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COVID-related Excess Missed HIV Diagnoses in the United States in 2021: Follow-up to 2020

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Abstract

Objective: COVID-19 and related disruptions led to a significant decline in HIV diagnoses in the US in 2020. A previous analysis estimated 18% fewer diagnoses than expected among persons with HIV (PWH) acquiring infection in 2019 or earlier, suggesting that the decline in overall diagnoses cannot be attributed solely to decreased transmission. This analysis evaluates the progress made towards closing the 2020 diagnosis deficit in 2021.

Methods: We apply previously developed methods analyzing 2021 diagnosis data from the National HIV Surveillance System to determine whether 2021 diagnosis levels of PWH infected pre-2020 are above or below the expected pre-COVID trends. Results are stratified by assigned sex at birth, transmission group, geographic region, and race/ethnicity.

Results: In 2021, HIV diagnoses returned to pre-COVID levels among all PWH acquiring infection 2011–19. Among Hispanic/Latino PWH and males, diagnoses returned to pre-COVID levels. White PWH, men who have sex with men, and PWH living in the south and northeast showed higher-than-expected levels of diagnosis in 2021. For the remaining populations, there were fewer HIV diagnoses in 2021 than expected.

Conclusions: While overall diagnoses among persons acquiring HIV pre-2020 returned to pre-COVID levels, the diagnosis gap observed in 2020 remained unclosed at the end of 2021. Fewer than expected diagnoses among certain populations indicate that COVID-19 related disruptions to HIV diagnosis trends remained in 2021. Although some groups showed higher-than-expected levels of diagnoses, such increases were smaller than corresponding 2020 decreases. Expanded testing programs designed to close these gaps are essential.

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Introduction

The COVID-19 pandemic resulted in a 17% drop in overall HIV diagnoses in the United States in 2020 compared to 2019, as reported in CDC's HIV Surveillance Report, while simultaneously testing and other services were severely disrupted [1–3]. There has been uncertainty, however, in the interpretation of these data- in particular, what portion of the drop is attributable to reduced testing services versus a drop in transmission levels. A recent analysis attempted to examine this issue by considering diagnoses only among persons with HIV (PWH) acquiring HIV in 2019 or earlier, prior to COVID-19 [4]. Year of infection was estimated by applying the CD4-depletion model to CD4 measurements taken at diagnosis. Such measurements form the basis for modern incidence estimation methods [5].

The analysis in [4] found that diagnoses observed in 2020, among PWH who acquired infection in 2019 or earlier, were estimated to be 18% lower than expected levels, assuming a continuation of previous diagnosis trends. This difference, representing diagnoses missed in 2020, cannot be explained by changes in incidence levels during COVID-19. The difference appeared to be uniform across estimated infection years, with diagnoses being missed among older and more recent infections at similar rates.

Females (at birth), persons who inject drugs (PWID), Hispanic/Latino PWH, and heterosexual persons missed diagnoses at higher rates as compared to other subpopulations. In total, among PWH acquiring infection in 2011-2019, an estimated 3100-3300 fewer infections than expected were diagnosed in 2020, compared to expected diagnosis levels given pre-COVID trends.

In this brief report, we perform a follow-up to the analysis in [4] for the year 2021 to assess whether the changes observed in HIV diagnosis patterns in 2020 persisted in 2021 and if the diagnosis deficit that was observed in 2020 has remained. Using the methods developed for the 2020 analysis[4], we project the expected number of diagnoses in 2021, for each infection year, among PWH who acquired infection from 2011-2019. As in the 2020 analysis[4], we then compare these expected diagnosis counts with observed diagnosis counts reported in CDC's HIV Surveillance Report. Analyses are performed for both the entire United States population, as well as stratifications by assigned sex at birth, transmission group, race/ethnicity, and region.

Methods

Diagnosis Projection

We apply the incidence-based and diagnosis delay-based methods first introduced in [4] to project expected diagnoses in 2021 among PWH acquiring infection in the years 2011-2019. These methods project the expected number of diagnoses in year y among infections acquired in year x as:

$$\text{Expected diagnoses in year } y \text{ among infections acquired in year } x = \text{Number of infections in year } x \times \text{Probability of diagnosis after } (y - x) \text{ yrs.}$$

The methods differ in exactly how the number of infections in year x and the probability of diagnosis after $(y - x)$ years are estimated. The mathematical details regarding differences in derivation can be found in [4].

While the window of projection in [4] was one year, this has been extended to two years in the present analysis. Accordingly, a validation analysis was performed against 2019 diagnoses using data from 2011-2017 to confirm consistency with surveillance data and is provided in the supplementary materials section. Note that, due to inferior accuracy compared to the other two methods, the linear-regression incidence-based method used in [4] was not applied in the present work.

A subset of the diagnoses data from the National HIV Surveillance System (NHSS) for 2021, reported in CDC's HIV Surveillance Report, 2021 [3], was used in this analysis. Specifically, we consider only those reported diagnoses from persons who acquired HIV prior to COVID-19, specifically during the years 2011-19. We note these data differ slightly from those used in [4], due to routine annual updating of NHSS data. Accordingly, the numbers reported here for 2020 may differ slightly from those presented in [4], which were based on the HIV diagnoses data reported in [2]. However, the overall findings and conclusions of [4] have not changed.

Results

Missed and Recovered Diagnoses in 2021

15,609 HIV diagnoses were observed in 2021 among PWH who were estimated to have acquired infections in the years 2011-19, compared with an expected total of 15,600 diagnoses (Figure 1, left), or approximately as many diagnoses as expected. As infections among this population were acquired prior to the onset of the COVID-19 pandemic, they are unaffected by any confounding in HIV diagnoses caused by COVID-19 related changes in incidence. These findings therefore suggest that HIV diagnoses in the United States resumed pre-COVID trends in 2021 among infections prior to 2020. We note further that the different methods were in good agreement with one another and surveillance data, with the discrepancy in overall diagnoses around 1%, and with a year-by-year trend discrepancy under 4% (Figure 1, right, see also Table/Figure A2 in the supplementary material, <http://links.lww.com/QAD/D98>).

In 2020, over the infection years 2011-19, 13,868 HIV diagnoses were observed compared to approximately 17,000 expected diagnoses, a deficit of approximately 3,100 (Table 1, Figure 1). While diagnoses in this group returned levels consistent with pre-COVID trends in 2021, a significant cumulative deficit of ~3100 diagnoses remained (Table 1).

Diagnosis levels did not recover in 2021 uniformly across groups. White PWH, PWH in the South and Northeast, and men who have sex with men (MSM) showed signs of higher-than-expected diagnosis levels in 2021, indicating some progress towards closing the 2020 diagnosis deficit among those subpopulations (Table 1, note that a negative number means more diagnoses than expected).

Diagnoses in 2021 among Hispanic/Latino PWH and males (at birth) showed a rebound close to, but still lower levels than, pre-COVID diagnosis levels. This indicates that while the diagnosis deficit from 2020 was not further exacerbated, no significant progress had been made towards closing this deficit in those subpopulations (Table 1).

Diagnosis levels in 2021 among all remaining populations – Black/African American PWH, PWH living in the West and Midwest, females, heterosexual persons, PWIDs, and MSM/PWIDs – rebounded somewhat but remained lower than expected in 2021. As a result, the COVID-related cumulative diagnosis deficit increased among these subpopulations when including 2021. A plot showing the overall percentage of PWH diagnosed at year-end 2021, by year of acquired infection, is provided as a supplement.

Discussion

Our estimates show that approximately the same number of HIV diagnoses occurred in 2021 as expected, among those infected between 2011-2019. While diagnoses appear to have returned to pre-COVID levels in 2021, little progress was made towards eliminating the diagnosis deficit from 2020. A return to the pre-COVID diagnosis level is insufficient as diagnoses must exceed pre-COVID trends to offset the deficits resulting from COVID. Overall, roughly 3,100 HIV diagnoses, from infections prior to 2020, that would have normally been identified, remained unidentified by the end of 2021.

In all populations examined, there were fewer missed diagnoses in 2021 than in 2020, suggesting some level of recovery in identifying HIV diagnoses in 2021 after substantial COVID setbacks in 2020. However, the extent of recovery varied by population. Among White PWH, MSM, and PWH in the South and Northeast, diagnosis levels in 2021 were higher-than-expected, and estimated missed diagnoses were negative. This is encouraging and does indicate progress towards reducing the diagnosis deficit among these groups. However, these recoveries were substantially smaller than the corresponding drops in 2020, and significant deficits remain. In the remaining subpopulations considered, the level of recovery was more limited as the estimated number of missed diagnoses in 2021 remained greater than zero. This means that the COVID-related diagnosis deficit in 2020 grew even larger by the end of 2021. More efforts need to be made to expand testing programs to offset these deficits.

Determining to what extent an observed change in HIV diagnosis levels may be explained by changes in testing, versus changes in transmission behavior, is not straightforward. The cohort examined in this analysis consists of persons with HIV infections acquired before the onset of the COVID-19 pandemic, so the difference between observed and expected diagnosis in 2021 among persons in this cohort are not affected by any changes in HIV incidence. This difference in diagnoses resulted from changes related to testing (e.g. testing behaviors, disruptions to testing services) during COVID-19. Our findings are useful in analyzing whether, to what extent, and among which populations, COVID-19 continued to affect HIV diagnoses in 2021, independently of any changes in HIV incidence. We recognize that other possible changes during the years 2020-21, unrelated to COVID-19, may have also influenced these findings.

We emphasize that this analysis does not account for infections acquired after 2019, or before 2011. These findings therefore only directly relate to excess missed HIV diagnoses when discussing infections acquired during 2011-2019. However, they suggest that there may also be excess missed HIV diagnoses during 2020-2021 among more recent infections. The identification of infections acquired during 2020 and 2021 is critical as persons with recently acquired infections generally have higher viral load and are more likely to transmit HIV.

We note that the examined population stratifications are not mutually exclusive. However, due to limitations on the data and population sizes, we do not report 2- and 3-way stratifications directly with the data used. Analyzing the independent factors for missed diagnosis is, therefore, an important subject for future investigation. Nevertheless, excess missed HIV diagnoses in 2020, among persons with previously-acquired HIV, still remain and were not recovered in 2021; and, these deficits still remain across the groups considered in this analysis.

In summary, our findings suggest that insufficient progress was made in 2021 towards reducing the substantial HIV diagnosis deficits incurred in 2020 among persons who acquired HIV during the years 2011-19. This is a matter of serious public health concern, as PWH with undiagnosed, and consequently, untreated infection are substantially more likely to transmit HIV [6–8]. A continued, persistent gap in diagnosis levels may serve to further compound this problem, and interventions focused on identifying PWH who have undiagnosed infection are critical. Large deficits persist in all examined subpopulations, as of the end of 2021. Even among the groups that showed higher-than-expected levels of diagnoses in 2021, these increases were substantially smaller than the corresponding decreases observed in 2020. Both general and focused interventions are necessary to eliminate the diagnosis deficit to avoid future increases in incidence. Additionally, we emphasize that expanding and improving the effectiveness of HIV testing programs is urgently needed to not only identify the excess missed HIV diagnoses in 2020 but also to go beyond that and reach more persons with undiagnosed HIV. Improving HIV testing to increase awareness of one's HIV status is an important public health priority, and the first critical step towards accessing effective HIV prevention and treatment to ultimately reduce HIV incidence.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Conflicts of interest and source of funding:

All support for this project was provided by the Centers for Disease Control and Prevention. The authors have no conflicts of interest to disclose.

Disclaimer:

The findings and conclusions in this manuscript are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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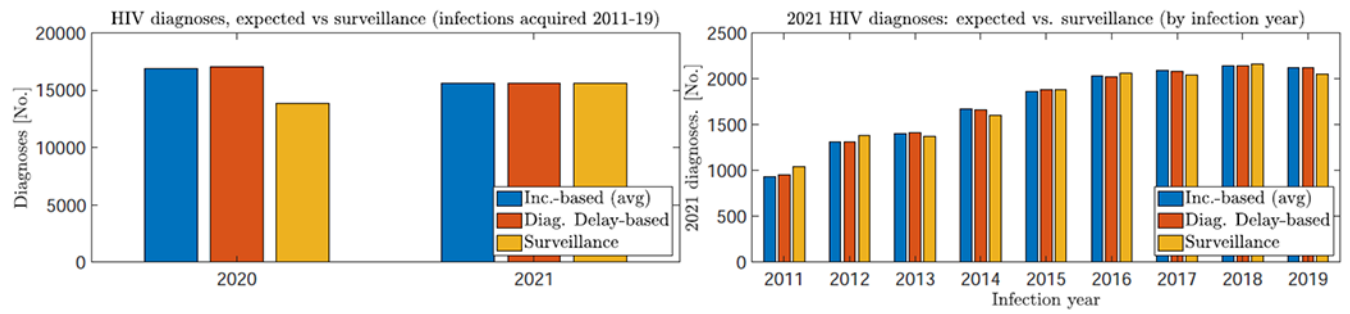


Figure 1.

Left: Total HIV diagnoses, observed vs expected, in 2020 and 2021; Right: 2021 HIV diagnoses, observed vs expected, by infection-year. Surveillance data represent a subset the HIV diagnoses data from the National HIV Surveillance System (NHSS) corresponding to persons who acquired HIV during the years 2011-19. Year of acquiring infection is estimated based on a CD4 depletion model (see [5]).

Table 1:

Total missed HIV diagnoses (expected diagnoses minus observed diagnoses) in 2020 and 2021, and deficit at the end of 2021, among those acquiring infection 2011-2019, overall and by subpopulation. Numbers reported are averages of 2 projection methods. Note a negative number means more HIV diagnoses than expected.

Group	Diagnoses, 2020				Diagnoses, 2021				Diagnosis deficit (2020 – 21)
	Expected (95% CI)	Observed	Missed (95% CI)	%missed	Expected (95% CI)	Observed	Missed (95% CI)	%missed	Total (95% CI)
Total	17,000 (16,700-17,200)	13,868	~3100 (2800-3300)	18.2%	15,600 (15,400-15,800)	15,609	~0 (–200-200)	0.0%	~3100 (2600-3500)
Black/ African American	7,300(7,100-7,400)	6,055	~1200 (1000-1400)	16.4%	6,700 (6,550 - 6,800)	6,472	~200 (100-300)	2.9%	~1400 (1100-1700)
Hispanic/ Latino	4,900 (4,700-5,000)	3,817	~1100 (900-1200)	22.4%	4,600 (4,500-4,700)	4,567	~0 (–50-100)	0.0%	~1100 (850-1300)
White	3,800 (3,700-3,900)	3,230	~600 (500-700)	15.8%	3,400 (3,300-3,500)	3,552	~–150 (–250–50)	–4.4%	~450 (250-650)
Male (at birth)	14,200 (13,900-14,300)	11,764	~2400 (2100-2500)	16.9%	13,000 (12,800-13,300)	12,991	~0 (–200-300)	0.0%	~2400 (1800-2800)
Female (at birth)	2,800 (2,700-2,900)	2,170	~650 (550-750)	23.2%	2,550 (2,500-2,700)	2,439	~100 (50-250)	3.9%	~750 (600-1000)
Northeast	2,400 (2,300-2,500)	1,921	~500 (400-600)	20.8%	2,200 (2,150-2,300)	2,197	~0 (–50-100)	0.0%	~500 (350-700)
Midwest	2,250 (2,150-2,300)	1,884	~350 (250-400)	15.6%	2,100 (2,000-2,200)	1,997	~100 (0-200)	4.5%	~450 (250-600)
West	3,600 (3,450-3,700)	2,925	~650 (500-750)	18.1%	3,300 (3,200-3,400)	3,055	~250 (150-350)	7.5%	~900 (650-1100)
South	8,800 (8,600-8,900)	7,203	~1600(1400-1700)	18.2%	8,100 (7,900-8,250)	8,179	~–100 (–300-50)	–1.2%	~1500 (1100-1750)
MSM ¹	11,850 (11,600-12,000)	9,944	~1900 (1650-2050)	16.0%	10,900 (10,700-11,100)	10,991	~–100 (–300-100)	–1.0%	~1800 (1350-2150)
HET ²	3,200 (3,050-3,300)	2,391	~800(650-900)	25.0%	2,900 (2,800-3,000)	2,792	~100 (0-200)	3.5%	~900 (650-1100)
PWID ³	1,300 (1,250-1,400)	1,054	~250 (200-350)	19.2%	1,200 (1,150-1,300)	1,153	~50 (0-150)	4.1%	~300 (200-500)
MSM/ PWID ⁴	650 (600-700)	459	~200 (150-250)	30.7%	600 (550-650)	522	~100 (50-200)	16.7%	~300 (200-450)

Observed HIV diagnoses represent a subset the diagnoses data from the National HIV Surveillance System (NHSS) corresponding to persons who acquired HIV during the years 2011-19. Year of acquiring infection is estimated based on a CD4 depletion model (see [5]).

¹ Men who have sex with men (MSM)

² Heterosexual persons (HET)

³ Persons who inject drugs (PWID)

⁴ Men who have sex with men and inject drugs (MSM/PWID)