The patient generated index as an early-warning system for predicting brain health challenges: A prospective cohort study for people living with HIV

Candidate for M.Sc. in Experimental Medicine, McGill University: Muhammad Mustafa Humayun

Research supervisor: Professor Nancy Mayo

Research objective:

To estimate the extent to which nominating areas related to depression, anxiety and cognition sentiments on the Patient Generated Index (PGI) predict the presence or emergence of depression, anxiety, or cognitive impairment among people living with HIV (n=856) at study entry and for successive assessments over 27-months
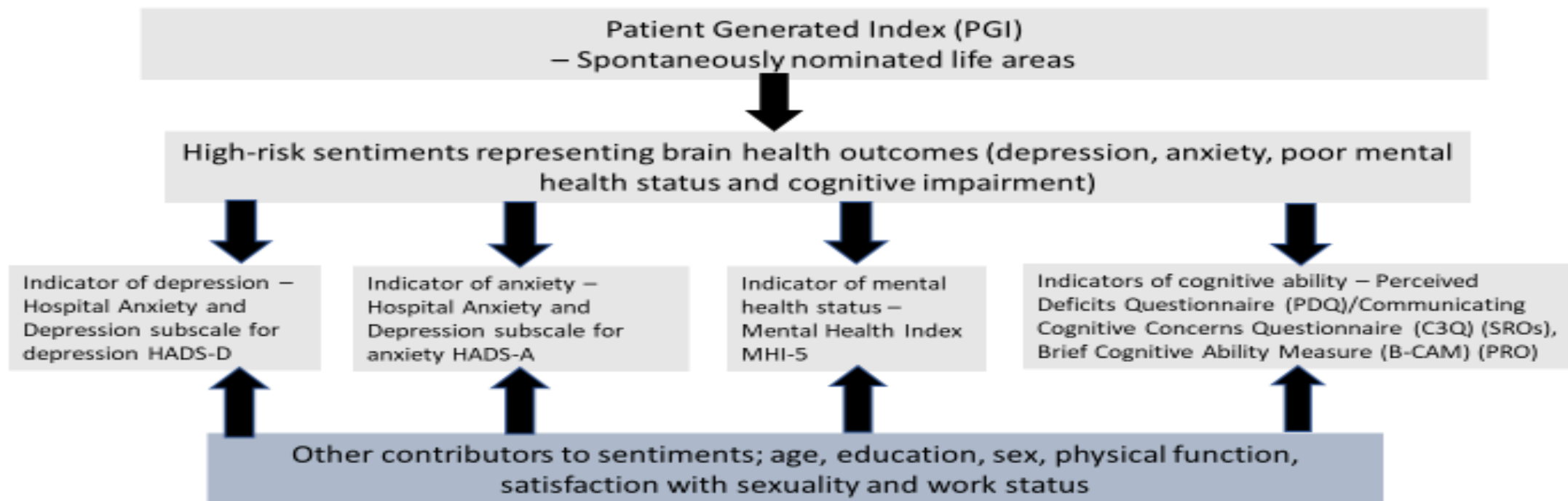
Background:

In research people are often asked to fill out questionnaires about their health and functioning. It is common that these questionnaires contain items that reflect serious health concerns. Typically, these concerns are not identified until the statistician analyses the data. An alternative is to use an individualized measure where people are asked to self-nominate areas of concern which can then be dealt with in real-time. The relevance of this approach to identify mental health concerns has not been explored in people aging with HIV.

Table 1: Socio-demographic and clinical characteristics of the sample

Assessment	First (study entry)	Second	Third	Fourth
	N (%) or mean ± SD	N (%) or mean ± SD	N (%) or mean ± SD	N (%) or mean ± SD
Sex, male	677 (84.9%)	632 (85.1%)	613 (85.0%)	565 (85.0%)
Age, Mean ± SD	52.9 ± 8.2	54.0 ± 8.3	54.7 ± 8.1	55.4 ± 8.1
Education				
No education or only kindergarten	35 (4.5%)	28 (3.9%)	25 (3.6%)	24 (3.7%)
Primary school	209 (27.0%)	195 (26.9%)	188 (26.7%)	168 (25.8%)
High school	268 (34.6%)	255 (35.1%)	249 (35.4%)	231 (35.4%)
CEGEP/College	184 (23.8%)	173 (23.8%)	170 (24.2%)	161 (24.7%)
University	78 (10.1%)	75 (10.3%)	72 (10.2%)	68 (10.4%)
Satisfaction with sexuality				
Very dissatisfied	155 (20.1%)	126 (19.0%)	111 (18.0%)	102 (16.6%)
Dissatisfied	161 (20.9%)	148 (22.3%)	128 (20.7%)	139 (22.7%)
Neither satisfied nor dissatisfied	225 (29.2%)	191 (28.8%)	172 (27.8%)	173 (28.2%)
Satisfied	176 (22.8%)	156 (23.5%)	158 (25.6%)	142 (23.2%)
Very satisfied	55 (7.1%)	42 (6.3%)	49 (7.9%)	57 (9.3%)
Working (paid work ≥15 h/w)	364 (45.9%)	310 (45.1%)	289 (45.3%)	287 (45.3%)
Good physical function (score of ≥ 45/100)	726 (93.6%)	628 (93.6%)	577 (91.3%)	572 (91.7%)
HIV Immune Markers				
Current CD4 in cells/mm3	636.3 ± 283.2	653.1 ± 265.4	647.7 ± 277.6	657.0 ± 267.9
Nadir CD4 in cells/mm3	218.0 ± 171.4	215.8 ± 166.9	213.4 ± 163.9	211.5 ± 162.0
Years since HIV diagnosis	16.8 ± 7.9	17.6 ± 7.9	18.5 ± 7.9	19.3 ± 7.9

Theoretical framework

Patient Generated Index (PGI) — Spontaneously nominated life areas

High-risk sentiments representing brain health outcomes (depression, anxiety, poor mental health status and cognitive impairment)

Indicator of depression — Hospital Anxiety and Depression subscale for depression HADS-D	Indicator of anxiety — Hospital Anxiety and Depression subscale for anxiety HADS-A	Indicator of mental health status — Mental Health Index MHI-5	Indicators of cognitive ability — Perceived Deficits Questionnaire (PDQ)/Communicating Cognitive Concerns Questionnaire (C3Q) (SROs), Brief Cognitive Ability Measure (B-CAM) (PRO)

Other contributors to sentiments; age, education, sex, physical function, satisfaction with sexuality and work status

Statistical methods

Logistic regression, linear regression and generalized estimating equations
- Each sentiment univariately
- Each sentiment plus other contributors
- All sentiments plus other contributors
- For logistic regression models compared using the C-statistic

HIGH-RISK SENTIMENTS

Mood and anxiety (emotional, inter-personal and cognitive processes)

Cognitive impairment
- Loss of memory/attentiveness
- Trouble understanding/ making sense
- State of confusion
- Difficulty recognizing people, places/things

Anxiety
- Worry (generalized anxiety disorder - GAD)
- Shame aversion & expressed intolerance for shame
- Expression of fear/ uncertainty

Mood (depression focus)
- Emotional factors: Expressed primarily as a) sadness/depressed mood, b) feelings (crying, grief, sad, worthless, hurt, loser, ugly and nasty). Additional indicators include sense of apathy, inner-turmoil, negative self-identity
- Inter-personal factors: Expressed through a) loneliness (baby, family, friends), b) hostility/anger (stop, shit, hate, kill, annoyed)
- Somatic and medical references (sick, hospital, pain, surgery)

Temporal categories (past, present or future focus): Use of first and second person singular

Depressogenic schemata (cognitive predictors of depression and anxiety);
- Absolutist thinking
- Self-focused attention (SFA) (selective/maladaptive self-regulatory cycle leads to loss of self-worth or magnified negative effect: pre-occupation of thoughts, feelings, image/body image, appraisal of oneself)
- Rumination a sub-component of SFA (persistent focus on the causes and consequences of symptoms). Extreme quantifiers linked to depression (everything, always, nothing, never)

Results and Conclusions

- The data comes from participants enrolled in the Positive Brain Health Now (+BHN) cohort (n=856).

- The nominated areas were category coded to a sentiment framework

- The sentiments categorized as 'emotional' predicted all of the mental health outcomes at all visits with adjusted odds ratios (OR) ranging from 1.61 to 2.00 and c-statistics >0.73 (good to excellent prediction)

- Nominating an anxiety sentiment was specific to predicting anxiety and mental health (OR: 1.65 & 1.52)

- Nominating a cognitive concern was specific to predicting self-reported cognitive concerns (OR: 4.78). Positive sentiments predictive of good cognitive function (OR: 0.36)

- This study indicates the value of using this semi-qualitative approach as an early-warning system in predicting brain health outcomes from the spontaneously nominated life areas within the Patient Generated Index (PGI)

Table 2: First assessment cross-sectional unadjusted and adjusted sentiment analysis

	HADS-D (183/768)	HADS-A (334/759)	MHI (301/778)	PDQ/C3Q (157/779)	B-CAM (n=731) 56.81±14.29
	OR (95% CI) [c]	OR (95% CI) [c]	OR (95% CI) [c]	OR (95% CI) [c]	b (se) [t]
Unadjusted					
Emotional	2.04 (1.42-2.92) [0.596]	1.86 (1.34-2.59) [0.607]	1.94 (1.40-2.69) [0.580]	2.15 (1.47-3.13) [0.638]	-0.99 (1.19) [-0.84]
Interpersonal	1.05 (0.67-1.62) [0.546]	1.09 (0.75-1.60) [0.579]	1.20 (0.82-1.75) [0.535]	0.78 (0.48-1.23) [0.597]	-0.08 (1.44) [-0.06]
Somatic	1.12 (0.73-1.70) [0.549]	1.11 (0.76-1.62) [0.579]	1.04 (0.71-1.52) [0.538]	1.30 (0.84-2.00) [0.599]	-3.84 (1.38) [-2.78]
Depressogenic schemata	1.06 (0.71-1.57) [0.550]	1.10 (0.77-1.56) [0.578]	1.07 (0.76-1.52) [0.537]	0.94 (0.60-1.44) [0.592]	1.20 (1.27) [0.95]
Anxiety	1.20 (0.78-1.82) [0.550]	1.44 (0.99-2.10) [0.585]	1.32 (0.91-1.91) [0.549]	1.15 (0.73-1.80) [0.597]	-0.26 (1.36) [-0.19]
Cognitive	1.77 (1.05-2.93) [0.554]	1.86 (1.12-3.13) [0.590]	1.67 (1.03-2.71) [0.554]	4.56 (2.76-7.55) [0.639]	-2.54 (1.79) [-1.42]
Positive	0.46 (0.23-0.84) [0.582]	0.79 (0.49-1.27) [0.578]	0.77 (0.47-1.24) [0.533]	0.36 (0.16-0.72) [0.619]	-1.19 (1.83) [-0.65]
Adjusted: Sentiments + Other contributors					
Emotional	1.98 (1.34-2.94) [0.749]	1.68 (1.17-2.42) [0.740]	1.79 (1.26-2.57) [0.733]	1.97 (1.31-2.95) [0.736]	
Interpersonal					
Somatic					-3.04 (1.29) [-2.36]
Depressogenic schemata					
Anxiety		1.72 (1.14-2.62) [0.740]			
Cognitive	1.61 (0.90-2.85) [0.741]	1.62 (0.93-2.86) [0.735]	1.50 (0.88-2.57) [0.729]	4.78 (2.73-8.39) [0.745]	
Positive	0.48 (0.23-0.93) [0.741]			0.36 (0.16-0.74) [0.737]	

All models were adjusted for the important sentiments, centre and all other contributors (age, sex, education, work status, sexuality, physical function)
Univariately, the sentiments associated with the threshold value are illustrated with grey shading

Table 3: First assessment at study entry to any assessment unadjusted and adjusted sentiment analysis

	HADS-D (628/2669)	HADS-A (1121/2661)	MHI (1004/2692)	PDQ/C3Q (328/1957)	B-CAM (n=2635)
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	b (s.e) [z]
Unadjusted					
Emotional	1.91 (1.43-2.55)	1.85 (1.41-2.42)	1.78 (1.36-2.32)	2.10 (1.51-2.93)	-0.45 (1.03) [-0.44]
Interpersonal	1.26 (0.88-1.82)	1.04 (0.76-1.43)	1.27 (0.92-1.75)	0.83 (0.56-1.24)	-0.56 (1.18) [-0.47]
Somatic	1.21 (0.86-1.71)	1.07 (0.78-1.46)	1.16 (0.84-1.59)	1.28 (0.88-1.87)	-2.88 (1.29) [-2.23]
Depressogenic schemata	1.15 (0.83-1.60)	1.18 (0.89-1.58)	1.05 (0.78-1.41)	1.13 (0.77-1.66)	-0.79 (1.03) [0.76]
Anxiety	1.28 (0.92-1.79)	1.39 (1.02-1.89)	1.39 (1.03-1.89)	1.02 (0.69-1.53)	-0.12 (1.14) [-0.11]
Cognitive	1.77 (1.15-2.73)	1.70 (1.12-2.56)	1.80 (1.22-2.66)	4.57 (2.96-7.07)	-1.33 (1.78) [-0.75]
Positive	0.49 (0.30-0.80)	1.01 (0.68-1.51)	0.81 (0.53-1.24)	0.37 (0.20-0.68)	0.05 (1.66) [0.03]
Adjusted: Sentiments + Other contributors					
Emotional	1.83 (1.37-2.45)	1.77 (1.34-2.35)	1.61 (1.22-2.13)	2.00 (1.41-2.82)	
Interpersonal					
Somatic					-2.21 (1.18) [-1.87]
Depressogenic schemata					
Anxiety		1.65 (1.20-2.26)	1.52 (1.12-2.06)		
Cognitive	1.69 (1.10-2.61)	1.39 (0.92-2.11)	1.61 (1.08-2.40)	4.78 (3.10-7.39)	
Positive	0.55 (0.33-0.91)			0.36 (0.19-0.67)	

All models were adjusted for the important sentiments, centre and all other contributors (age, sex, education, work status, sexuality, physical function)
Univariately, the sentiments associated with the threshold value are illustrated with grey shading