Appendix for the manuscript "*Identifying mental health and substance use disorders using emergency department and hospital records: a population-based retrospective cohort study of diagnostic concordance and disease attribution*"

Appendix 1

Table 1: Service hours and mental health services available in 11 hospitals/acute care clinics under the purview of VCH

Emergency department*	No. of ED visits in the past year (No. visits resulting in hospital admission in the past year)	Hours	Psychiatrists or Mental health crisis teams on site?
St Paul's Hospital	210488 (29967)	24 hours	Yes. The emergency department contains an Acute Behavioral Stabilization Unit which provides specialized care for patients with complex mental health and substance use needs. The unit is managed by Emergency with the staffing support being an interdisciplinary team of emergency physicians, emergency nurses, psychiatrists, registered psychiatric nurses (or equivalent), psychiatric assessment nurses and workers, as well as input from consultative services such as the specialized Addictions Consultation Team.
Vancouver General Hospital	91836 (17832)	24 hours	Yes. Psychiatric Emergency Assessment & Triage (PEAT) service is a co-managed space in the VGH Emergency Department for assessing and triaging ED clients who present with MHSU conditions.
Mount St. Joseph Hospital	22008 (2822)	08:00-20:00	Yes. Geriatric psychiatry service: provides acute care and consultation, initial assessment, and follow-up care for ambulatory patients over the age of 65 who are experiencing complex psychiatric disorders.
Lions Gate Hospital	15594 (2167)	24 hours	Yes. There is a Psychiatric Emergency Program which provides access to prompt psychiatric assessments through the emergency department at Lions Gate Hospital. Mental Health nurses staffed in the emergency department provide mental health assessment in consultation with the on call psychiatrist.
Richmond Hospital	11689 (2093)	24 hours	Yes. The Psychiatry Assessment and Emergency Unit provide short-term assessment, stabilization and treatment services for individuals experiencing a psychiatric/mental health crisis. Provides a 4-bed brief stay (72 hours or less) unit for assessment, stabilization and treatment of individuals experiencing a psychiatric/mental health crisis. The interdisciplinary team is able to access both hospital and community resources, on an as needed basis.
Powell River General Hospital	1856 (142)	24 hours	Yes. In-Patient Psychiatry: a 7-bed unit on the 4th Floor of the Powell River General Hospital provides acute care for people suffering from an acute psychiatric illness that are unable to be cared for at home or in supportive community programs.
University of British Columbia (UBC) Health Sciences Centre	3996 (151)	8:00-20:00	No.
Squamish General Hospital	555 (49)	24 hours	No. Squamish General Hospital does not have a psychiatric ward or mental health beds. People in

			acute mental health distress will be transported from the Squamish emergency department to Lions Gate Hospital. If the issue is not acute, emergency room doctors can help the patient access a treatment team that includes two psychiatrists in Squamish.
Whistler D & T Centre	287 (9)	8:00-20:00	Yes. The Whistler Health Centre which provides emergency care also provides Mental Health and Substance Use services at the same location. Outpatient individual and group counseling for people with mental health and/or addiction problems. It also has an Adult Mental Health and Substance Use Program, which serves clients over the age of 19 who are diagnosed with a major mental illness and experiencing significant problems that interfere with their functioning in the community.
Pemberton D & T Centre	161 (9)	8:30-20:30	The Pemberton Health Centre which provides emergency care also provides Mental Health and Substance Use services at the same location. Outpatient individual and group counselling are available for people with mental health and/or addiction problems.
Sechelt Hospital	1052 (150)	24 hours	The Psychiatry Assessment and Emergency Unit provides short-term assessment, stabilization, and treatment services for individuals experiencing a psychiatric/mental health crisis. A mental health emergency services nurse is on site Monday to Friday.

*Data for Mount St.Joseph Hospital, Powell River General Hospital and St, Paul Hospital are available from April 1 2009, onward. Data for Sechelt Hospital are from October 17, 2012 onward. Data for Whistler D & T Centre, and Pemberton D & T Centre are from April 1 2015 onward.

Table 2. Classification of any and specific types of mental and substance use disorders based on ICD-9-CA and ICD-10-CA codes.

Health conditions	ICD-9-CA	ICD-10-CA
Mental health and substance use disorders	290-319	F00-F99
Any selected substance use disorders		
Alcohol use disorders	291, 303, 305.0, 357.5, 425.5, 535.3, 571.0-571.3, 655.4,760.71,V65.42	F10, Z50.2, Z71.4, Z72.1,G31.2, G62.1, G72.1, I42.6, K29.2, K70, K86.0, O35.4, P04.3, Q86.0
Other substance use disorders [b]	292, 304, 305.2-305.9, 965.0, 969.x (4,6,7), 970.81, E850.0-E850.2, E853.2, E854.1,E854.2, 648.3, 760.73,760.75, 779.5	F11-F16, F19, T40, T42.4, T43.6, X42, X62, Y12, Z50.3, Z71.5, Z72.2, P04.4, P96.1
Opioid use disorder	304.0, 304.7, 305.5, 965.0, E850.0-E850.2	F11, X42 & (T40.0-T40.4 or T40.6), X62 & (T40.0-T40.4 or T40.6), Y12 & (T40.0-T40.4 or T40.6)
Any selected mental health disorders		
Mood disorders [c]	296, 311,300.4	F30–F31 F32–F33, F34, F38, F39
Depression	296.2, 296.3, 296.5,311, 300.4	F31.3-F31.5, F32,F33, F34.1
Psychoses	295,297,298	F20, F22-F25, F28,F29
Neurotic/stress/somatoform disorders [d]	300, 308, 309,	F40-45, F48
Anxiety disorders	300.0, 300.2	F40, F41
Personality disorders	301	F60–F62, F69, F21

[b] Included opioid use disorder; [c] Included depression; [d] Included anxiety disorders.

Appendix 2

Table 1A. Identification of mental health and substance use disorders using hospital (any diagnosis codes) and ED records among DTES cohort participants (using data from April 1st 2012 onward) (N=56,875).[a]

Health conditions	Total	Proportion of individuals identified by data source		
	Number of individuals	Hospital records only N (%)	ED records only N (%)	Both hospital and ED records N (%)
Mental health and substance use disorders	12355	3632 (29.4)	3388 (27.4)	5335 (43.2)
Any substance use disorders	9655	3844 (39.8)	2872 (29.7)	2939 (30.4)
Alcohol use disorders	4587	1928 (42.0)	1518 (33.1)	1141 (24.9)
Non-alcohol substance use disorders [b]	7418	3686 (49.7)	1813 (24.4)	1919 (25.9)
Opioid use disorder	4317	2079 (48.2)	1360 (31.5)	878 (20.3)
Any mental health disorders	6225	1370 (22.0)	1890 (30.4)	2965 (47.6)
Mood disorders [c]	2709	1063 (39.2)	869 (32.1)	777 (28.7)
Depression	2015	719 (35.7)	860 (42.7)	436 (21.6)
Psychoses	3438	513 (14.9)	1077 (31.3)	1848 (53.8)
Neurotic, stress and somatoform disorders [d]	2434	1039 (42.7)	1150 (47.2)	245 (10.1)
Anxiety disorders	1797	412 (22.9)	1265 (70.4)	120 (6.7)
Personality disorders	1260	1062 (84.3)	80 (6.3)	118 (9.4)

[a] Cases identified using at least one hospital or emergency department record of diagnosis code indicating a case; [b] Included opioid use disorder; [c] Included depression; [d] Included anxiety disorders.

Table 2A. Concordance between the primary diagnosis code assigned in the ED and any diagnosis codes assigned at hospital discharge following an ED visit for any mental health and substance use-related conditions (N=16926, 48116 pairs).

Health conditions	Condition indicated in				Concordance statistics				Validity statistics (assume hospital discharge diagnosis as "gold-standard")			
	Any N (%)	ED only N (%)	Hospital only N (%)	ED and hospital N (%)	Overall agree	Positive agree	Negative agree	Kappa (95% CI)	Sensitivity (95% CI)	Specificity (95% CI)	Positive predictive value (95% CI)	Negative predictive value (95% CI)
Mental health and substance use disorders	30775 (64.0)	214 (0.4)	17530 (36.4)	13031 (27.1)	0.63	0.59	0.66	0.34 (0.34,0.35)	0.43 (0.42,0.43)	0.99 (0.99,0.99)	0.98 (0.98,0.99)	0.50 (0.49,0.50)
Any selected substance use disorders	23733 (49.3)	78 (0.2)	21926 (45.6)	1729 (3.6)	0.54	0.14	0.69	0.07 (0.07,0.07)	0.07 (0.07,0.08)	1.00 (1.00,1.00)	0.96 (0.95,0.97)	0.53 (0.52,0.53)
Alcohol use disorders	8127 (16.9)	30 (0.1)	7975 (16.6)	122 (0.3)	0.83	0.20	0.90	0.16 (0.16,0.17)	0.11 (0.10,0.12)	1.00 (1.00,1.00)	0.94 (0.92,0.95)	0.83 (0.82,0.83)
Other substance use disorders [b]	9320 (19.4)	66 (0.1)	8228 (17.1)	1026 (2.1)	0.63	0.07	0.77	0.04 (0.04,0.04)	0.04 (0.03,0.04)	1.00 (1.00,1.00)	0.92 (0.90,0.94)	0.62 (0.62,0.63)
Opioid use disorder	18644 (38.7)	56 (0.1)	17929 (37.3)	659 (1.4)	0.83	0.03	0.91	0.02 (0.02,0.03)	0.02 (0.01,0.02)	1.00 (1.00,1.00)	0.80 (0.73,0.86)	0.83 (0.83,0.84)
Any selected mental health disorders	16034 (33.3)	1330 (2.8)	5569 (11.6)	9135 (19.0)	0.86	0.73	0.90	0.63 (0.62,0.64)	0.62 (0.61,0.63)	0.96 (0.96,0.96)	0.87 (0.87,0.88)	0.85 (0.85,0.86)
Mood disorders [c]	3199 (6.6)	687 (1.4)	1904 (4.0)	608 (1.3)	0.92	0.39	0.95	0.35 (0.34,0.37)	0.28 (0.26,0.29)	0.99 (0.98,0.99)	0.66 (0.64,0.68)	0.93 (0.92,0.93)
Depression	927 (1.9)	59 (0.1)	843 (1.8)	25 (0.1)	0.95	0.32	0.97	0.29 (0.27,0.31)	0.24 (0.23,0.26)	0.99 (0.98,0.99)	0.47 (0.44,0.50)	0.96 (0.96,0.96)
Psychoses	3192 (6.6)	49 (0.1)	3043 (6.3)	100 (0.2)	0.91	0.72	0.94	0.67 (0.66,0.68)	0.70 (0.69,0.71)	0.95 (0.95,0.95)	0.75 (0.74,0.76)	0.94 (0.93,0.94)
Neurotic/stress/somatoform disorders [d]	10387 (21.6)	1976 (4.1)	2523 (5.2)	5888 (12.2)	0.95	0.10	0.97	0.09 (0.07,0.10)	0.06 (0.05,0.07)	0.99 (0.99,0.99)	0.31 (0.27,0.36)	0.95 (0.95,0.95)
Anxiety disorders	5348 (11.1)	672 (1.4)	3380 (7.0)	1296 (2.7)	0.98	0.05	0.99	0.05 (0.03,0.07)	0.03 (0.02,0.04)	1.00 (1.00,1.00)	0.30 (0.20,0.41)	0.98 (0.98,0.98)
Personality disorders	2803 (5.8)	333 (0.7)	2319 (4.8)	151 (0.3)	0.94	0.06	0.97	0.06 (0.04,0.07)	0.03 (0.03,0.04)	1.00 (1.00,1.00)	0.67 (0.59,0.75)	0.94 (0.93,0.94)

Abbreviations: ED, emergency department; CI: confidence interval; [b] Included opioid use disorder; [c] Included depression; [d] Included anxiety disorders.

Table 3A. Factors associated with discordance between the primary diagnosis code assigned in the emergency department and any diagnosis codes assigned at hospital discharge following an emergency department visit[a]

	Outcomes: Discordance in identifying		
	Mental health and substance use disorders (N=30,722)	Any selected substance use (N=23,688)	Any selected mental health disorders (N=16,017)
Characteristics	Odds Ratios (95% CI)		
Male	**0.86 (0.79,0.93)**	0.94 (0.82,1.08)	**0.89 (0.81,0.98)**
Age at visit			
>=65	Reference	Reference	Reference
55-64	**0.68 (0.59,0.77)**	1.12 (0.87,1.45)	**0.41 (0.34,0.49)**
45-54	**0.48 (0.43,0.55)**	1.06 (0.83,1.35)	**0.36 (0.30,0.43)**
35-44	**0.31 (0.27,0.35)**	1.05 (0.82,1.35)	**0.28 (0.24,0.33)**
25-34	**0.25 (0.22,0.28)**	1.28 (0.99,1.66)	**0.27 (0.22,0.32)**
<25	**0.23 (0.20,0.27)**	1.12 (0.82,1.53)	**0.35 (0.29,0.43)**
Ever residing in DTES [b]	**1.45 (1.33,1.58)**	1.20 (1.04,1.39)	1.09 (0.99,1.20)
Homeless at time of visit [c]	0.91 (0.84,1.00)	**0.79 (0.69,0.91)**	**1.11 (1.00,1.23)**
Year of visit			
2007-2011	Reference	Reference	Reference
2012-2014	**0.74 (0.68,0.79)**	**0.61 (0.53,0.70)**	0.93 (0.85,1.02)
2015-2017	**0.74 (0.68,0.80)**	**0.75 (0.64,0.87)**	0.95 (0.86,1.05)
Day of visit			
Weekday	Reference	Reference	Reference
Weekend	**1.22 (1.14,1.30)**	0.89 (0.79,1.00)	**1.30 (1.19,1.41)**
Holiday	**1.38 (1.13,1.69)**	0.96 (0.67,1.39)	**1.67 (1.31,2.14)**
Time of visit			
9:00 AM-8.59 PM	Reference	Reference	Reference
9:00 PM-8.59 AM	**1.40 (1.31,1.49)**	0.92 (0.82,1.03)	**1.34 (1.24,1.45)**
Triage acuity at ED			
Semi to none urgent	Reference	Reference	Reference
Urgent	**0.78 (0.71,0.86)**	**0.60 (0.49,0.73)**	**1.15 (1.01,1.30)**
Resuscitation-Emergency	**0.79 (0.71,0.87)**	**0.64 (0.52,0.80)**	**1.19 (1.04,1.35)**
Emergency department hospital			
St Paul hospital	Reference	Reference	Reference
Lions gate hospital	**0.56 (0.45,0.71)**	**0.35 (0.25,0.48)**	**1.52 (1.17,1.97)**
Mount Saint Joseph hospital	**1.34 (1.11,1.61)**	**0.34 (0.26,0.44)**	**2.51 (1.78,3.53)**
Other	0.70 (0.28,1.71)	0.63 (0.12,3.38)	1.13 (0.41,3.10)
Richmond hospital	1.14 (0.96,1.36)	**0.36 (0.28,0.46)**	**3.35 (2.69,4.17)**
Vancouver general hospital	**0.52 (0.48,0.56)**	**0.85 (0.75,0.97)**	**0.77 (0.71,0.84)**
Length of ED visit			
< 6 hours	Reference	Reference	Reference
>=6 hours	**0.88 (0.81,0.95)**	**0.53 (0.44,0.64)**	**1.36 (1.23,1.51)**

[a] Among visits with either hospital or emergency department record indicating a case.
[b] Determined by known postal code or homeless user of VCH services, or DTES indication in CommunityMart data
[c] Determined by presence of postal code V6Y2A1 (used if no fixed address or postal code in discharge abstract database/emergency department database); postal code "XX" (used for transient/homeless populations in discharge abstract database/EDMart); postal code A0A 0A0 (assigned if no postal code for visit in EDMart and CommunityMart); indication of homelessness in EDMart/CommunityMart data