Risk profiles in mono- infected TB patients and those co-infected with HCV and/or HIV

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Background

- HIV/HCV co-infection is driven by disease interactions and shared transmission routes (e.g. injection drug use), resulting in disease clustering in *core groups* characterized by social and economic deprivation.
- TB, however, is not typically evaluated under the syndemics model despite sharing risk factors with HCV and being strongly associations with HIV.
- In low incidence settings, TB is typically found in: 1) core groups with risk behaviors, or 2) foreign-born (FB) people with comorbidities that favor reactivation of latent infection but few behavioral risk factors.
- TB cases with risk behaviors may be part of a previously identified HIV/HCV co-infection group.[1,2]
- Understanding risk profiles of TB cases with differing co-infections could inform optimal service mixes for these risk sub-groups.

Methods

- The ***BC Hepatitis Testers Cohort*** (BC-HTC) includes clients tested for HCV or HIV at the BCCDC Public Health Laboratory, and all cases of HBV, HCV, HIV, and active TB reported by public health since 1990.
- Testing and case data is linked with British Columbia (BC) Ministry of Health administrative data, cancer diagnoses and deaths.
- Demographic and risk behaviors are compared between: 1) TB mono-infected, 2) TB/HIV co-infected, 3) TB/HCV co-infected, and 4) tri-infected (TB/HIV/HCV) cases from BC.
- Co-infection groups are defined by the presence of disease at any point during the study period (1990-2003), and not only co-infections diagnosed concurrently with TB diagnoses.
- Multinomial logistic regression is used to identify risk factors for coinfection relative to TB-mono-infected cases. The following demographic, risk factor, and socioeconomic variables were evaluated: origin of birth (CB vs. FB), age at TB diagnosis, hepatitis B infection, alcohol use, mental health, injection drug use (IDU), diabetes, sex, period of TB diagnosis, and socioeconomic quintiles.
- Period of TB diagnosis is included in the model to account for secular trends but is withheld from model outputs. Adjusted OR and their associated 95% confidence intervals are used as an estimates of risk.
- Risk factors (e.g. illicit drug use) was calculated based on combinations of administrative and diagnostic codes that have previously been reported.[3] The Quebec Index of Material and Social Deprivation was used to calculate social and material deprivation quintiles.[4]
- Temporality of co-infection is evaluated by identifying the date of co-infection with HIV or HCV relative to the TB diagnosis.

Results

- A total of 6587 cases of active TB were identified in BC-HTC cohort (1990-2013): 90% have TB only, 2.2% have TB/HIV, 4.5% have TB/HCV, and 3.4% have TB/HIV/HCV.
- TB mono-infected cases were mostly foreign-born (FB) and older, with a low percentage of illicit drug use (IDU), problematic alcohol use, and/or major mental health diagnosis.
- TB/HCV and TB/HIV/HCV co-infected were primarily Canadian-born (CB) with a high percentage of IDU and problematic alcohol use. Major mental health diagnosis was more common in the TB/HIV/HCV than in TB/HCV co-infected.

Table 1. Multivariate logistic regression results. Estimates represent OR (with associated confidence intervals) in comparison to TB mono-infected people.

Variable		TB/HIV OR (95% CI)	TB/HCV OR (95% CI)	TB/HIV/HCV OR (95% CI)
Origin				
	Foreign-born	1	1	1
	Canadian-born	1.7 (1.12-2.58)	3.6 (2.53-5.20)	6.3 (3.40-11.92)
	Unknown	1.9 (0.77-4.83)	1.4 (0.59-3.31)	4.5 (1.5-13.43)
Sex				
	Male	2.7 (1.82-4.10)	1.4 (1.04-1.88)	1.2 (0.83-1.84)
	Female	1	1	1
Age Category				
	0-35	0.53 (0.35-0.79)	0.33 (0.23-0.56)	0.57 (0.37-0.87)
	35-65	1	1	1
	>65	0.11 (0.045-0.25)	0.23 (1.83-3.50)	0.073 (0.01-0.54)
Risk Factors				
	Hepatitis B	3.0 (1.61-5.40)	4.6 (2.92-7.19)	15.0 (0.89-25.29)
	Problematic Alcohol Use	0.78 (0.50-1.28)	2.53 (1.83-3.50)	1.15 (0.76-1.76)
	Major Mental Health	2.0 (1.29-3.00)	1.0 (0.74-1.43)	1.9 (1.3-2.86)
	Injection Drug Use	2.9 (1.72-4.74)	6.3 (4.48-8.87)	33.5 (2.00-55.72)
	Diabetes	0.22 (0.10-0.48)	1.18 (0.83-1.67)	0.46 (0.24-0.90)
Socioeconomic Quintile				
	Q1 (most privileged)	1	1	1
	Q2	1.5 (0.70-3.03)	1.5 (0.81-2.62)	1.7 (0.59-4.72)
	Q3	1.4 (0.67-2.94)	1.4 (0.78-2.49)	1.9 (0.71-5.01)
	Q4	2.1 (1.08-4.25)	1.8 (1.03-3.08)	2.2 (0.86-5.68)
	Q5 (most deprived)	3.3 (1.79-6.19)	2.6 (1.58-4.30)	4.2 (1.80-9.96)

- Coinfection was less likely in those 0-29 years of age and >60 years of age relative to those 30-59 years of age (Table 1).
- The odds of TB/HIV coinfection was 1.7 greater in CB, 3 times greater in those with hepatitis B, 2 times greater in those with mental health issues, 2.9 times greater in IDU, 2.7 greater in males, and 3.3 times greater in those belonging to the lowest socioeconomic quintile (Table 1).
- The odds of being TB/HCV was 3.6 times greater in CB, 4.6 times greater in those with Hepatitis B, 6.3 times greater in IDU, 2.5 times greater in those who abuse alcohol, 1.4 times greater in males, and 2.6 times greater in those from the lowest socioeconomic quintile (Table 1).
- The odds of being tri-infected was 6.3 times greater in CB, 1.9 times greater in those with mental health issues, 33.5 times greater in IDU, and 4.2 times greater in those from the lowest socioeconomic quintile (Table 1).
- 65% (n=356) of TB cases with HCV co-infection (i.e. TB/HCV and TB/HCV/HIV) were diagnosed with HCV ≥ 90 days prior to TB diagnosis. Similarly, 65% (n=237) of TB cases with HIV infection (i.e. TB/HIV and TB/HCV/HIV) were diagnosed with HIV ≥ 90 days before TB diagnosis (Figure 1).

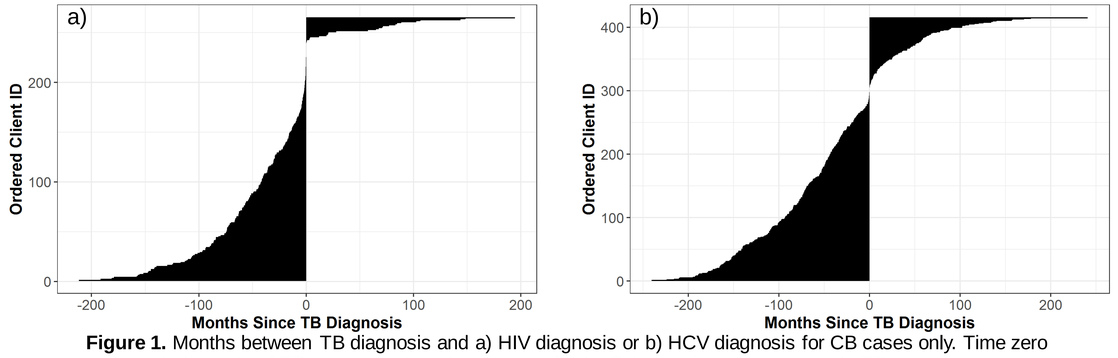

Figure 1. Months between TB diagnosis and a) HIV diagnosis or b) HCV diagnosis for CB cases only. Time zero represents the date of TB diagnosis. Negative times reflect HCV or HIV diagnoses prior to TB diagnoses.

Discussion

- TB mono-infected clients differ from those co-infected with HCV and/or HIV with regards to demographic and lifetime risk behaviors.
- The older age and low percentage of risk behaviors for TB mono-infected is suggestive of reactivation of latent infection. Multiple Components Analysis (MCA) (*not shown*) suggest risk behaviors cluster with CB but not FB cases.
- Our findings demonstrate a commonality of social deprivation, mental illnesses and substance use across those with co-infections
- Two-thirds of co-infection cases had HCV or HIV prior to TB diagnosis, suggesting immuno-compromising conditions and/or treatment may increase the risk of TB infection. Alternatively, risk factors for HIV/HCV acquisition may also increase the risk of TB (e.g. social and material deprivation).
- The high material and social deprivation, IDU and mental illness in TB/HIV/HCV suggests the need for interventions based on a syndemics approach, including mental health and addiction services.

Conclusion

- Improving the health of co-infected TB cases requires a suite of services addressing both disease and the social determinants/behaviors facilitating infection. Linking clients with TB/HCV to harm reduction and mental health interventions may be particularly beneficial, especially given known associations between IDU and incomplete treatment.[5]
- Additional information on the temporality of risk behavior and disease is needed to better guide the formation of effective screening programs.
- Further work is needed to understand the spatial distribution of co-infected TB cases, provincial testing patterns for HIV and HCV in TB cases, and the nature of heath seeking behaviors for specific co-infection subgroups.
- The study shows the power of linked administrative datasets like the BC-HTC to evaluate syndemics, especially for diseases that may not typically be evaluated together.

References

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