Factors Associated with Mortality in a Cohort of People Living with HIV in British Columbia, Canada

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SHAPE
The STOP HIV/AIDS Program Evaluation Study

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Land acknowledgement

We respectfully acknowledge that our work takes place on the traditional, ancestral, and unceded territories of the Coast Salish peoples, including the xʷməθkʷəy̓əm (Musqueam Nation), Skwxwú7mesh Úxwumixw (Squamish Nation) and mi ce:p kʷətxʷiləm (Tsleil-Waututh Nation).

Mortality among people living with HIV in BC, Canada

- Modern antiretroviral therapy (ART) has led to substantial improvements in life expectancy[1] and quality-of-life[2] among people living with HIV (PLWH)

- Mortality has decreased by 83% between 1996-2012 among PLWH in BC[3]

- However, PLWH continue to experience a higher burden of morbidity and mortality than people without HIV[4]

- Over the last decade, PLWH face additional challenges including age-related comorbidities[5], the drug poisoning crisis[6,7], and the COVID-19 pandemic[8]

1. Samji, H., Cescon, A., Hogg, R. S., et al. (2013). Closing the gap: Increases in life expectancy among treated HIV-positive individuals in the United States and Canada. *PLoS ONE*, *8*(12), 6–13. https://doi.org/10.1371/journal.pone.0081355
2. Montaner, J. S. G., Lima, V. D., Harrigan, P. R., et al. (2014). Expansion of HAART coverage is associated with sustained decreases in HIV/AIDS morbidity, mortality and hiv transmission: The "HIV treatment as prevention" experience in a Canadian setting. *PLoS ONE*, *9*(2), 1–10. https://doi.org/10.1371/journal.pone.0087872
3. Eyawo, O., Franco-Villalobos, C., Hull, M. W., et al. (2017). Changes in mortality rates and causes of death in a population-based cohort of persons living with and without HIV from 1996 to 2012. BMC Infectious Diseases, 17(1), 1–15. https://doi.org/10.1186/s12879-017-2254-7
4. Nanditha, N. G. A., Zheng, G., Tafessu, H. M., et al. Disparities in multimorbidity and mortality among people living with and without HIV across British Columbia's health regions: a population-based cohort study. *Canadian Journal of Public Health*, *112*(6), 1030–1041. https://doi.org/10.17269/s41997-021-00525-4
5. Nanditha, N. G. A., Paiero, A., Tafessu, H. M., et al. (2021). Excess burden of age-associated comorbidities among people living with HIV in British Columbia, Canada: A population-based cohort study. *BMJ Open*, *11*(1), 1–10. https://doi.org/10.1136/bmjopen-2020-041734
6. Salters, K. A., Parent, S., Nicholson, V., et al. (2021). The opioid crisis is driving mortality among under-served people living with HIV in British Columbia, Canada. *BMC Public Health*, *21*(1), 1–8. https://doi.org/10.1186/s12889-021-10714-y
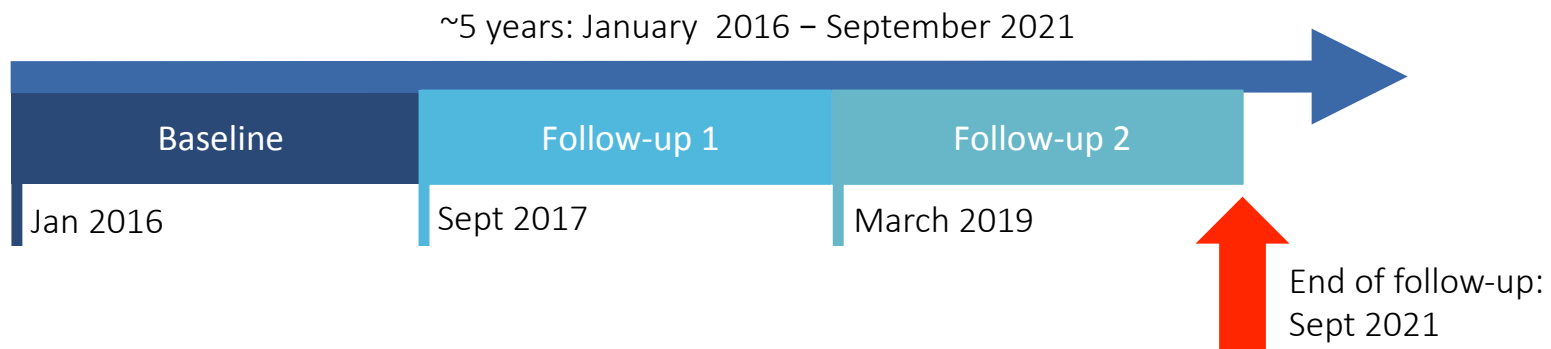7. St-Jean, M., Dong, X., Tafessu, H., Moore, D., et al. (2021). Overdose mortality is reducing the gains in life expectancy of antiretroviral-treated people living with HIV in British Columbia, Canada. *International Journal of Drug Policy*, *96*, 103195. https://doi.org/10.1016/j.drugpo.2021.103195
8. Murthy, S., Archambault, P. M., Atique, A., et al. (2021). Characteristics and outcomes of patients with COVID-19 admitted to hospital and intensive care in the first phase of the pandemic in Canada: a national cohort study. *CMAJ Open*, *9*(1), E181–E188. https://doi.org/10.9778/cmajo.20200250

SHAPE study design

The STOP HIV/AIDS Program Evaluation (SHAPE) study[9] is a longitudinal cohort study designed to monitor health care engagement and therapeutic outcomes of PLWH in BC

- Eligibility: PLWH ≥19 living in British Columbia, Canada
- Recruitment: Purposive sampling based on recruitment quotas of the proportion of PLWH in BC*

~5 years: January 2016 – September 2021

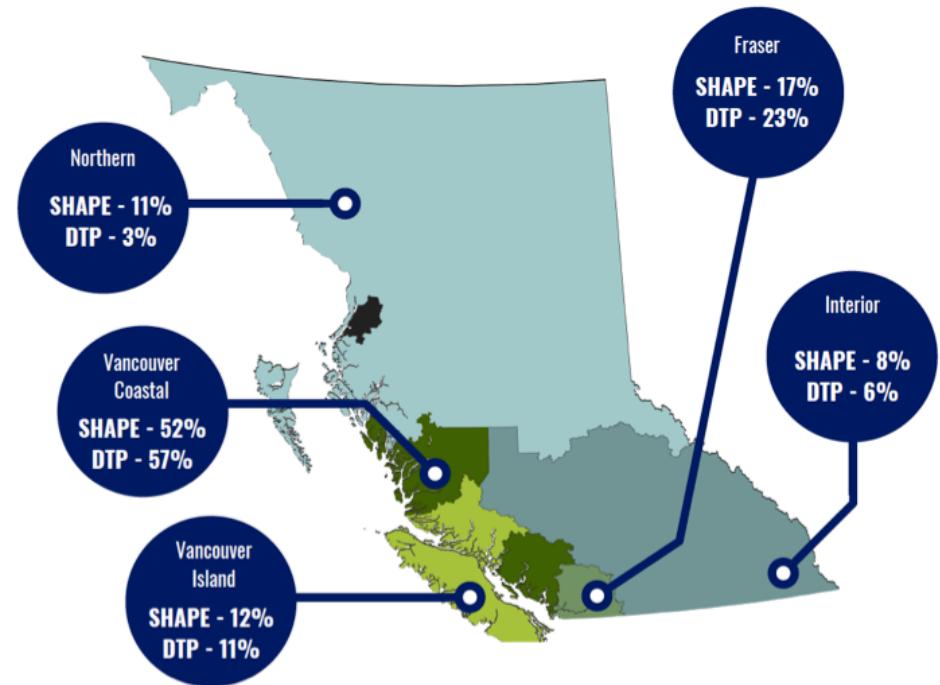| Baseline	Follow-up 1	Follow-up 2
Jan 2016	Sept 2017	March 2019

End of follow-up: Sept 2021

9. Bever, A., Salters, K., Tam, C., Moore, D. M., Sereda, P., Wang, L., Wesseling, T., Grieve, S., Bingham, B., & Barrios, R. (2020). Cohort profile: The STOP HIV/AIDS Program Evaluation (SHAPE) study in British Columbia, Canada. BMJ Open, 10(5), 1–8.

SHAPE cohort demographics

Total recruited n=644

- Age ≥50: 343 (53%)
- Gender
    - Women: 139 (22%)
    - Men: 496 (77%)
- gbMSM: 368 (57%)
- PWID: 273 (42%)

SHAPE

The STOP HIV/AIDS Program Evaluation Study

Northern
SHAPE - 11%
DTP - 3%

Fraser
SHAPE - 17%
DTP - 23%

Interior
SHAPE - 8%
DTP - 6%

Vancouver Coastal
SHAPE - 52%
DTP - 57%

Vancouver Island
SHAPE - 12%
DTP - 11%

Methods & analysis

Data collection

- Baseline survey data collected information on **sociodemographic characteristics, quality-of-life, continuity of care, comorbidities**
- Participants followed forward in time from their enrolment into the SHAPE study (between **January 2016 to September 2021**)
- Date and cause of death identified through linkage **to BC Vital Statistics registry** (ICD-10)

Data and statistical analysis

- Bivariate analyses using Chi-square/Fisher's Exact test and Wilcoxon rank sum test to characterize those who had died during the study period
- Survival analysis: Univariable and multivariable Cox proportional hazards model to examine factors associated with all-cause mortality

Results

- Most common specified cause of death was overdose (n=12, 16.9%), and non-AIDS related cancers (n=10, 14.1%)

- Large proportion of cause of deaths is unknown (n=22, 31%)*

- Crude all-cause mortality rate among SHAPE participants was similar to all PLWH in BC (found in the DTP)

  - 20.7 (95% CI: 15.9-25.5) vs. 20.7 (19.3-22.0) per 1000 PY

All-cause mortality	n (%)
Overall (SHAPE n=644)	71 (11.02)
Age at enrollment	
<40	7 (9.86)
40-49	25 (35.21)
50-59	23 (32.39)
60+	16 (22.54)
Gender	
Male	57 (80.28)
Female	14 (19.72)

Crude Mortality Rate (with 95% CI) for each time period
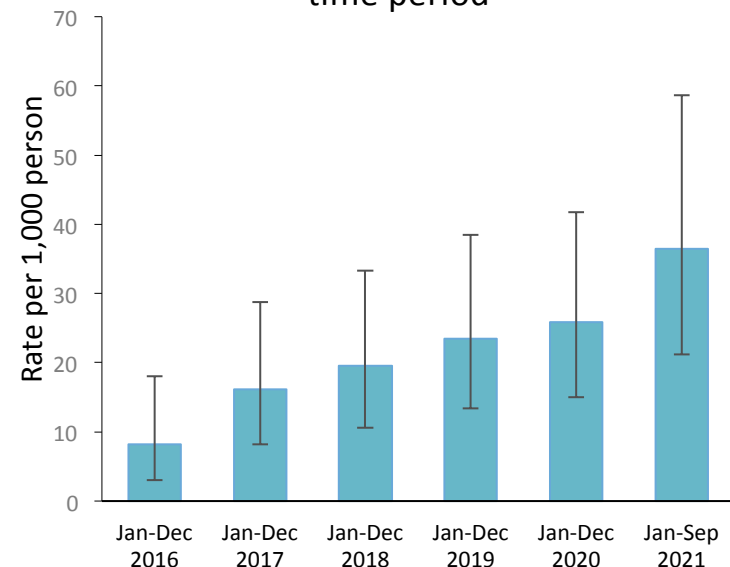
*It may take up to two years or more for cause of death to be determined and recorded in BC Vital Statistics.

Results

Descriptive characteristics of sociodemographic factors associated with mortality in the SHAPE cohort

Explanatory variables	Alive (n, %)	Deceased (n, %)	Total (n, %)	P-value
Age at enrolment (median, Q1-Q3)	49 (41, 55)	41 (45, 59)	51 (45-59)	0.014
Gender				
Male	436 (76.09)	57 (80.28)	493	
Female	125 (21.82)	14 (19.72)	139	0.415
Other+	12 (2.09)	0 (0.00)	12	
Sexual orientation				
Straight	194 (33.86)	39 (54.93)	233	
Gay or lesbian	273 (47.64)	21 (29.58)	294	0.002
Other^	106 (18.50)	11 (15.49)	117	
Ever been incarcerated				
No	382 (66.67)	34 (47.89)	416	0.002
Yes	191 (33.33)	37 (52.11)	228	
Homelessness in the last year				
No	501 (87.43)	51 (71.83)	552	<0.001
Yes	72 (12.57)	20 (28.17)	92	

Explanatory variables	Alive (n, %)	Deceased (n, %)	Total (n, %)	P-value
Injection substance use in the last year				
No	464 (80.98)	48 (67.61)	512	0.009
Yes	109 (19.02)	23 (32.39)	132	
Hazardous drinking				
No	348 (60.73)	46 (64.79)	394	0.508
Yes	225 (39.27)	25 (35.21)	250	
Current smoker				
No	306 (53.4)	30 (42.25)	336	0.076
Yes	267 (46.6)	41 (57.75)	308	
Ever diagnosed with mental health disorder				
No	196 (34.21)	25 (35.21)	221	0.866
Yes	377 (65.79)	46 (64.79)	423	
Quality of life (SF-6D) (median, Q1-Q3)	0.72, 0.62-0.86	0.66, 0.57-0.76	0.69, 0.61-0.86	<0.001
Social support (MOS-SSS) (median, Q1-Q3)	64.5, 44.7-85.5	50, 25-75	64.5, 42.1-85.5	0.002

Adjusted Cox proportional hazards model examining factors associated with time to death from enrolment amongst SHAPE participants

Explanatory variables	Adjusted Cox proportional hazards ratio (aHR) aOR (95% CI)	P-value
Age at enrolment (per 10 year increase)	1.41 (1.10-1.80)	0.013
Gender Female Male	Not selected	
Sexual orientation Straight Gay or lesbian Other	1.00 0.42 (0.25-0.73) 0.54 (0.27-1.05)	0.002 0.069
Ever been incarcerated No Yes	Not selected	
Recent homelessness No Yes	Not selected	
IDU in last 12 months No Yes	Not selected	
Current smoker No Yes	Not selected	
Quality of life SF-6D score (per 0.1 score increase)	0.77 (0.63-0.93)	0.007
Social support MOS-SSS score (per 10 score increase)	0.90 (0.82-0.98)	0.017

Discussion

- Disproportionate mortality among those experiencing recent homelessness, recent injection substance use, and those with a history of incarceration

- High burden of comorbidities among PLWH
  - 75.9% have one or more comorbidities

- Greater social support and quality-of-life are protective
  - In our adjusted models, despite including homelessness and substance use, connection with others had a large impact on mortality
  - Previous SHAPE research also found social support to be protective of treatment interruptions

Conclusions

- Our findings highlight how socio-structural inequities continue to impact the longevity of PLWH despite universal ART
  - Continued engagement of those experiencing homelessness and substance use is needed
  - Future potential programs may aim to increase social supports

Limitations

- High proportion of deaths are undetermined; many of these may be attributable to poisoned drug supply

Future research

- Future analyses may examine cause-specific death once undetermined causes of death are identified
- Trends in mortality over time compared to non-PLWH

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