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State-level gonorrhea rates and expedited partner therapy laws: insights from time series analyses

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ABSTRACT

Objective: In this study, we examined state-level monthly gonorrhea morbidity and assessed the potential impact of existing expedited partner therapy (EPT) laws in relation to the time that the laws were enacted.

Study design: Longitudinal study.

Methods: We obtained state-level monthly gonorrhea morbidity (number of cases/100,000 for males, females and total) from the national surveillance data. We used visual examination (of morbidity trends) and an autoregressive time series model in a panel format with intervention (interrupted time series) analysis to assess the impact of state EPT laws based on the months in which the laws were enacted.

Results: For over 84% of the states with EPT laws, the monthly morbidity trends did not show any noticeable decreases on or after the laws were enacted. Although we found statistically significant decreases in gonorrhea morbidity within four of the states with EPT laws (Alaska, Illinois, Minnesota, and Vermont), there were no significant decreases when the decreases in the four states were compared contemporaneously with the decreases in states that do not have the laws.

Conclusion: We found no impact (decrease in gonorrhea morbidity) attributable exclusively to the EPT law(s). However, these results do not imply that the EPT laws themselves were not effective (or failed to reduce gonorrhea morbidity), because the effectiveness of the EPT law is dependent on necessary intermediate events/outcomes, including sexually transmitted infection service providers' awareness and practice, as well as acceptance by patients and their partners.

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Introduction

Gonorrhea is the second most commonly reported bacterial sexually transmitted infection (STI) in the United States (US).[1] The overall burden of gonorrhea was estimated at over 800,000 new cases in 2008 costing over $162 million (in 2010 US dollars) in direct lifetime medical expenses.[2,3] In women, untreated gonorrhea can cause pelvic inflammatory disease and can develop into more costly and complicated sequelae such as chronic pelvic pain, ectopic pregnancy, and tubal infertility.[4] In men, untreated gonorrhea can cause epididymitis and prostatitis.[4] Thus, the importance of early identification of infected individuals followed by adequate treatment cannot be overstated.

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One way to quickly reach and treat potentially infected individuals is the expedited partner therapy (EPT)—a partner management procedure in which medication or prescription is provided to the partner of a patient who tests positive for chlamydia or gonorrhea without previous medical/physical evaluation or prevention counseling of the partner.[5,6] Studies have reported the potential effectiveness of EPT in reducing STIs,[7,8] including randomized controlled trials.[9–11] In addition, EPT is associated with higher percentages of partners treated than other forms of partner notification,[12] and has been shown to be cost-effective under some conditions.[13] Because of its potential effectiveness, EPT has been recommended by the Centers for Disease Control and Prevention (CDC) and other national organizations.[5,14–16] Consequently, just over 50% ($n = 26$) of the states in the US have enacted laws at different times (mostly within the past decade) that permit EPT for specific STIs (i.e. both chlamydia and gonorrhea or chlamydia only) or non-specific STIs (i.e. 'the treatment of sexually transmitted disease').[17,18]

A study of local health departments in high-STI morbidity areas across the country found that partner notification interviews were conducted in <20% of gonorrhea cases with notable variation across geographic regions, suggesting that partner treatment rates in the absence of EPT are low.[19] Effective EPT can potentially reduce transmission by substantially reducing the duration of infectiousness which will eventually reduce the overall burden within the communities or jurisdictions where EPT is practiced. Thus, the objective of this study was to examine state-level gonorrhea morbidity over time and assess the potential impact of existing EPT laws in relation to the time that the laws were enacted (i.e. effective date).

Methods

Study design

We designed a longitudinal study that examined and compared monthly gonorrhea rates within and across all 50 states and the District of Columbia in the US over specified time periods.

Data

We obtained monthly gonorrhea rates (number of cases/100,000) for male, female, and both sexes (total) from January 1995 to December 2014 (where available) for each state and the District of Columbia, a total of 51 geographic units, from national STI surveillance data. For the purpose of this study, the District of Columbia was considered a state. However, monthly data were not available for all the states over the entire period. For instance, monthly gonorrhea rates data were not available for California and Arizona before January 2002 and January 2003, respectively. Next, based on the findings from Hodge et al.,[17,18] we summarized and merged state-level information on EPT laws and policies as of December 2014.

Visual examination

In the first part of our analyses, we created charts of the data—monthly morbidity (number of gonorrhea cases/100,000 residents) for all the 51 states. We then included a vertical line representing the time of the intervention (i.e. the month in which EPT law was effective) for the states with the laws. This enabled us to visually examine the changes over time in relation to the changes that occurred at and/or after the law was enacted for the states with the law (experimental group). In addition, it enabled us to visually examine the changes over time for the states that did not have the law (control group). Finally, the charts assisted us in the time series model specification, including when (which month) to apply the expected changes as most changes might be realized sometime after the dates/months in which the EPT laws were enacted.

Although we used data on the burden of gonorrhea, we did not focus our impact analyses on only the states with gonorrhea-specific EPT laws in our analyses. We included all the states that enacted any form of law—explicitly permitting EPT for gonorrhea and chlamydia, for chlamydia only, or for STIs in general terms. First, given the recommendation for presumptive dual treatment of patients with either gonorrhea or chlamydia,[5] there was the potential for spillover impact—EPT for chlamydia resulting in treatments for gonorrhea as well. That was why we included states with EPT laws for chlamydia only as well. Second, there was the potential for EPT for STIs in general to also impact gonorrhea rates. Finally, we separately examined the potential for a relatively higher and/or noticeable impact of the EPT laws for three of the states (Arkansas, Illinois and Louisiana) in which EPT was prohibited prior to the dates/months that their EPT laws were enacted.

Initially, we planned to assess the impact of the EPT laws for a total of 26 states that had some form of the EPT law as of December 2014. However, we could not include California in the experimental group because the monthly gonorrhea morbidity data for California was available from January 2002, although their EPT law was enacted in January 2001. As a result, California was included in the control group. Due to the large number of states, we showed miniature charts for the states in the experimental group only ($n = 25$).

Statistical analyses

Next, we used a panel time series approach to statistically examine the potential impact of the EPT laws on gonorrhea morbidity across the states. Based on the structure of our data, we used an autoregressive time series model in a panel format and applied an intervention (interrupted time series) analysis based on the months in which the EPT laws were enacted. Panel data analyses have several advantages, including higher variability and degrees of freedom while minimizing multicollinearity concerns.[20–22] In addition, beside examining and testing the difference in the burden of the disease before and after the laws were enacted within each state, it was equally important to examine and test the changes that occurred in the experimental group with the contemporaneous changes in the control group. This was because if another state that did not have any EPT law showed analogous change(s) in gonorrhea morbidity at or around the same time, then the change(s) in the state with the EPT law cannot be ascribed exclusively to the EPT law. As a result, we used a mixed model approach by exploring both fixed effects (within state) and random effects (within and across states).