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Short-term Impact of Changes in Public Health Information Systems on Sexually Transmitted Infection Surveillance Data Quality

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Abstract

Jurisdictional health departments use public health information systems (PHIS) to maintain and transmit their surveillance data for national surveillance. We investigated if changes to a PHIS had an impact on sexually transmitted infection case-based surveillance data and document short-term issues that resulted in decreased data quality.

Short Summary:

Changes to a jurisdiction's public health information systems had a short-term impact on sexually transmitted infection case-based surveillance data quality.

INTRODUCTION

In the United States, rates of sexually transmitted infections (STIs), particularly syphilis, have increased in the past decade. In 2022, the total syphilis rate increased to 62.2 cases per 100,000 population at an estimated lifetime cost of \$1,190 per case.^{1,2} Public health information systems (PHIS), used by state, tribal, local and territorial (STLT) health departments to monitor and transmit their STI surveillance data to the Centers for Disease Control and Prevention (CDC), are a crucial component of disease surveillance and public health response.

PHIS for STI case surveillance data vary across STLT health departments (Appendix 1).³ Within jurisdictions, changes to PHIS are common and can include transitioning to a new

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PHIS or updating standards for transmitting data to CDC. Beginning in 2018, jurisdictions were able to transition to a new transmission standard for STI case surveillance by onboarding message mapping guides (MMGs) that use Health Level 7 (HL7) standards and allow for improvements such as greater detail in case reports and the capacity to transmit case data to CDC in near real-time.⁴ HL7 MMGs are a detailed framework providing a standardized way to describe and transmit case information. We examined the short-term impact of changes in jurisdictions' PHIS on national case-based surveillance for STIs.

METHODS

Twelve jurisdictions with documented changes to their PHIS from 2019 to 2021 were selected for analysis based on consultation with CDC STI surveillance subject matter experts who also identified the month and year of each change. This includes all jurisdictions with a known change during the study period. Among these jurisdictions, nine onboarded new STI MMGs and three transitioned to a new PHIS for STI surveillance. For each jurisdiction, case notification data for chlamydia, gonorrhea, and syphilis were extracted from the National Notifiable Diseases Surveillance System (NNDSS). Two sets of files were used: (1) provisional "snapshot" files that were an archived data pull from the end of each month (12 monthly files per year) and (2) reconciled year-end files (1 file per year).

For each jurisdiction, the number of consecutive months with impacted case data transmission to CDC was calculated. Case data for all syphilis stages, gonorrhea, and chlamydia were included for this analysis. STI case notifications are transmitted to CDC at a weekly interval by most jurisdictions, so the absence of new cases in a monthly snapshot file is indicative of a data transmission issue. In four jurisdictions, during the transition period, a low number of case notifications were submitted early in the transition and then paused. To standardize the definition of "non-transmission months," in consultation with surveillance data experts, a month was considered to be impacted if fewer than 10% of the jurisdiction's average monthly case count from the previous year were present in the monthly snapshot file.

Additionally, for primary and secondary (P&S) syphilis cases, the completeness of seven critical demographic variables (age, HIV status, pregnancy status, race and Hispanic ethnicity, sex, sex of sex partners, and sexual orientation) was calculated based on whether the provided value was "valid and usable." This measure is limited to P&S syphilis as these cases are a priority for case investigation and therefore more likely to have complete information for these variables.⁵ To be considered valid and usable, an interpretable value must be present for the given variable, which excludes responses of "missing," "unknown," or "refused to answer." Variables and values considered valid and usable were chosen based on CDC national STI reporting practices⁵⁻⁸ in consultation with CDC STI surveillance staff.

RESULTS

Among the nine jurisdictions onboarding new STI MMGs during the study period, the median number of non-reporting months was 2.0 (range: 0, 10), compared to a median of 8.0 months (range: 4, 19) for the three jurisdictions that were transitioning to a new

PHIS (Table 1). Three of the nine jurisdictions onboarding MMGs experienced no delay in the transmission of case notifications. The number of non-reporting months across the 12 jurisdictions ranged from 0 to 19. By the annual data close out, all jurisdictions provided data for the entire calendar year. The annual close out date for NNDSS varies from year to year, so we are unable to provide specific dates.

The percent change in completeness of key variables was mixed, differing by variable and type of change (Table 1). For jurisdictions onboarding STI MMGs, the impact on variable completeness was generally small, with the largest median change of -2.9% (range: -10.7, 9.7) for the variable “sex of sex partners.” Those jurisdictions transitioning to a new PHIS had greater variability in the percent change of completeness, with “sex of sex partners” improving by a median of 4.7% (range: 0.0, 10.7) while “HIV status” completeness decreased by 16.6% (range: 23.2, 5.5). HIV status was the only variable for which all three jurisdictions transitioning to a new PHIS experienced a substantial decrease in completeness.

DISCUSSION

All jurisdictions included in this study were able to provide a full calendar year of case notification data to CDC prior to the annual data close out. However, when onboarding MMGs or transitioning to a new PHIS, regular functions of STI PHIS may be impacted temporarily. Potential causes include interruptions to data entry and reporting workflows, staff onboarding to new processes, and other technical challenges. These challenges can result in delays in data transmission to CDC or other data quality issues. Transmission delays can limit the usability of provisional national STI surveillance data and incomplete case reports can result in jurisdictions being excluded from national STI surveillance reporting, leading to an inability to have a comprehensive understanding of the epidemiology of STIs in the United States. Longer term impacts of these changes are not considered in this study, but the changes, though with potential short-term adverse impacts, may ultimately result in more timely data transmission with improved data quality in the long term.

CDC offers robust documentation and technical support for onboarding HL7 MMGs.⁹ Transitioning to a new PHIS often requires the involvement of external partners in addition to STLT health department and CDC staff, adding complexity to the ability to achieve these changes. This may account for the higher median delay in reporting amongst the three jurisdictions in this group. Further, some PHIS are unable to transmit all requested variables for a STI case notification. Transitioning from one PHIS to another can result in widely divergent rates of demographic variable completeness in the short term, as demonstrated by the range in changes of percent completeness of selected variables in Table 1.

This study has important limitations. There is no comprehensive database on all PHIS changes or local issues such as laboratory errors relevant to surveillance; as such, our small sample size was limited to the 12 jurisdictions with known changes, and it was not feasible to include PHIS changes prior to 2019 for a more in-depth analysis of specific changes attributable to the COVID-19 pandemic. STI case data transmission practices and the capacity for real-time data quality checks vary by jurisdiction, and these practices are

not accounted for in this study. Further, the study period includes the beginning of the COVID-19 pandemic, which had a major impact on STI surveillance in the US.¹⁰ The impact of the COVID-19 pandemic on STI surveillance was heterogeneous and is not fully understood. Changes in data quality could reflect other events occurring simultaneously with the onboarding of MMGs or PHIS transitions. Future qualitative work could explore mechanisms in more detail. Another area for future research that was outside the scope of this analysis would be comparing reporting timeliness and data completeness between jurisdictions with and without PHIS changes.

PUBLIC HEALTH IMPLICATIONS

This study highlights the challenges that STLT health departments may face when making changes to their STI PHIS. Changes to PHIS to use more efficient data transmission standards such as HL7 may improve long-term STI surveillance quality; however, this study demonstrates that it is necessary to plan for short-term interruptions in data transmission to CDC.¹¹ More comprehensive reporting on changes within jurisdictions could improve future understanding of data aberrations and contributing causes.

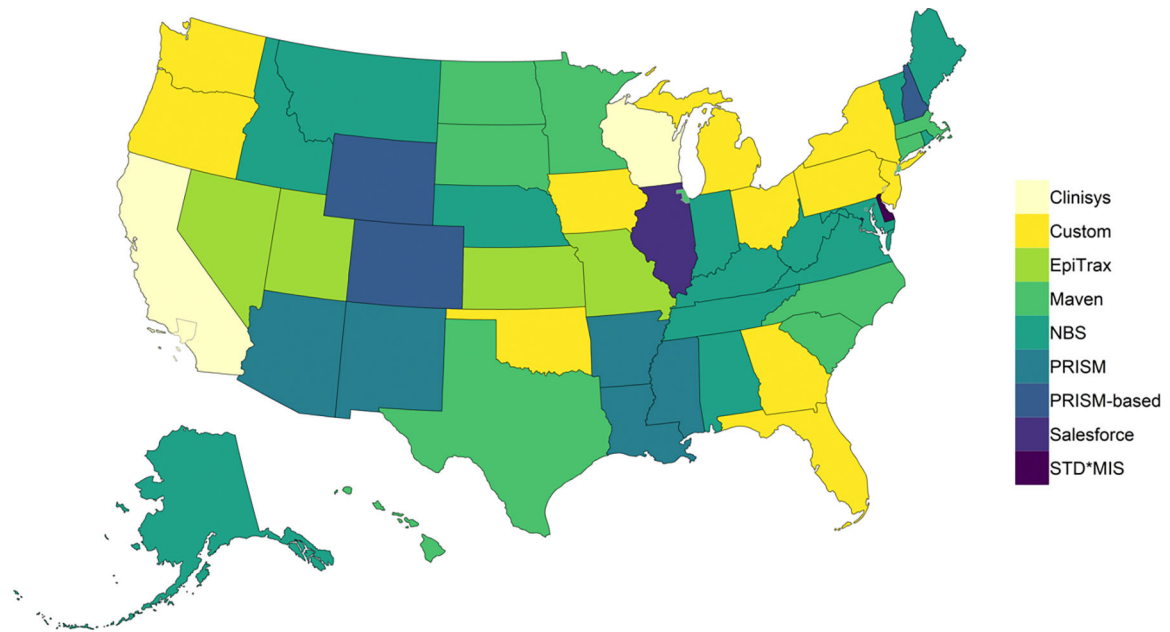
Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix 1.: Public health information systems used for STI case surveillance by US state and project area, 2024



Note: Data are current as of August 23, 2024. Custom PHIS systems are developed and maintained by the jurisdiction. PRISM-based systems are PRISM systems that have been customized by the jurisdiction. Clinisys: California, Los Angeles, Wisconsin. Custom: Florida, Georgia, Iowa, Michigan, New Jersey, New York, Ohio, Oklahoma, Oregon, Pennsylvania, Philadelphia, San Francisco, Washington. EpiTrax: Kansas, Missouri, Nevada, Utah. Maven: Connecticut, Hawaii, Illinois, Massachusetts, Minnesota, New York City, North Carolina, North Dakota, South Carolina, South Dakota, Texas. NBS: Alabama, Alaska, Baltimore, Idaho, Indiana, Kentucky, Maine, Maryland, Montana, Nebraska, Rhode Island, Tennessee, Vermont, Virginia, West Virginia. PRISM: Arizona, Arkansas, Louisiana, Mississippi, New Mexico. PRISM-Based: Colorado, New Hampshire, Wyoming. Salesforce: Chicago, Washington DC. STD*MIS: Delaware

Source: CDC STI Informatics, Public Health Information Systems. <https://www.cdc.gov/sti-informatics/php/training/phish.html>

Abbreviations: National Electronic Disease Surveillance System Base System (NBS), Patient Reporting Investigation Surveillance Manager (PRISM), Sexually Transmitted Disease Management Information System (STD*MIS)

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Table 1.

Summary of short-term impact of PHIS changes on STI surveillance data quality

Measure	Onboarded STI MMGs (n=9 jurisdictions) Median (Range)	Transitioned to new STI PHIS (n=3 jurisdictions) Median (Range)
Number of nonreporting months ¹	2.0 (0, 10)	8.0 (4, 19)
Percent change in valid age	0.0 (−0.5, 0.2)	0.0 (0.0, 0.1)
Percent change in valid HIV status	0.3 (−16.7, 44.7)	−16.6 (−23.2, −5.5)
Percent change in valid pregnancy status	−0.3 (−7.3, 1.7)	−1.3 (−1.6, −0.8)
Percent change in valid race/Hispanic ethnicity	0.8 (−17.0, 5.1)	−2.7 (−24.9, −0.1)
Percent change in valid sex	0.0 (−0.1, 1.7)	−0.8 (−1.0, 0.0)
Percent change in valid sex of sex partners	−2.9 (−10.7, 9.7)	4.7 (0.0, 10.7)
Percent change in valid sexual orientation	0.0 (−6.9, 31.9)	0.1 (−4.5, 5950.0) ²

Abbreviations: message mapping guide (MMG), public health information system (PHIS), sexually transmitted infection (STI)

¹The number of nonreporting months measures reporting delays in syphilis, gonorrhea, and chlamydia case data. All other measures include only primary and secondary syphilis case data.

²The high percent change is a result of a jurisdiction with 1.0 percent of cases with a valid value prior to the transition.