The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the U.S. Department of Health and Human Services or the U.S. Public Health Service.

### Background

Transmitted drug resistance-associated mutations (TDRMAs) have been described for all major classes of antiretroviral therapy (ART) for HIV infection.

- Drug resistance testing for protease (PR) and reverse transcriptase (RT) gene mutations is recommended for all patients at the time of HIV diagnosis.
- Testing for integrase (IN) gene TDRMAs is recommended if transmitted resistance to integrase strand transfer inhibitors (INSTI) is a concern.
- Routine drug resistance testing is based on HIV sequences generated by conventional bulk sequencing methods.

### Objectives & Methods

**Objective 1: Characteristics HIV Sequence Reporting to NHSS**
- Characterize PR/RT and IN sequence data from drug resistance tests performed within 5 months of HIV diagnosis for people diagnosed with HIV from 2013-2016.

**Objective 2: Characteristics TDRMs**
- Analyze HIV sequence data generated by routine drug resistance testing to detect TDRMs for the following drug classes:
  - PR/RT
  - IN

**Results**

**Case Characteristics**
- U.S. Jurisdictions Included in Analysis (N=23)

**TDRMs Overall**
- Total sequences analyzed: 44,083
- 42 (0.9%) TDRMs reported

**IN Results (N=5,570)**
- 42 (0.8%) TDRMs reported

**PR/RT Results (N=34,512)**
- 4,105 (11.9%) TDRMs reported

**Common Mutations**
- Prevalence of Specific TDRM by Drug Class, 2013-2016*

**Discussion**

- HIV sequence data reporting was new for many jurisdictions in 2013 and reporting increased overall from 2013-2016. Since 2014, many other jurisdictions have begun HIV sequence collection.
- Less than half of HIV diagnoses from 2013-2016 in these 23 jurisdictions had a reported drug resistance test performed 3 months before HIV diagnosis, and an increasing proportion of cases had only IN sequence reported. Drug resistance testing for PR/RT mutations is needed to detect TDRMAs for mTFFIs, which remains a clinical backbone for ART.
- IN/TDF TDRM prevalence was low overall, but increased during a period when INSTI use and IN sequence reporting also increased. This indicates a need for ongoing population-level monitoring and additional analysis to identify those at most risk for INSTI TDRM.
- TDRM prevalence among people who injected drugs (PWID) increased during this time period when U.S. drug overdose deaths also increased and multiple HIV outbreaks occurred among PWID.
- Among people diagnosed with HIV infection attributed to perinatal transmission, 287/35 (81%) sequences had drug resistance mutations.
- Due to the increased proportion of drug resistance testing and/or increased types of drug resistance testing, many states have begun HIV sequence collection.

**Limitations**

- TDRM prevalence in this analysis might differ from prevalence among all U.S. cases we included only 23 U.S. jurisdictions and could not include undiagnosed cases or cases with no drug resistance test ordered, performed, or reported to NHSS.
- Cases in the analysis were assumed to be ART-naive if no evidence of prior ART use was found during case investigation; some cases might have been incorrectly classified as ART-naive. However, sequences were only included if they were performed within 3 months of diagnosis.

**References**

2. Centers for Disease Control and Prevention. HIV testing. Available at: https://www.cdc.gov/hiv/testing/testing.html.

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