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BRIEF REPORT

The Value of Medical Chart Reviews: A Methodological Approach to Supplement Mortality Data During Pandemic Outbreaks

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Administrative data may provide incomplete understanding of pandemic disease impact. Medical record review–based assessments of COVID-19–related causes of death were conducted among people with diagnosed HIV in New York State, which identified more COVID-19–related causes of death than Vital Statistics, thereby offering a deeper understanding of the pandemic's impact on this population.

Keywords. AIDS; cause of death; COVID-19; HIV; mortality.

Administrative data surveillance systems such as Vital Statistics play a critical role in monitoring and understanding the impact of diseases, behaviors, and events that are in a relatively steady state [1, 2]. While these traditional systems for tracking and understanding the impact of disease are effective, they may become strained during a novel disease outbreak. Specifically, the time lag and slow-changing data being collected limit the ability to understand an outbreak [3], diminishing efforts to establish public health priorities, engage in prevention activities, or address disease burden. Additionally, studies show that administrative data may not be accurate or complete and errors in mortality reporting are common [4]. Thus, surveillance data may not be adequate for providing insight into the impact of an outbreak on vulnerable populations with underlying medical conditions given the challenges in ascertaining comorbid conditions [5, 6]. However, these populations are at increased risk of adverse health outcomes, including mortality, during outbreaks such as the recent COVID-19 pandemic.

In New York State (NYS), an epicenter of the pandemic, approximately 19% (38 480) of all deaths in 2020 were COVID-19 related [7]. Among New Yorkers who experienced severe COVID-19–related outcomes, risk of hospitalization or death among persons with diagnosed HIV (PWDH) was significantly higher than among affected persons without HIV. Mortality among PWDH in NYS increased 32% from 1794 deaths in 2019 to 2367 in 2020 before declining again in 2021 [8]. Notably, this was the first time that the state experienced an increase in deaths among PWDH since 2013. This percentage increase also exceeded that in the overall NYS population: a 30% increase from 156 405 deaths in 2019 to 203 393 in 2020 [9, 10].

The change in the trajectory of HIV mortality during the height of the COVID-19 pandemic highlights the need to expeditiously understand the impact that an epidemic has on mortality among vulnerable populations. Utilizing medical record review may provide an innovative means to supplement administrative data to understand and address outbreaks in vulnerable populations. The primary purpose of this study was to quantify COVID-19–related causes of death among PWDH in NYS through medical record reviews to inform the extent to which this methodology is effective at supplementing traditional administrative data sources during pandemic outbreaks.

METHODS

Study Population and Data Sources

We conducted a retrospective cohort study of PWDH reported to NYS HIV surveillance who died in a hospital from March through December 2020 to determine the deaths attributable to COVID-19 during the first 9 months of the pandemic. Two sources constituted the data for this study: (1) the NYS HIV surveillance registry, which receives name-based HIV-related laboratory test reports for individuals who receive HIV-related care in NYS [11], and (2) medical record abstractions. Following consultation with the NYS Department of Health institutional review board, this study was determined to be public health surveillance and did not require board review.

Deaths occurring in 2020 among PWDH were identified through the NYS HIV surveillance registry (n = 2367) [12]. PWDH were excluded if their deaths were not indicated as in NYS or the facility of death was not a hospital. Electronic medical records were requested from the relevant hospitals by a NYS

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Table 1. Patient Characteristics and Causes of Death Among PWDH Who Died in NYS Hospitals in 2020

	PWDH Who Died in NYS Hospitals in 2020		COVID-19 Related		HIV Related		Not HIV or COVID-19		Insufficient Information		
	No.	%	No.	Row %	No.	Row %	No.	Row %	No.	Row %	*P* Value
Overall	748		378	50.5	24	3.2	251	33.6	95	12.7	
Gender identity											.44[a]
Female	241	32.2	115	47.7	6	2.5	84	34.9	36	14.9	
Male	507	67.8	263	51.9	18	3.6	167	32.9	59	11.6	
Sex at birth											.05[a,b]
Female	110	14.7	49	44.6	4	3.6	44	40.0	13	11.8	
Male	240	32.1	132	55.0	10	4.2	87	36.3	11	4.6	
Not documented	398	53.2	197	49.5	10	2.5	120	30.2	71	17.8	
Age at death, y											<.0001[c]
20–49	130	17.4	40	30.8	10	7.7	58	44.6	22	16.9	
50–59	214	28.6	102	47.7	9	4.2	72	33.6	31	14.5	
60–69	250	33.4	132	52.8	5	2.0	82	32.8	31	12.4	
≥70	154	20.6	104	67.5	0	.0	39	25.3	11	7.1	
Race and ethnicity											<.0001[a]
Non-Hispanic White, Asian, American Indian, or Alaska Native[d]	71	9.5	31	43.7	2	2.8	31	43.7	7	9.9	
Non-Hispanic Black	332	44.4	185	55.7	11	3.3	111	33.4	25	7.5	
Hispanic	150	20.1	85	56.7	7	4.7	49	32.7	9	6.0	
Not documented	186	24.9	74	39.8	4	2.2	55	29.6	53	28.5	
Unknown (chart specified)	9	1.2									
Smoking status											<.0001[a]
Ever	232	31.0	101	43.5	11	4.7	101	43.5	19	8.2	
Never	203	27.1	120	59.1	6	3.0	59	29.1	18	8.9	
Not documented	313	41.8	157	50.2	7	2.2	91	29.1	58	18.5	
Housing status											.0499[b,e]
Stable or hospice	528	70.6	280	53.0	17	3.2	189	35.8	42	8.0	
Supportive (group, institutional)	114	15.2	70	61.4	4	3.5	37	32.5	3	2.6	
Homeless, shelter, or single-room occupancy	19	2.5	6	31.6	2	10.5	9	47.4	2	10.5	
Not documented	87	11.6	22	25.3	1	1.2	16	18.4	48	55.2	
Low CD4											<.0001[a]
Yes	403	53.9	174	43.2	23	5.7	160	39.7	46	11.4	
No	345	46.1	204	59.1	1	.3	91	26.4	49	14.2	

Abbreviations: NYS, New York State; PWDH, people with diagnosed HIV.

[a] *P* value generated with Pearson χ^2.

[b] Excludes not documented.

[c] *P* value generated with Monte Carlo estimate for the exact test.

[d] Includes 66 non-Hispanic White persons, 4 Asian, and 1 American Indian/Alaska Native.

[e] *P* value generated with Fisher exact text.

Department of Health contracting organization for the 923 PWDH whose facility of death was available and indicated as a hospital. Available medical records (n = 888) were abstracted by a trained clinical team. Following abstraction, records that indicated a death date prior to 1 March 2020 (n = 139) or an HIV-negative status (n = 1) were excluded from analysis. The final sample size was 748.

Clinician Review

Three infectious disease physicians (M. H., C. G., J. D.) reviewed deidentified medical record abstractions to classify abstracted text fields describing details related to underlying and contributing cause of death (COD), in aggregate, into 4 mutually exclusive categories: COVID-19 related, HIV related, neither COVID-19 or HIV, or insufficient information. All records were reviewed by at least 2 clinicians. To solidify the classification methodology across physicians, the first 20 records were reviewed and discussed by all 3 physicians. Reviewer agreement was calculated by Krippendorff α, which indicated moderate agreement (α = 0.57). Discordant responses were resolved to consensus via discussion among all 3 physicians. Records denoted as having insufficient information for COD determination received a final review by C. G. with additional indicators for CD4-defined AIDS: CD4 cell count <200 cells/mm^3 and CD4 percentage <14% based

Table 2. Odds of COVID-19–Related Death Among PWDH Who Died in NYS Hospitals in 2020

	OR	95% CI		aOR[a]	95% CI	
Age at death, y						
20–49	1 [Ref]			1 [Ref]		
50–59	2.14	1.32	3.49	2.02	1.21	3.38
60–69	2.58	1.60	4.15	2.37	1.43	3.92
≥70	4.53	2.65	7.75	3.67	2.08	6.47
Race and ethnicity						
Non-Hispanic White and Asian	1 [Ref]			1 [Ref]		
Non-Hispanic Black	1.61	.94	2.77	1.79	1.01	3.19
Hispanic	1.62	.89	2.93	2.13	1.13	4.01
Not documented	1.34	.73	2.43	1.52	.81	2.87
Smoking status						
Ever	0.49	.33	.73	0.54	.35	.82
Never	1 [Ref]			1 [Ref]		
Not documented	0.87	.59	1.29	0.85	.56	1.29
Low CD4						
Yes[b]	0.43	.31	.59	0.50	.36	.70
No	1 [Ref]			1 [Ref]		

Includes 645 observations; excludes those with cause of death assigned as "insufficient information."

Abbreviations: aOR, adjusted odds ratio; NYS, New York State; OR, odds ratio; PWDH, people with diagnosed HIV; Ref, reference.

[a]Adjusted for age, race and ethnicity, smoking, and CD4.

[b]If a person had a CD4 count <200 or CD4 percentage <14% at any time within 730 days (2 years) before the date of death.

on the most recent laboratory reporting to NYS HIV surveillance within 2 years of death. Records that still did not have sufficient details to determine COD remained classified as "insufficient information" for the bivariate analysis and were excluded from regression analyses.

Statistical Analysis

Descriptive statistics for patient demographic and clinical characteristics (gender, sex assigned at birth, race and ethnicity, most recent housing, and tobacco smoking history) were generated for patients included in the final analysis, and bivariate analyses were conducted to assess the distribution of COD by patient characteristics. Pearson χ^2 test, Fisher exact test, and Monte Carlo estimation of the exact test were used, where appropriate, to test for statistical significance; results were deemed statistically significant at $P < .05$. Logistic regression analyses were conducted to determine the odds of COVID-19–related death (vs non–COVID-19 related), adjusting for statistically significant characteristics. Analyses were conducted with SAS (version 9.4; SAS Institute).

RESULTS

Among PWDH who died in NYS hospitals between March and December 2020, the majority identified as male (67.8%), were aged 50 to 59 years (28.6%) or 60 to 69 years (33.4%), had race and ethnicity documented as non-Hispanic Black (44.4%) or Hispanic (20.1%), and were stably housed or in hospice (70.6%; Table 1). Over half (50.5%) of deaths were deemed to be COVID-19 related, as opposed to 3.2% HIV related and 33.6% related to neither HIV nor COVID-19. Approximately 13% of cases did not have sufficient information to determine COD from medical records. These trends in COD continued across most demographic groups, with the majority of COD being COVID-19 related. COD varied significantly at the bivariate level by age at death, race and ethnicity, smoking status, and housing status. COVID-19–related CODs were more prevalent as age increased, from 30.8% among patients aged 20 to 49 years to 67.5% among patients aged ≥70 years; they were also more prevalent among patients who were non-Hispanic Black (55.7%) or Hispanic (56.7%), among patients who never smoked (59.1%), and among patients who lived in supportive housing (61.4%).

Adjusting for age, race and ethnicity, smoking, and CD4-defined AIDS, the odds were attenuated but still increased significantly with age as compared with PWDH aged 20 to 49 years (Table 2). Adjusted odds of COVID-19–related death were significantly more likely among PWDH who were non-Hispanic Black (adjusted odds ratio [aOR], 1.79; 95% CI, 1.01–3.19) and Hispanic (aOR, 2.13; 95% CI, 1.13–4.01) as compared with non-Hispanic White and Asian. Smoking (aOR, 0.54; 95% CI, .35–.82) and CD4-defined AIDS (aOR, 0.50; 95% CI, .36–.70) also significantly decreased the adjusted odds of COVID-19–related deaths.

DISCUSSION

Our medical record review yielded a determination that greater than half of all deaths among PWDH who died between March and December 2020 in NYS hospitals were related to COVID-19. This is much higher than the 18% underlying and 2% contributing COD listed as COVID-19 among PWDH in NYS in 2020 in Vital Statistics data [13]. The substantial impact of the COVID-19 pandemic on hospitals in NYS may have resulted in hospitalization primarily of more severe COVID-19 cases [14]. While this likely contributes to some of the difference between the prevalence of COVID-19–related COD from our study and the previous Vital Statistics–based work, our medical record review methodology identified COVID-19–related deaths at nearly 20 percentage points higher than a Vital Statistics analysis of our specific sample of PWDH (31%; W. Patterson, MPH, email communication, November 2023). A limitation of this study was the inability to disaggregate underlying and contributing causes of death from the medical record review. Future research would benefit from matched analyses of medical record reviews and Vital Statistics data to ascertain underlying and contributing causes of death.

The supplemental clinical data available through comprehensive reviews of abstracted medical records yielded valuable information to provide a greater understanding of the impact

of COVID-19 on PWDH. While these reviews can be resource intensive, this methodology can be replicated within health care institutions and networks that may not have ready access to Vital Statistics or other administrative data, providing a means to better understand the impact of the COVID-19 pandemic or other significant events on vulnerable populations. Moreover, although the present analysis was conducted on an extended retrospective timeline, medical record review can provide a more real-time understanding of public health issues than what is possible with time-lagged administrative data [15, 16].

Notes

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References

1. Murray J, Cohen AL. Infectious disease surveillance. In: International Encyclopedia of Public Health. Amsterdam: Elsevier, **2017**: 222–9.
2. New York State Department of Health. Vital statistics of New York State. Accessed 7 March 2024. Available at: https://www.health.ny.gov/statistics/vital_statistics/
3. Jajosky RA, Groseclose SL. Evaluation of reporting timeliness of public health surveillance systems for infectious diseases. BMC Public Health **2004**; 4:29.
4. McGivern L, Shulman L, Carney JK, Shapiro S, Bundock E. Death certification errors and the effect on mortality statistics. Public Health Rep **2017**; 132:669–75.
5. Braunstein SL, Wahnich A, Lazar R. COVID-19 outcomes among people with HIV and COVID-19 in New York City. J Infect Dis **2023**; 228:1571–82.
6. Tesoriero JM, Swain CE, Pierce JL, et al. COVID-19 outcomes among persons living with or without diagnosed HIV infection in New York State. JAMA Netw Open **2021**; 4:e2037069.
7. Centers for Disease Control and Prevention. National Center for Health Statistics provisional death counts for coronavirus disease 2019 (COVID-19). Accessed 21 February 2024. Available at: https://www.cdc.gov/nchs/nvss/vsrr/covid19/index.htm
8. New York State Department of Health, CUNY Institute for Implementation Science in Population Health. Ending the epidemic dashboard. Accessed 21 February 2024. Available at: https://etedashboardny.org/data/deaths-and-hospitalizations/deaths-nys/
9. New York State Department of Health. Vital statistics of New York State. Table 31a: death summary information by race/ethnicity, New York State—2019. Updated December 2021. Accessed 14 August 2024. Available at: https://www.health.ny.gov/statistics/vital_statistics/2019/table31a.htm
10. New York State Department of Health. Vital statistics of New York State. Table 31a: death summary information by race/ethnicity, New York State—2020. Updated April 2023. Accessed 14 August 2024. Available at: https://www.health.ny.gov/statistics/vital_statistics/2020/table31a.htm
11. New York State Department of Health. Part 63: HIV/AIDS testing, reporting and confidentiality of HIV-related information. Accessed 22 December 2021. Available at: https://health.ny.gov/professionals/reportable_diseases/eclrs/hiv/index.htm
12. New York State Department of Health. New York State HIV/AIDS annual surveillance report for persons diagnosed through December 2022. **2023**. Available at: https://www.health.ny.gov/diseases/aids/general/statistics/annual/2022/2022_annual_surveillance_report.pdf
13. Patterson W, Rosenthal M, Rajulu DT. Brief report: trends in HIV mortality in the context of the COVID-19 pandemic. J Acquir Immune Defic Syndr **2023**; 94:91–4.
14. Rothfeld M, Sengupta S, Goldstein J, Rosenthal BM. 13 Deaths in a day: an "apocalyptic" coronavirus surge at an NYC hospital. New York Times. 25 March 2020. Accessed 24 February 2021. Available at: https://www.nytimes.com/2020/03/25/nyregion/nyc-coronavirus-hospitals.html
15. Dufort EM, Koumans EH, Chow EJ, et al. Multisystem inflammatory syndrome in children in New York State. N Engl J Med **2020**; 383:347–58.
16. Rosenberg ES, Dufort EM, Udo T, et al. Association of treatment with hydroxychloroquine or azithromycin with in-hospital mortality in patients with COVID-19 in New York State. JAMA **2020**; 323:2493–502.