Individual and Site-Level Factors Associated with Risk of Death among People with HIV

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THE DC COHORT
Advancing HIV Care and Treatment in the District of Columbia

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Background

- Although antiretroviral therapy (ART) allows persons with HIV (PWH) to live longer, healthier lives, many PWH may not be receiving comprehensive HIV care, resulting in shortened survival.
- Individual-level factors may contribute to shortened survival yet site-level factors and availability of ancillary services may also influence survival among PWH.
- We sought to assess factors associated with mortality among a cohort of PWH receiving care in Washington, DC (The DC Cohort).

Objectives

- To describe and compare individual factors, site-level factors, and care continuum patterns among those who died and those who survived in the DC Cohort.

Methods

DC COHORT STUDY

- Ongoing longitudinal observational cohort study of HIV-infected persons in care in Washington, DC at 14 participating clinical sites.
- Data abstracted from participants' electronic medical records manually and through electronic exports and linked with DC. Department of Health Vital Statistics death certificate data.
- Included participants enrolled from 1/2011 -12/2016 who died after enrollment or were actively enrolled in the Cohort.
- Conducted survey of Cohort clinical sites to assess availability of selected services.
- Developed an overall clinic assessment score (range 0-9) for each site based on availability of services (e.g., hours, referrals, visit intervals, re-engagement services, subspecialty care).
- Stratified sites into low (≤6) vs. high (7-9) scoring based on median score.
- Examined other site-level variables including systematic retention in care monitoring and routine review of medication pick up (ART monitoring).

ANALYSIS

- Measured care continuum outcomes (e.g., retention in care, on ART, viral suppression) in the 6-months prior to death.
- Conducted univariable analyses to compare participants who died vs. survived.
- Used Cox proportional hazards models to identify associations between site-level variables and time to death since HIV diagnosis.

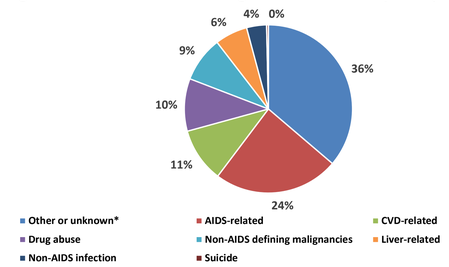
Results

Table 1. Characteristics of DC Cohort Participants at Enrollment by Vital Status (N=6,603)

	Total	Alive	Dead	P-value
	N=6,603	N=6,316	N=287	
Participant Characteristic	N (%)	N (%)	N (%)	
Age at enrollment (median, IQR)	47.9 (37.7, 55.2)	47.6 (37.3, 54.9)	54.6 (46.6, 60.4)	**<0.0001**
Months of follow up, median (IQR)	44.2 (25.4,62.3)	45.2 (26.6, 63.0)	22.0 (10.4, 34.1)	**<0.0001**
Sex (male)	4710 (71.3)	4504 (71.3)	206 (71.8)	0.864
Race/ethnicity*				
NH Black	5196 (78.7)	4961 (78.6)	235 (81.9)	0.362
NH White	786 (11.9)	745 (11.9)	32 (11.1)	
Hispanic	354 (5.4)	346 (5.5)	8 (2.8)	
Other/unknown	267 (4.0)	255 (4.0)	12 (4.2)	
Mode of HIV Transmission*				
Heterosexual	2193 (33.2)	2088 (33.1)	105 (36.6)	**<0.0001**
MSM and MSM/IDU	2403 (36.4)	2343 (37.1)	63 (20.9)	
IDU	471 (7.1)	421 (6.7)	50 (17.4)	
Insurance*				
Medicaid	2602 (39.4)	2503 (39.6)	99 (34.5)	**<0.0001**
Private/Self-pay	1788 (27.8)	1747 (27.7)	41 (14.3)	
Public**	1005 (15.2)	951 (15.1)	54 (18.8)	
Medicare	963 (14.6)	878 (13.9)	85 (29.6)	
Smoking (ever)	3556 (53.9)	3350 (53.0)	206 (71.8)	**<0.0001**
Homeless/Unstably Housed	589 (8.9)	554 (8.8)	35 (12.6)	0.252
Alcohol use (ever)	1897 (28.7)	1786 (28.3)	111 (38.7)	**0.0003**
Recreational drug use (ever)	2321 (35.2)	2188 (34.6)	133 (46.3)	**<0.0001**
Duration of infection at time of enrollment (yrs) (median, IQR)	9.7 (4.4,16.8)	9.5 (4.3, 16.6)	12.2 (6.5, 19.0)	**<0.0001**
AIDS dx	2808 (42.5)	2633 (41.7)	175 (61.0)	**<0.0001**
Late diagnosis***	1177 (17.8)	1115 (17.7)	62 (21.6)	0.087
CD4 (cells/µl) (median, IQR)	529 (342, 738.5)	536 (349, 744)	374.5 (192, 612)	**<0.0001**
Viral load (copies/ml)(median, IQR)	u (u, 140)	u (u, 130)	30 (u, 1,475)	**0.0129**
Prescribed ART during study (yes)	6154 (93.2)	5884 (93.2)	270 (94.1)	0.207
Co-morbidities				
HTN	2043 (30.9)	1923 (30.5)	119 (41.5)	**<0.0001**
Depression/Mental health	1685 (25.5)	1585 (25.1)	100 (34.8)	**0.0002**
Hepatitis C	947 (14.3)	856 (13.6)	91 (31.7)	**<0.0001**
Hepatitis B	248 (3.8)	239 (3.8)	9 (3.1)	0.572
Diabetes	713 (10.8)	659 (10.4)	54 (18.8)	**<0.0001**
Chronic renal failure	342 (5.2)	309 (4.9)	33 (11.5)	**<0.0001**

*Percentages may not = 100 due to missing data. **Public insurance includes ADAP, Ryan White, DC Alliance, and VA insurance. ***Late diagnosis defined as HIV and AIDS diagnosis within 12 months of each other.

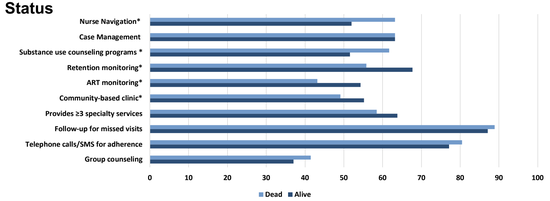
Figure 1. Cause of Death among DC Cohort Participants (N=287)



*Other/unknown cause of death included 52 deaths categorized as 'unknown', 15 attributed to renal failure, 8 accidents/violent deaths, and 8 related to diabetes.

Results

Figure 2. Availability of Selected Site-level Services by Participant Vital Status



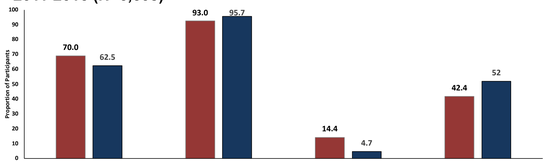
* Indicates statistically significant differences at a p-value ≤0.05 when comparing service availability by vital status.

Table 2. Multivariable Analysis of Site-level Factors Associated with Risk of Death

Site-level Covariate	Unadjusted HR (95% CI)	Adjusted HR (95% CI)**
Clinic assessment score category (high vs. low)*	1.22 (0.94,1.58)	1.32 (0.99, 1.76)
ART monitoring (no vs. yes)	**1.39 (1.10, 1.75)**	**1.70 (1.26, 2.29)**
Retention monitoring (no vs. yes)	**1.47 (1.17, 1.86)**	**1.47 (1.10, 1.97)**
Substance abuse counseling (no vs. yes)	**0.76 (0.60, 0.96)**	0.84 (0.60, 1.17)
Group counseling (no vs. yes)	0.91 (0.72,1.15)	**0.49 (0.31, 0.76)**
Routine follow-up of missed visits (no vs. yes)	0.88 (0.61, 1.28)	0.98 (0.63, 1.51)
Provides primary care (no vs. yes)	1.23 (0.95, 1.60)	1.31 (0.98, 1.75)
Provides ≥3 specialty services (no vs. yes)	1.18 (0.93, 1.49)	**2.16 (1.31, 3.55)**
Urgent care (no vs. yes)	1.13 (0.85, 1.49)	1.08 (0.73, 1.60)
Clinic type (hospital vs. community-based)	0.96 (0.76, 1.21)	**0.63 (0.44, 0.90)**
Case Management (no vs. yes)	0.90 (0.71, 1.14)	1.03 (0.76, 1.39)
Nurse Navigation (no vs. yes)	0.93 (0.73, 1.19)	0.80 (0.60, 1.06)

*Clinic assessment score consisted of 9 clinic-level variables including: group counseling, telephone calls/SMS, follow-up for missed visits, care coordination with other specialties, evening hours, seeing new patients within 14 days, provide primary care, provide care for >=3 specialties, and urgent care.** Models adjusted for all individual-level variables and clinical type (community vs. hospital based).

Figure 3. Comparison of HIV Care Continuum Outcomes by Vital Status, 2011-2016 (N=6,603)



Care continuum outcomes were assessed among participants who had data in the 6 months prior to death, or had at least 6 months of follow-up for those who survived. Retention in care was defined as a visit, CD4 or viral load indicative of HIV care receipt. P<0.05 for all care continuum outcomes comparing those who died with those who survived.

Results (continued)

- Among 6,603 participants, 287 (4.3%) died from 2011-2016; 1.05 deaths per 100 person-years.
- Deaths were mostly among males (71.8%), blacks (81.9%), and the mean age at death was 56.7 yrs.
- Median time from HIV diagnosis to death was 14.5 years (IQR:9.1, 21.1).
- 24% of deaths were AIDS-related, 10% cardiovascular disease (CVD)-related and 9% due to non-AIDS related malignancies. (Figure 1)
- Mean number of days from last care encounter to death was 78 (IQR:30-183) with a median CD4 closest to death of 344 cells/µl (IQR:159, 562).
- Participants who died attended more hospital-based clinics with substance use and nurse navigation programs but fewer clinics with ART and retention monitoring services. (Figure 2)
- In separate multivariate analyses, an increased risk of death was observed among those in care at clinics with no ART monitoring (aHR 1.70; 95%CI:1.26, 2.29), no retention monitoring (aHR1.47; 95%CI: 1.10, 1.97), and those without 3 or more specialty services (aHR 2.16; 95%CI: 1.31, 3.55).
- HIV care continuum outcomes found that higher proportions of those who died were retained in care in the 6-months prior to death (p=0.0185), yet lower proportions were prescribed ART (p=0.0418) and were virally suppressed (VL<200 copies/ml)(p<0.0001). (Figure 3)

Conclusions

- Deaths observed primarily among those diagnosed longer and with more co-morbid conditions than those surviving.
- Despite relatively high rates of retention in care and ART use, almost a quarter of deaths among HIV-positive persons were still HIV-related.
- Limitations include non-random patient assignment to clinics, hence sicker participants may be more likely to seek care at hospital-based clinics. Additionally, ~20% of participants had missing cause of death data.
- Strengths include large participant sample size, comprehensive site-level services data and data representing HIV care delivery in large urban city.
- Variability and comprehensiveness of site-level services may influence the quality of care being provided, help mitigate poor outcomes, and improve survival among people living with HIV.

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