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HIV Diagnoses through Partner Services in the United States in 2019 and opportunities for improvement

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Abstract

Background: HIV Partner Services (HIV PS) is an effective strategy for diagnosing HIV infection. Sex/needle-sharing partners of individuals diagnosed with HIV are notified about potential exposure and offered HIV testing and other services. We assessed the HIV PS contribution to HIV diagnoses in the U.S. and assessed priority areas for improvements.

Methods: National HIV Monitoring and Evaluation Partner Services and case surveillance data reported to the Centers for Disease Control and Prevention for 2019 were used for this analysis. The percentage of all new diagnoses that HIV PS programs reported are described nationally and by state. Linkage to HIV medical care among newly diagnosed partners is described. Potential increases in diagnosing HIV infection are assessed by HIV PS step to identify priority areas for improvement.

Results: HIV PS contributed 1,214/35,164 (3.5%) of all diagnoses nationally in 2019, and contributions ranged 0-31.8% by state. Of partners tested with non-missing data, 22.7% were newly diagnosed. An estimated 1,692 new partner diagnoses were lost during HIV PS steps. Steps resulting in the highest losses included index patients not being interviewed, partners not being tested for HIV, and index patients not being located. Seventy-two percent of partners newly diagnosed with HIV were linked to HIV medical care.

Conclusions: HIV PS is an effective strategy for diagnosing HIV, and a high percent of sex/needle-sharing partners were newly diagnosed with HIV. Expanded HIV PS in some states and targeted improvements in HIV PS steps can enhance the contribution of HIV PS toward achieving national goals.

SHORT SUMMARY

HIV Partner Services in 2019 resulted in 1,214 diagnoses (3.5% of diagnoses in the United States) with 22.7% new positivity among partners without prior diagnosis. Areas for improvement are identified.

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Keywords

HIV infections; HIV Testing; partner services programs; partners; partner notification

INTRODUCTION

Diagnosing HIV as early as possible after infection is one of the four pillars of the *Ending the HIV Epidemic* in the U.S. (EHE) strategic initiative, and the National HIV/AIDS Strategy established the goal of increasing knowledge of HIV infection to 95% by 2025.[1,2] HIV partner services (HIV PS) is a free, voluntary activity in which persons with newly diagnosed or reported HIV (index patients) are interviewed to elicit information about their sexual or needle-sharing partners, to notify partners about their potential exposure to HIV, and offer them HIV testing and other services.[3] Some programs may also offer HIV PS to previously diagnosed index patients infected with a new STI, which triggers an investigation.[4,5] A systematic review conducted in 2007 found that 14% to 20% of partners named and tested were newly diagnosed with HIV.[6] A more recent analysis focusing on U.S. counties and states included in EHE found that 20% of HIV PS partners who were tested in 2019 were newly diagnosed with HIV.[7] Two studies found HIV PS to be cost saving. In New York state, one study found HIV PS to be a cost-saving intervention after accounting for total program costs.[8] Another analysis examining cost-effectiveness by population groups with risk factors found that HIV PS was cost-saving among men who have sex with men (MSM), persons who inject drugs (PWID), and heterosexual persons.[9] A recent network modeling study found HIV PS to be highly efficient, requiring lower resources per infection averted.[10] Despite the benefits of HIV PS in promoting diagnoses of HIV among those infected, evidence suggests that partner identification through HIV PS in the U.S. is declining.[7] An important first step in addressing this decline, is to identify areas for improvement in HIV PS implementation.

The Centers for Disease Control and Prevention (CDC) annually publishes information on HIV PS data collected as part of the National HIV Monitoring and Evaluation (NHM&E) data. These data are used to calculate the percentage of index patients and partners who progress through each step of HIV PS toward testing and linking newly diagnosed partners to HIV medical care.[5] Although critical for program monitoring and improvement, this information alone does not directly identify what steps should be prioritized for improvement to increase HIV diagnoses among partners with HIV. Understanding the contribution of HIV PS to HIV diagnoses and where enhancements would improve the identification of previously undiagnosed HIV infections is crucial to support this highly effective strategy and contribute to the national goal of ending the HIV epidemic in the United States.

Using data from 2019, this analysis aims to describe the extent to which HIV PS contributed to HIV diagnoses in the U.S. and identify which HIV PS steps should be prioritized for improvement. Potential new diagnoses missed at each step of HIV PS are estimated and compared to identify priority areas for improvement.

MATERIALS AND METHODS

Data Source

HIV PS data were reported to CDC by 51 state and local health departments in the United States, Puerto Rico, and U.S. Virgin Islands in 2019 through the CDC's NHM&E system. We chose to focus this analysis on 2019 because it was the most recent data not impacted by reporting challenges during the COVID-19 pandemic. Index patients eligible for and enrolled in HIV PS were included in this analysis. Index patients not deceased and not out of jurisdiction were considered eligible, and index patients who were interviewed were considered enrolled in HIV PS. The number of sex and/or needle-sharing partners named by index patients and initiated for HIV PS were analyzed.

The 2019 National HIV Surveillance System (NHSS) data were used to compare HIV PS diagnoses to the total number of diagnoses nationally and by state.[11]

Variables

Variables used for this analysis focused on the HIV PS steps outlined below. All measures were dichotomous (yes/no) except for the number of partners named by index patients. Specifically, the following HIV PS steps were analyzed:

Index patients eligible for HIV PS (not deceased and not out of jurisdiction):

- Located
- Interviewed for HIV PS (enrolled, yes/no)
- Number of partners named

Partners:

- Initiated for HIV PS
- Notifiable (not previously diagnosed with HIV, out of jurisdiction, deceased, or potentially violent)
- Notified of potential HIV exposure
- Tested for HIV
- Newly diagnosed with HIV
- Linked to HIV medical care

Analysis

Percentages were calculated for each HIV PS step (as outlined above), excluding missing data from the denominator. Data missingness was also calculated to contextualize findings. To describe missing data throughout all steps (i.e. all steps combined), missing data for index patients were expressed in terms of potential partners by multiplying the number of index patients with missing data times the number of partners named per interview. For example, if 100 index patients were missing data and 0.5 partners were named per interview, this would be expressed as missing data for 50 potential partners (100 times 0.5).

Analyses at the national level include HIV PS data from 51 health departments that reported HIV PS data. State-level analyses include data from 49 health departments which were aggregated to the state or territory level (i.e., data from directly funded cities including Baltimore, Chicago, New York City, and Philadelphia were added to their respective states; n = 45 states/territories) and compared to NHSS data. Data reported by San Francisco and Los Angeles health departments were not analyzed at the state level because information for the state health department was not available. The percent of all diagnoses that resulted from HIV PS was calculated by comparing HIV PS reported diagnoses to HIV case surveillance totals at the national and state level.

To understand the potential impact of improvements at each modifiable step throughout HIV PS, the number of potential new diagnoses lost was calculated for each step. Modifiable steps are those that might be affected by improved HIV PS program implementation. We considered five steps to be modifiable for improvement: 1) index patient located, 2) index patient interviewed, 3) partner initiated, 4) partner notified, and 5) partner tested. Non-modifiable steps included the number of partners named per index patient interview, the percent of partners that were notifiable, and the percent of partners that were newly diagnosed with HIV infection. Linkage to HIV medical care is described in this analysis, but potential improvements are not estimated because, under ideal conditions, all newly diagnosed partners would be linked to HIV medical care.

Potential gains from improving HIV PS steps rely on subsequent steps, so the number of potential diagnoses were calculated in two ways: 1) Maximum potential - assuming all remaining steps were completed for all index patients or partners, and 2) Single-step improvement - assuming the given step was the only one improved. The first approach provides information on the maximum potential diagnoses lost in each step, while the second calculation provides information on improving only the single step. To calculate the potential newly diagnosed partners lost, the observed data for each step were used to impute information for non-observed potential index patients and partners. For example, the maximum number of potential partner diagnoses lost due to partners not being initiated was calculated by multiplying the number not initiated by: 1) the remaining non-modifiable percentages (notifiable and newly diagnosed as HIV-positive), and 2) each percent of data that were non-missing for remaining HIV PS steps (to account for missing data). For the single-step potential calculation, the number was multiplied by all subsequent steps, including both modifiable and non-modifiable step percentages. Using the same example, the number of partners not initiated was multiplied by the percentages for: notifiable, partners notified, tested, and newly diagnosed as HIV-positive, and non-missing data percentages. Detailed calculations for the number of potential newly diagnosed partners lost are provided in the Supplemental Table.

RESULTS

In the 45 states/territories for which all health departments reported data, 3.5% (1,214 / 35,164) of all new HIV diagnoses reported in 2019 by NHSS were reported by HIV PS programs (Table 1). The percent of diagnoses reported from HIV PS by state ranged from

0% in Connecticut, Idaho, Montana, US Virgin Islands, and West Virginia to 31.8% in North Carolina.

An estimated 1,692 partner HIV diagnoses were lost throughout all HIV PS steps (Table 2), reflecting a potential to increase diagnoses by 139%. When potential diagnoses lost were analyzed by HIV PS step, the same three steps emerged as leading to the largest losses when using the maximum potential or single-step improvements: index patients who were not interviewed (589 of potential diagnoses lost using the maximum, 371 when using single-step improvement); partners who were not tested (405 of potential diagnoses under both methods); and index patients who were not located (390 of potential diagnoses lost using the maximum, 188 when using single-step improvement).

In the reported HIV PS data (not estimated), 414/573 (72.3%) of tested partners with a new HIV diagnosis were linked to HIV medical care.

DISCUSSION

These findings highlight improvement opportunities and demonstrate the continued importance of HIV PS as an essential component of HIV prevention and care in the United States and its dependent areas. Of partners tested in 2019 with non-missing data and no prior diagnosis, 22.7% were newly diagnosed with HIV, demonstrating how highly effective HIV PS is in identifying previously undiagnosed people with HIV. For comparison, of the 2,452,507 CDC-funded HIV tests conducted in 2019, new positivity was 0.4% overall and 0.6% in non-healthcare settings.[12] HIV PS contributed more than twelve hundred diagnoses in 2019, representing 3.5% of all diagnoses reported in surveillance data.

The contribution of HIV PS toward HIV diagnoses varied by state. In North Carolina, HIV PS contributed nearly a third of all diagnoses, followed by Virginia where HIV PS contributed 21.3%. In ten states/dependent areas, however, HIV PS contributed less than 1.0% of diagnoses. While HIV PS activities are currently required for every CDC-funded health department, our findings suggest that the expansion of HIV PS to reach sexual or needle sharing partners of persons with newly diagnosed with HIV should be a priority in many states. Although some jurisdictions have fewer HIV diagnoses and the likelihood of identifying a notifiable partner who subsequently tests positive for HIV may be low, this is not the case for high prevalence jurisdictions. Although the reasons for low partner identification were not collected as part of the data for this analysis, it is important to understand how HIV PS might be improved. A study conducted in 2015 among New England public health STD directors and investigators found that commonly reported barriers included both funding/staffing challenges and index patients reporting no partners or anonymous partners.[13] This analysis helps identify states/territories that may benefit from enhanced HIV PS activities to capture missed opportunities for diagnosis, and for whom a deeper exploration of barriers to implementation should be studied.

With respect to maximizing diagnoses among undiagnosed partners with HIV and improving HIV PS, we estimate that the number of newly diagnosed partners could be increased by approximately 1,692 if all modifiable steps were completed for all index patients and

partners. If all HIV PS steps were improved, index patients who were located but not interviewed emerged as the step in which most potential new diagnoses were lost. Of located index patients, only 76.6% were interviewed, resulting in an estimated 589 potential new diagnoses lost. This was followed by testing notified partners and locating index patients, resulting in an estimated maximum of 405 and 390 newly diagnosed partners lost, respectively. If only one step were to be improved, testing notified partners could increase partner diagnoses by 405 (a 33.3% increase of the 1,214 reported diagnoses) and should be prioritized for improvement. Improving index patient interviews also emerged as a priority, potentially increasing diagnoses by 371 (30.6%).

Finally, the percent of newly diagnosed partners that were linked to HIV medical care (72.3%) was lower than both the Healthy People 2020 target (85%), the 2025 target set in the National HIV/AIDS Strategy for the United States (95%), and the overall national estimate in 2019 (81.3%).[2,14,15] Improvements in linkage are crucial to achieve viral suppression and prevent future HIV transmission.

There are important limitations for this analysis. The extent of missing data is high, which can potentially underestimate the contribution of HIV PS toward diagnoses. This could also introduce bias if data missingness is associated with any calculated probabilities. The analysis also only includes data from 2019. The rationale for this was to use the most recent data available, that was not affected by the COVID-19 pandemic. We recommend updating these analyses as data quality improves over time to update findings. The data collected by CDC also does not provide information about *why* HIV PS steps were not completed. We recommend that future efforts focus on delineating predominant barriers to performance throughout each HIV PS step and how those might be overcome. Finally, this analysis used observed probabilities for non-modifiable steps (partners named per interview, partners notifiable, and new HIV diagnosis) to estimate the potential partners with HIV that could have been diagnosed if the steps were optimally executed. Therefore, the number of potential partners diagnosed is limited by this assumption. The purpose of this analysis, however, is to provide an empirical method to compare potential gains from improvements in different steps of HIV PS rather than define quantitative targets for HIV PS diagnoses. This comparison should be the focus when interpreting findings.

Conclusion

HIV PS makes an important contribution toward national efforts in HIV testing and the identification of previously undiagnosed people with HIV. A high proportion of tests conducted through HIV PS resulted in new diagnoses among sex and/or needle-sharing partners of index patients. Although all states practice some HIV PS activities to identify people with HIV, many states may benefit from broader implementation. This analysis also identified specific areas for focused improvement in HIV PS, including increasing the proportion of index patients that are located, the proportion that are interviewed, and increasing HIV testing among partners that are notified of potential exposure to HIV. Strategies to improve performance in these areas may differ by jurisdiction, but the modernization of field services for HIV PS may provide a basis for reassessing efforts to promote improvements.[16] Linkage to HIV medical care among partners should also be a

focus area for improvement, as the reported percent was lower than national estimates and targets. Expedited testing of all partners and linkage of newly diagnosed partners to HIV medical care through HIV PS programs are important components of national efforts to end the HIV epidemic, and ongoing improvements can enhance the contribution of HIV PS toward achieving national goals.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

New HIV Diagnoses Reported by Partner Services and Total New HIV Diagnoses in 45 U.S. States/Territories Reporting Partner Services Data, 2019

State	Total HIV diagnoses (surveillance)	# Newly diagnosed partners reported by HIV PS	% of all diagnoses attributed to HIV PS	Newly diagnosed partners linked to HIV medical care[a]
Alabama	638	75	11.8	16/25 (64.0%)
Alaska	27	2	7.4	2/2 (100%)
Arizona	761	4	0.5	2/2 (100%)
Arkansas	287	4	1.4	2/2 (100%)
Colorado	461	48	10.4	45/46 (97.8%)
Connecticut	213	0	0.0	N/A
Delaware	93	1	1.1	N/A
District of Columbia	255	2	0.8	1/1 (100%)
Florida	4378	55	1.3	0/26 (0%)
Georgia	2439	38	1.6	0/1 (0%)
Hawaii	65	3	4.6	N/A
Idaho	28	0	0.0	N/A
Illinois	1252	18	1.4	0/3 (0%)
Indiana	486	5	1.0	2/2 (100%)
Iowa	100	9	9.0	7/7 (100%)
Kentucky	326	7	2.1	2/3 (66.7%)
Louisiana	881	12	1.4	10/12 (83.3%)
Maine	30	1	3.3	0/1 (0%)
Maryland	918	3	0.3	3/3 (100%)
Massachusetts	535	9	1.7	6/6 (100%)
Michigan	674	10	1.5	0/1 (0%)
Mississippi	477	20	4.2	15/18 (83.3%)
Missouri	488	19	3.9	12/13 (92.3%)
Montana	25	0	0.0	N/A
Nebraska	81	2	2.5	1/2 (50.0%)
Nevada	512	22	4.3	0/9 (0%)
New Hampshire	31	2	6.5	2/2 (100%)
New Jersey	1057	3	0.3	3/3 (100%)
New Mexico	156	2	1.3	1/1 (100%)
New York	2330	28	1.2	9/15 (60.0%)
North Carolina	1365	434	31.8	166/208 (79.8%)
North Dakota	40	5	12.5	5/5 (100%)
Ohio	980	62	6.3	46/50 (92.0%)
Oregon	199	5	2.5	N/A
Pennsylvania	989	37	3.7	27/27 (100%)

State	Total HIV diagnoses (surveillance)	# Newly diagnosed partners reported by HIV PS	% of all diagnoses attributed to HIV PS	Newly diagnosed partners linked to HIV medical care[a]
Puerto Rico	383	38	9.9	8/36 (22.2%)
Rhode Island	72	4	5.6	1/1 (100%)
South Dakota	33	3	9.1	N/A
Tennessee	773	21	2.7	N/A
Texas	4302	8	0.2	N/A
U.S. Virgin Islands	8	0	0.0	N/A
Virginia	822	175	21.3	11/31 (35.5%)
Washington	483	5	1.0	4/4 (100%)
West Virginia	146	0	0.0	N/A
Wisconsin	211	3	1.4	2/2 (100%)
Total	35164	1214	3.5	414/573 (72.3%)

Notes: California, Kansas, Minnesota, Oklahoma, South Carolina, Utah, Vermont, and Wyoming are not represented because complete data were not available; N/A = not applicable (no new HIV diagnoses or no linkage information was reported).

[a]The percentage calculation excludes individuals with missing data, so the denominator may be smaller than the total number of newly diagnosed partners reported by HIV PS

Table 2.

Partner Services Steps, Observed and Potential Newly Diagnosed Partners, and Missing Data in 51 U.S. Jurisdictions Reporting Partner Services Data, 2019

HIV PS Step	Persons who received services / Reported Persons with Non-missing Data (%)	Persons with missing data / Reported Persons (%)	Potential Newly Diagnosed Partners Lost: Maximum potential[c]	Potential Newly Diagnosed Partners Lost: Single step improvement
Index Patients				
Located	41,272/47,667 (86.6%)	1,731/49,398 (3.5%)	390	188
Interviewed	31,298/40,870 (76.6%)	402/41,272 (1.0%)	589	371
Partners named/interview[a]	23,723/31,298 (0.76)	N/A	N/A	N/A
Index Patient Total		**2,133/49,398 (4.3%)**		
Expressed as Partners[b]		**1,617/37,442 (4.3%)** [b]		
Partners				
Initiated	20,910/23,723 (88.1%)	N/A	228	163
Notifiable[a]	13,163/19,411 (67.8%)	1,499/20,910 (7.2%)	N/A	N/A
Notified	11,625/12,197 (95.3%)	966/13,163 (7.3%)	80	60
Tested	6,714/8,952 (75.0%)	2,673/11,625 (23.0%)	405	405
New HIV Diagnosis[a]	1,214/5,348 (22.7%)	1,366/6,714 (20.3%)	N/A	N/A
Partner Total				
Total		**8,121/37,442 (21.7%)** [b]	**1,692**	
Linked to HIV Medical Care	414/573 (72.3%)	641/1,214 (52.8%)	N/A	

Notes: Totals may not add up due to rounding of estimated variables; Kansas, Minnesota, Oklahoma, South Carolina, Utah, Vermont, and Wyoming are not represented because complete data were not available. Los Angeles and San Francisco are included but California state health department data were not available; N/A = not applicable (estimate not applicable for step or no missing data).

[a] Non-modifiable step

[b] Total percent of partners with missing data, including index patients in terms of partners (number of index patients multiplied by the number of partners named per interview). Although the rounded number of partners named per interview is presented in the table, the unrounded number of partners named per interview was used in the calculation.

[c] Assuming that all remaining modifiable steps are completed for 100% of index patients and partners