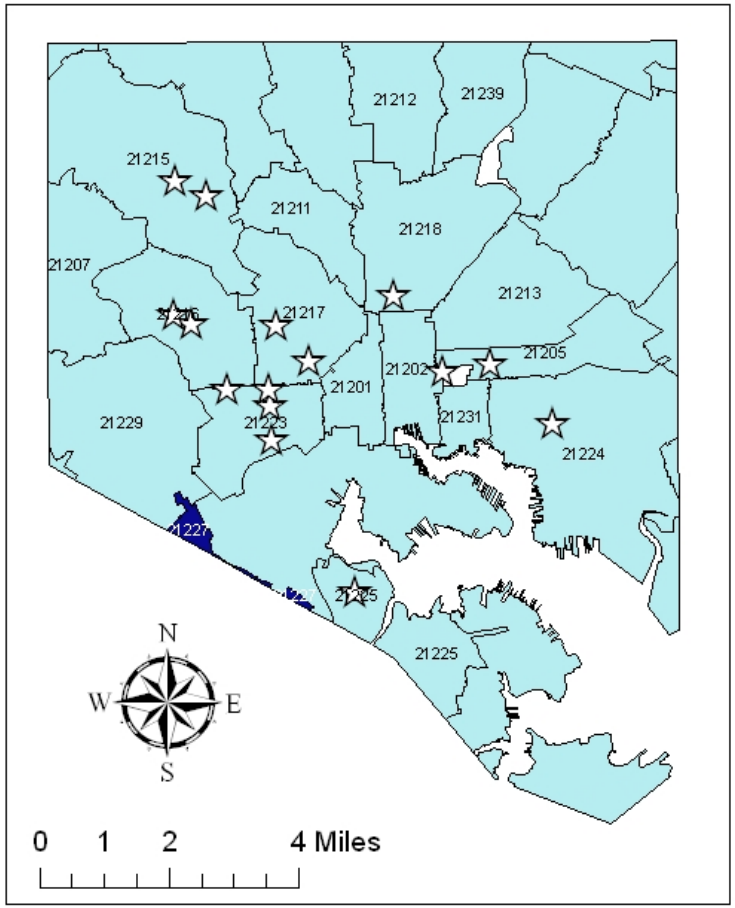
IDU HIV incidence rates declined 14.6% annually

Temporal Trends in IDU HIV Incidence in Baltimore, MD

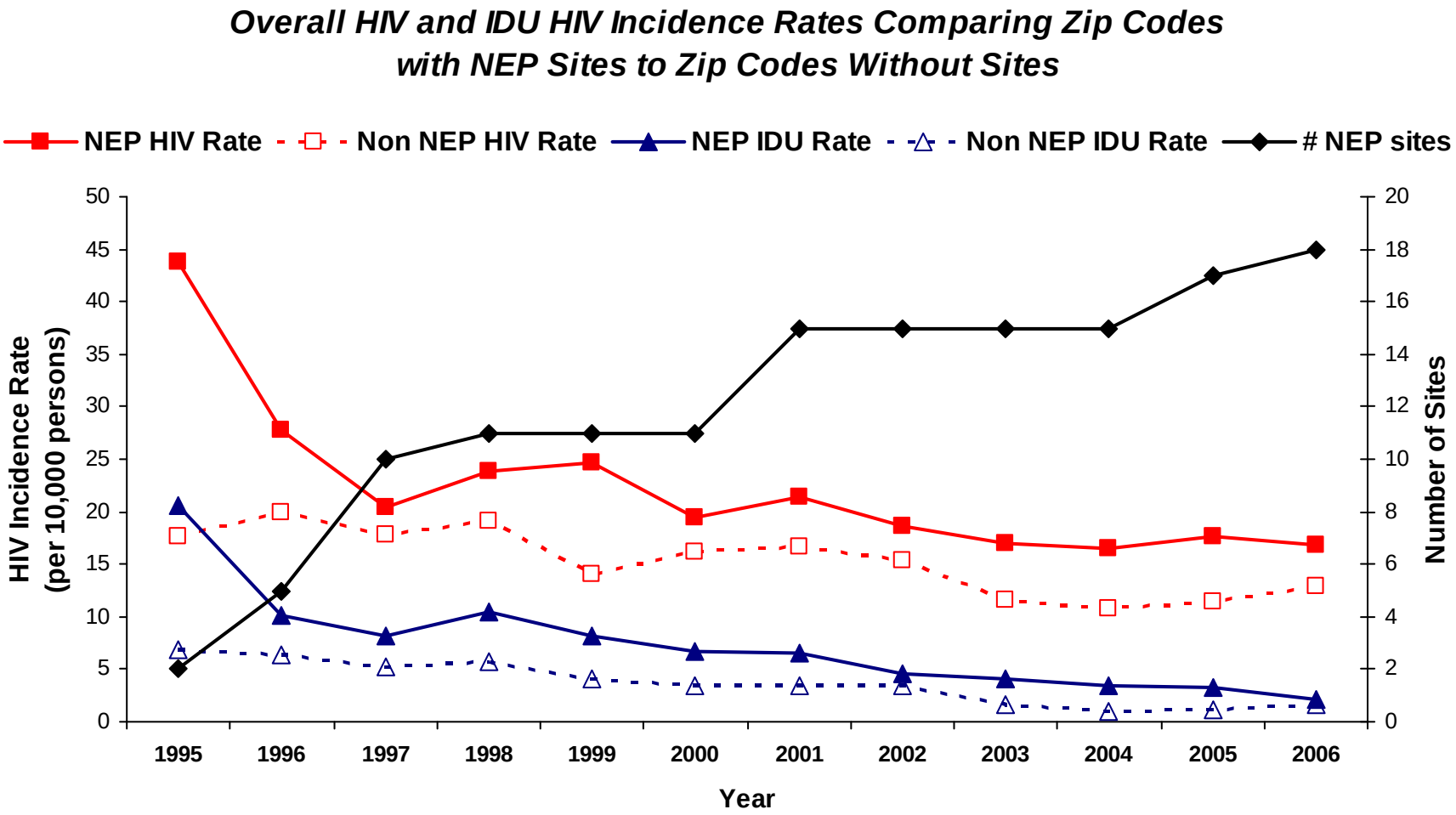
1995



2006



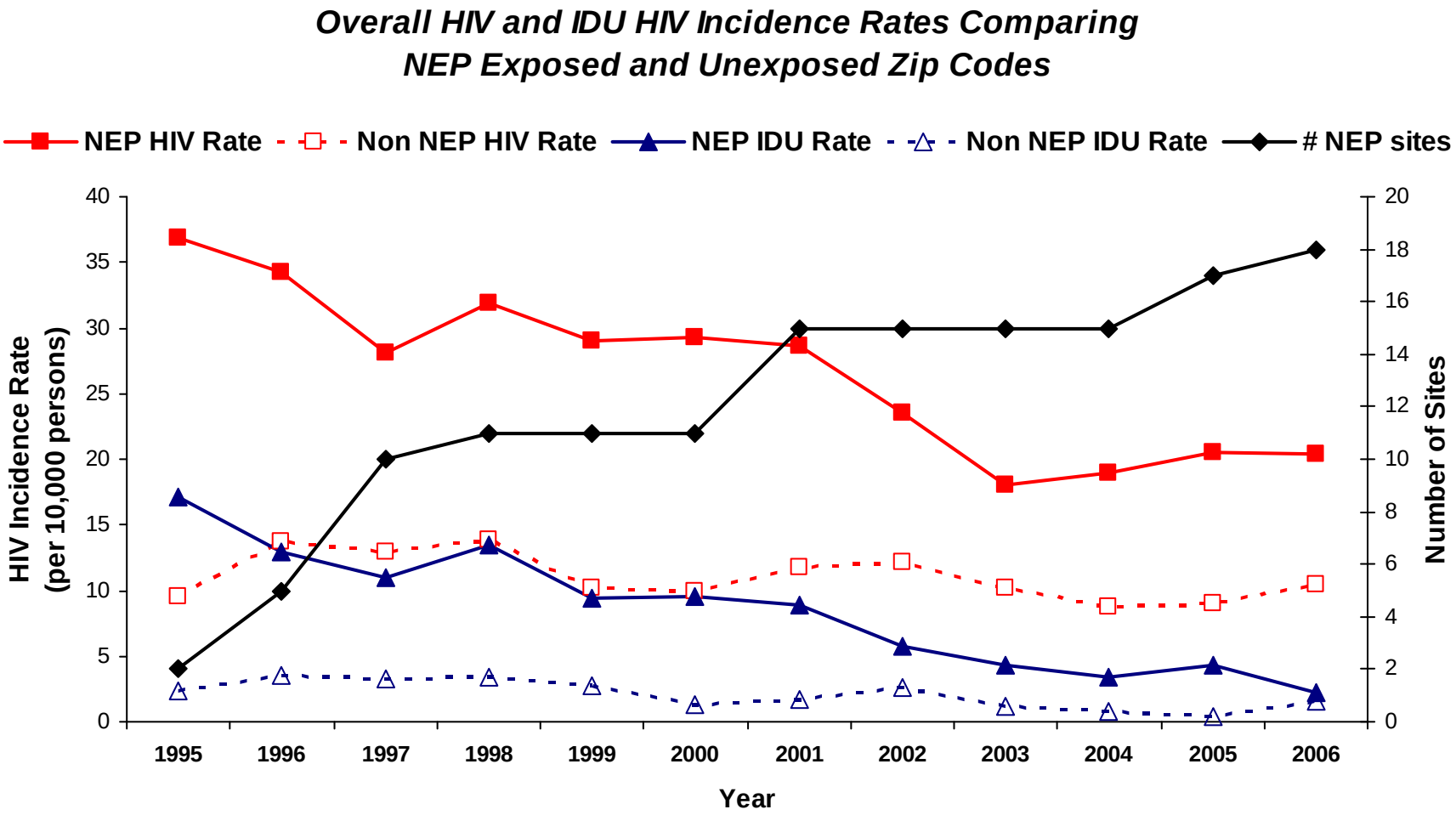
Dramatic decline in NEP incidence rates from 95-97 (NEP location analysis)



Overall, no significant difference in rate of decline

- **NEP location analysis:**
  - Zip codes without NEP sites observed a 2.7% annual decline in HIV incidence ($p<0.001$)
  - Zip codes with NEP sites observed a 4% annual decline in HIV incidence, but this was not statistically different from the unexposed group
  - However, zip codes with NEP sites had a 3.7% slower annual decline in IDU associated HIV incidence compared to zip codes without NEP sites ($p=0.011$)

Faster rate of decline in NEP exposed zip codes
(NEP usage analysis)



Exposed zip codes had faster rate of HIV incidence decline

- **NEP usage analysis:**
  - Unexposed zip codes observed a 0.9% annual decline in HIV incidence, but it was not statistically significant ($p = 0.092$)
  - Conversely, NEP exposed zip codes observed a 5.0% annual decline in HIV incidence ($p < 0.001$)
  - The annual rate of decline in IDU associated HIV incidence, which was approximately 13%, was not statistically different between the two exposure groups

Catchment Analysis

- **A catchment analysis was performed using NEP client enrollment data to validate the use of zip code level exposure**
- **Found that clients enrolled at a site within their zip code of residence only 35.8% of the time**
- **Overall, clients reported an address zip code equal to an NEP site zip code 60.1% of the time**
  - Lead to 40% misclassification during NEP location analysis
- **However, this does highlight the expansive reach of the Needle Exchange Program**

Limitations

- **Zip code level comparisons have several limitations:**
  - NEP location analysis was based on the assumption that NEP clients are visiting sites within their zip code of residence
    - This assumption leads to 40% misclassification
  - Assumes effect of NEP would be reflected in zip code level HIV incidence rates
  - Possibility of ecologic fallacy

Limitations

- **Exposure ascertainment**
- **Heterogeneity of IDU risk behavior**
- **Lack of HIV trend data prior to 1994**
- **Route of exposure only known in 57% of incident HIV cases**
- **Defining population at risk**
  - In both total and IDU populations
- **HIV diagnosis vs. HIV incidence**
  - Potential lag time

Key Messages

- HIV and IDU associated HIV incidence have both declined significantly since 1995
- Based on the catchment analysis, the needle exchange program appears to have widespread coverage throughout the city
- Effects may not be detectable on the zip code level due to broad program reach
- More studies are needed in order to adequately characterize the association between the Needle Exchange Program and trends in HIV incidence

Acknowledgements & References

- **Acknowledgements**
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  - Chris Serio and the staff of the Needle Exchange Program
  - Colin Flynn and the Maryland AIDS Administration
  - Dr. Michael Ibrahim and Dipti Shah

- **References**

  - **Maryland Department of Health and Mental Hygiene. Baltimore City HIV/AIDS Epidemiologic Profile: Fourth Quarter 2007. <www.dhmh.state.md.edu/AIDS.>**