

Determination of AIDS- and Non-AIDS-Related Causes of Death Reported in Death Certificates as Compared to Physicians' Reviews in a Tertiary Referral Hospital in Vancouver, British Columbia

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Background

- Ascertaining cause-specific mortality is essential in epidemiological and clinical studies which guide the planning, implementation and evaluation of programs aimed at targeting disease elimination.
- Due to differences in autopsy rates, death certificate completions and record-keeping methods, it is important to establish the validity of death certificates in all communities that conduct surveillance studies.
- Reliability of death certificates in Vancouver, British Columbia (BC), Canada, for assessing causes of death (CoD) for HIV-infected individuals remains uncertain.

Objective

- To examine the reliability of underlying CoD as reported in death certificates for individuals enrolled in a specialized hospital-based HIV outpatient clinic (IDC) in Vancouver, BC.

Methods

- Data Sources:** Death certificates obtained from the British Columbia Vital Statistics Agency were linked with the IDC's internal database. Data on medical history, clinical laboratory tests and mortality (including autopsies if available) were obtained from the IDC's database and from individual medical records.
- Study Cohort:** All subjects of age ≥ 19 years old enrolled in the IDC, located in a tertiary referral hospital in downtown Vancouver, BC, with at least one visit to the clinic and deceased between 01-Jan-2004 and 31-Dec-2015 and at least one documented CD4 count measurement and plasma viral load (PVL) test were included in the study.
- Procedure:** Causes of death were independently reviewed by two physicians based on all available information and recorded using a modified version of the previously validated "Coding Causes of Death in HIV" (CoDe) algorithm¹. In case of a disagreement, a third physician served as tie-breaker.
- Statistical Analyses:** Agreement rate as well as sensitivity, specificity and positive predictive value (PPV) were assessed for CoD from death certificates which were compared against the validated causes of death as determined by physicians' reviews.

Results

Agreement between reviewers

- There were 271 deaths included in the initial analyses. Agreement rate among physicians was 86% with a kappa coefficient of 0.68 ($p < 0.001$) indicating substantial agreement². After removing all unclassifiable/unknown causes of death, agreement rate was 89% with a kappa coefficient of 0.73 ($p < 0.001$) also indicating substantial agreement.
- Table 1** shows agreement among physicians (excluding unclassifiable/unknown causes of death) stratified by degree of certainty ($n=265$).

Table 1: Physician Agreement Rate Stratified by Degree of Certainty

	Degree of Certainty*		
	Definitely (n=87)	Likely (n=92)	Possible (n=86)
Agreement rate (Kappa statistic)	90% (k=0.79)	92% (k=0.81)	86% (k=0.44)

* Definite: Confirmation of death diagnosis based on histopathology (autopsy or biopsy) or direct microscopy, culture or PCR; Likely: Confirmation of death diagnosis based on clinical history and supporting evidence by imaging and/or laboratory markers; Possible: confirmation of death diagnosis based on clinical history, signs and symptoms

References

- Kowalska JD, Friis-Moller N, Kirk O et al. 2011. The Coding Causes of Death in HIV (CoDe) Project: Initial Results and Evaluation of Methodology. *Epidemiology*, 22(4): 516-523.
- Viera AJ and Garrett JM. 2005. Understanding Interobserver Agreement: The Kappa Statistic. *Family Medicine*, 37(5): 360-363.

Results (continued)

Death certificates reliability assessment

- Deaths were classified by physicians and death certificates respectively as: AIDS-related (27.31% vs. 35.79%), non-AIDS-related (70.11% vs. 54.98%) and unclassifiable/unknown (2.58% vs. 9.23%).
- Agreement rate was 78% between physicians' reviews and death certificates (**Table 2**) with a kappa coefficient of 0.57 ($p < 0.001$) indicating moderate agreement.

Table 2: Cross-Tabulation: Underlying Causes of Death in the IDC from Jan 2004 - Dec 2015 (n=271)

Vital Statistics	Physician Reviews	Frequency	Percent
AIDS-related	AIDS-related	66	24.35
AIDS-related	Non-AIDS-related	30	11.07
AIDS-related	Unclassifiable/Unknown	1	0.37
Non-AIDS-related	AIDS-related	4	1.48
Non-AIDS-related	Non-AIDS-related	142	52.4
Non-AIDS-related	Unclassifiable/Unknown	3	1.11
Unclassifiable/Unknown	AIDS-related	4	1.48
Unclassifiable/Unknown	Non-AIDS-related	18	6.64
Unclassifiable/Unknown	Unclassifiable/Unknown	3	1.11

- Using more detailed categories, the most common CoD ascertained by physicians were AIDS-related ($n=74$, 27.31%), non-AIDS-related malignancies ($n=44$, 16.24%), substance abuse ($n=44$, 16.24%) and chronic viral hepatitis ($n=16$, 5.90%).

As per death certificates, the most common CoD were AIDS-related ($n=97$, 35.79%), non-AIDS-related malignancies ($n=43$, 15.87%), substance abuse ($n=32$, 11.81%) and unknown causes ($n=25$, 9.23%).

- When excluding unclassifiable/unknown causes of death as determined by death certificates, agreement rate increased to 86% with a Kappa coefficient of 0.69 ($p < 0.001$) indicating substantial agreement.

Table 3: 2x2 Table: Underlying Causes of Death Determined by Physician Reviews vs. Vital Statistics in IDC Cohort, Jan 2004 - Dec 2015 (n=242)

		Physicians' Reviews (Gold Standard)		
		AIDS-related	Non-AIDS-related	Total
Vital Statistics	AIDS-related	66	30	96
	Non-AIDS-related	4	142	146
	Total	70	172	242

*Unclassifiable/unknown causes of death have been excluded from these analyses

- Sensitivity was 94% (95% CI: 89%-99%), specificity was 83% (95% CI: 77%-885) and positive predictive value (PPV) was 69% (95% CI: 59%-78%).

Discussion

- While providing moderate reliability when compared to physicians' reviews, death certificates overestimated AIDS-related and unknown/ill-defined causes of death in this sample of patients from a hospital-based outpatient HIV clinic.
- When excluding unknown/unclassifiable causes of death, death certificates provide substantial reliability as well as high sensitivity and specificity for ascertaining underlying causes of death.
- Delayed reporting can cause long delays or inaccuracies in determining cause-specific mortality. Unknown/unclassifiable deaths might be supplement with additional information in a later date.
- As trends in cause-specific mortality continue to shift from AIDS- to non-AIDS-related CoD, it is critical to be able to more reliably capture mortality statistics.

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