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

David Roth[1], James Johnston[1], Jason Wong[1], Mel Krajden[1], Zahid Butt[2], Nabin Shrestha[1], Mark Gilbert[1], Victoria Cook[1], Naveed Z Janjua[1]

[1]BC Centre for Disease Control, Vancouver, British Columbia, [2]University of British Columbia, Vancouver, British Columbia

BC Centre for Disease Control
An agency of the Provincial Health Services Authority

655 West 12th Avenue
Vancouver, BC V5Z 4R4

Tel 604.707.2443
Fax 604.707.2441

www.bccdc.ca

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.
- Temporality of co-infection was evaluated by identifying co-infection cases where HIV or HCV was diagnosed ≤90 days prior to TB diagnosis.
- 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]

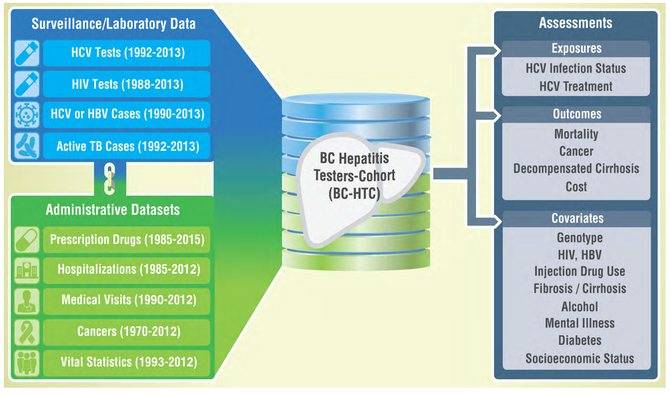

Figure 1. British Columbia Hepatitis Testers Cohort (BC-HTC)

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.

Table 1. Demographic factors for mono--infected and co-infected TB Cases. Groups are mutually exclusive.

	TB Only		*TB-HIV*		*TB-HCV*		*Tri-Infected*	
Total TB Cases	***5927***		***144***		**294**		**222**	
Demographic Group	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Age at TB Diagnosis								
<10y	158	**2.7**	0	**0.0**	1	**0.3**	1	**0.5**
10-19y	266	**4.5**	3	**2.1**	4	**1.4**	0	**0.0**
20-29y	880	**14.8**	9	**6.3**	17	**5.8**	31	**14.0**
30-39y	854	**14.4**	55	**38.2**	59	**20.1**	89	**40.1**
40-59y	1551	**26.2**	62	**43.1**	166	**56.5**	98	**44.1**
>=60	2218	**37.4**	15	**10.4**	47	**16.0**	3	**1.4**
Sex								
Male	3136	**52.9**	109	**75.7**	207	**70.4**	145	**65.3**
Female	2789	**47.1**	35	**24.3**	87	**29.6**	76	**34.2**
Other	2	**0.0**	0	**0.0**	0	**0.0**	1	**0.5**
Demographic Group								
Foreign-born	4358	**73.5**	69	**47.9**	67	**22.8**	18	**8.1**
Canadian born	1334	**22.5**	69	**47.9**	219	**74.5**	196	**88.3**
Unknown	235	**4.0**	6	**4.2**	8	**2.7**	8	**3.6**

- 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-infection 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.
- Social deprivation was greater for co-infected cases than TB mono-infected. Material deprivation was greatest in TB/HCV co-infected but similar in TB mono infected and TB/HIV co-infected.
- 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.

Table 2. Risk factor and comorbidity data for mono--infected and co-infected TB Cases

	TB Only		*TB-HIV*		*TB-HCV*		*Tri-Infected*	
Total TB Cases	***5927***		***144***		**294**		**222**	
Comorbidities	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Diabetes	1277	**21.5**	7	**4.9**	60	**20.4**	17	**7.7**
Hep B infection *[ever]*	216	**3.6**	14	**9.7**	39	**13.3**	80	**36.0**
Hep B infection *[up to 90 days]*	143	**2.4**	10	**6.9**	23	**7.8**	47	**21.2**
Risk Factors	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Illicit Drug Use (ever)	188	**3.2**	32	**22.2**	133	**45.2**	192	**86.5**
Problematic Alcohol Use (ever)	599	**10.1**	40	**27.8**	176	**59.9**	143	**64.4**
Major Mental Health Diagnosis (ever)	732	**12.4**	42	**29.2**	97	**33.0**	129	**58.1**
Depression	1910	**32.2**	57	**39.6**	185	**62.9**	133	**59.9**
Social Deprivation								
1 (least deprived)	1320	**22.3**	13	**9.0**	22	**7.5**	7	**3.2**
2	1144	**19.3**	17	**11.8**	31	**10.5**	15	**6.8**
3	1015	**17.1**	17	**11.8**	35	**11.9**	24	**10.8**
4	1003	**16.9**	26	**18.1**	57	**19.4**	34	**15.3**
5 (most deprived)	1202	**20.3**	66	**45.8**	143	**48.6**	134	**60.4**
Unknown	243	**4.1**	5	**3.5**	6	**2.0**	8	**3.6**
Material Deprivation								
1 (least deprived)	633	**10.7**	24	**16.7**	25	**8.5**	22	**9.9**
2	793	**13.4**	16	**11.1**	28	**9.5**	22	**9.9**
3	957	**16.1**	20	**13.9**	40	**13.6**	12	**5.4**
4	1359	**22.9**	30	**20.8**	56	**19.0**	43	**19.4**
5 (most deprived)	1942	**32.8**	49	**34.0**	139	**47.3**	115	**51.8**
Unknown	243	**4.1**	5	**3.5**	6	**2.0**	8	**3.6**

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.

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