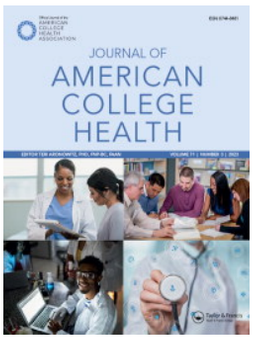

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Mental health and academic outcomes over the first year at university in international compared to domestic Canadian students

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ABSTRACT

Objective: To compare risk factors and associated mental health and academic outcomes between international and domestic students.

Participants: Canadian university undergraduate students.

Methods: Electronic surveys were completed at university entry and the end of first year. Surveys assessed demographics, risk factors, symptoms of mental disorders, and access to support. Academic outcomes were obtained from university databases.

Results: International students had comparable or lower rates of clinically significant anxiety, depression, and insomnia. Domestic female students reported the highest screening rates for common mental disorders. However, international students were more likely to report having attempted suicide. International students felt less connected to the university community and had lower academic performance. Psychosocial risk factor profiles and proportions accessing mental health services were similar.

Conclusions: The scope of mental health need appears more similar than different between international and domestic students; however, international students may benefit from targeted academic and social support initiatives.

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Academic performance; higher education; international students; mental health; university

Introduction

Student mental health has become a priority for universities globally.[1,2] Student need for mental health support is straining current resources and universities are considering how to best meet this challenge. Convergent evidence from across institutions and countries shows that student mental health concerns have increased in proportion and complexity over the past decade.[3,4] Widening access to university and decreasing stigma may have contributed to this trend; resulting in a more diverse student population with varied risk profiles and a broader spectrum of mental health concerns.[1,5]

For example, in a recent national study of US college students there was evidence of an increase in reported lifetime diagnoses and positive depression screens between 2007 and 2017, with one-third of students reporting a 12-month diagnosed mental health condition at last survey. Furthermore, the proportion of students seeking mental health services increased from 19% in 2007 to 34% in 2017,[6] while levels of stigma decreased over the same period. Similarly, in the United Kingdom there was a five-fold increase from 2006 to 2016 in the number of students disclosing a mental health condition at entry to university and an increased demand for university counseling services. Moreover, evidence suggests that the scope of need may be underrepresented, as a sizeable proportion of students with mental health problems do not disclose them or seek treatment.[4,5]

Widening access to university has seen an increase in the number of international students attending foreign universities. While many stressors related to making new friends, financing studies, and heightened competition and learning expectations are shared across the university student population,[7] international students may experience unique challenges related to language and sociocultural barriers.[8] International students studying in the United States often perform worse academically, in an unfamiliar educational system.[9] They frequently experience cultural and social isolation, and can encounter cultural misunderstandings and racial discrimination.[10] Despite the added challenges, it has

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Access to de-identified data considered upon request to the corresponding author after study completion.

been found that international students reach out for help less often,[10] and experience more barriers to care.[8]

It is unclear how international and domestic students compare in terms of other risk factors for mental health conditions such as early adversity,[11] and personal and family history of mental illness.[12] While our planned analysis did not draw upon a particular theoretical framework, *a priori* we hypothesized that mental health symptoms, diagnoses of mental illness and associated risk factors would differ substantially between domestic and international students upon entry to university. This might be attributed to the fact that the students come from strikingly different cultures and settings with varying norms with respect to recognition and diagnosis of mental illness, acceptance of risk-taking, and the stigmas associated with being mentally ill.[10] Furthermore, we hypothesized that international students willing to come to Canada for training may be systematically healthier than their domestic counterparts, a form of selection bias attributable to their abilities to travel and relocate internationally. Theoretically, all of these influences would result in differential mental health experiences in international and domestic students, with lower burdens of illness in the international cohort.

At an institutional level, this information could be used to develop universal and tailored mental health supports addressing the specific needs of international students. In this study, we sought to compare theoretically important remote and proximal risk factors between international and domestic undergraduate students at entry to university and their association with mental health and academic outcomes at the completion of their first year.

Methods

Data are from the U-Flourish Student Well-Being and Academic Success study.[13] All first-year undergraduate students studying at Queen's University were invited to participate in an online survey in September of 2018. This baseline survey collected information on demographic characteristics, risk factors, and indicators of mental health. A follow-up survey was completed in March of 2019 that included validated measures of common mental health concerns, school connectedness, and barriers to care, and questions related to mental health support. Survey responses were linked to academic data abstracted from the university database. Ethics approval for this study was received from the Queen's University and Affiliated Teaching Hospitals Research Ethics Board (PSIY-609-18).

Study variables

Demographics

Age was calculated using the date of survey completion and date of birth obtained from the university database. Gender and international student status were based on self-report. Students reported their ethnicity and parental levels of education from a standard list, and program of study was acquired from the university database.

Mental health outcomes

Available measures are described in detail elsewhere.[14] Participants reported whether they or a first-degree relative had been diagnosed with a mental disorder. Current mental health status was measured using five options ranging from "very poor" to "very good." Anxiety symptoms and depressive symptoms were measured using the Generalized Anxiety Disorder 7-item Scale (GAD-7)[15] and Patient Health Questionnaire (PHQ-9),[16] respectively. Scores $\geq$ 10 on the GAD-7 and PHQ-9 indicate positive screens for clinically significant symptoms. Related functional impairment in those screening positive was based on whether the symptoms made it "very" or "extremely" difficult (vs. "somewhat" or "not at all") to do work, take care of things at home, or get along with other people. Sleep quality was indicated via the eight-item Sleep Condition Indicator.[17] A score of ≤16 out of 32 indicates a positive screen for clinically significant insomnia. Finally, lifetime self-harm, suicidal ideation, and suicide attempts were assessed at school entry and follow-up (in the past 6 months) using questions from the Columbia Suicide Rating Scale.[18]

Academic outcomes

School connectedness was measured using the College Student Subjective Well-Being Questionnaire subscale.[19] Low connectedness was defined as being in the bottom quartile of the sample distribution (subscale score ≤13). Cumulative Grade Point Average (GPA) was abstracted from the university database, with a GPA <2.7 over the first year considered as lower academic performance.

Risk and protective factors

Childhood adversities, including experiences of abuse, were measured via the Childhood Experience of Care and Abuse Questionnaire (CECA).[20] More proximal risk factors were measured using brief validated scales including: the Rosenberg Self-Esteem Scale,[21] the social competence and support subscales of the Resilience Scale for Adolescents (READ),[22] the Perceived Stress Scale 4 (PSS-4),[23] and the GSOEP Short Scale was used to measure locus of control.[24] Lack of regular exercise was defined as working out or attending a gym or fitness class less than once a week in the past month. Finally, substance misuse was defined as engaging in any of the following at least once a week in the past month: binge drinking, cannabis use, and use of nonprescribed or recreational drugs. These are established risk factors for mental health and illness in this population, and their choice for inclusion in the U-Flourish study has been described elsewhere.[13]

Treatment

Students reported whether they were receiving treatment or support for a mental health condition and if so, whether it was pharmacological, psychological or both. Perceived barriers to mental health care were assessed in students that reported needing care but did not receive it using a 9-item

modified version of the stigma subscale of the Barriers to Access to Care Evaluation scale (BACE),[25] and the 12-item attitudinal and 6-item practical subscales of the Barriers to Care Checklist.[26]

Statistical analysis

International and domestic students were compared on demographic characteristics, risk factors and symptom levels at school entry and completion of the first year, stratified by gender. *A priori*, gender was considered as a potential effect modifier based on previous findings that male and female undergraduate students report significantly different mental health experiences.[14] Students that identified as non-binary gender were excluded because of restrictions surrounding small cell sizes ($n = 25/3029$ at baseline). Chi-square- and t-tests were used to test for differences in proportions and means. Effect sizes were quantified using absolute differences in proportions and Cohen's d.[27] Mental health and risk factors were similarly compared. In an exploratory, *post hoc* analysis, because of the preponderance of students from mainland China in the Queen's University student population, differences in symptom levels were compared in Chinese and non-Chinese international students.

A series of log-binomial regression models were used to examine associations between: (1) international student status and mental health and academic outcomes, and (2) baseline risk factors and mental health and academic outcomes in both student groups. Estimates accounted for age and gender differences. The analyses examining cumulative GPA and number of failed courses were further adjusted for program of study and excluded students in professional programs which included few international students. Analyses were 80% powered to detect relative risks of 1.20–1.39 in domestic students and 1.54–2.31 in international students ($\alpha = 0.05$, two-sided). Linear mixed effects regression models were used to examine whether symptoms of anxiety, depression and insomnia had changed over the first year. Interaction terms were used to examine whether changes in symptoms differed between international and domestic students. Average cumulative GPA was also compared between international and domestic students using multivariable linear regression. Finally, we compared the use of mental health support services over the academic year between international and domestic students. While our study had many statistical tests, the results were intended to be hypothesis generating and focus on overall trends and patterns of risk and risk differences, as opposed to findings for specific variables. Hence, no adjustments for multiple comparison were made.[28] The type 1 error rate was set at 5% per test, and a 5% family-wise error rate was not implemented.

To aid in the interpretation, a convenience sample of international students from China studying at Queen's University ($n = 7$) provided feedback on the main findings, drawing on lived experience. Common themes that emerged were identified and reported.

Results

The full baseline sample included 3029 students.[14] After restriction to students with data on international student status, the available samples for baseline and follow-up were 2991 ($n = 2694$ domestic and 297 international) and 1937 ($n = 1794$ domestic and 143 international), respectively. Response rates were lower in international compared to domestic students at baseline (44% vs. 59%) and follow-up (48% vs. 67%). International students were more likely to be older, of Asian ethnicity, from families with lower parental education, and enrolled in Arts, Humanities, and Social sciences, and Computing Sciences (Table 1). Common countries of origin included: China (63% of baseline, 46% follow-up) and the United States (12% of baseline, 15% follow-up).

Mental health at entry to university

At school entry, international females were less likely than domestic females to rate their mental health as "below average" (11% vs. 17%, $p = .03$) or report a lifetime history of a mental disorder (22% vs. 33%, $p < .01$); while these rates were comparable in males (Table 2). The proportion of international and domestic males screening positive for anxiety and insomnia was comparable, but in females international students reported lower rates of clinically significant anxiety (26% vs. 39%, $p < .01$) and insomnia (10% vs. 21%, $p < .01$). International females were less likely to report having self-harmed than domestic females, while international males reported higher rates of self-harm than domestic males, however these differences were not statistically significant. A greater proportion of international students reported having attempted suicide in their lifetime, especially among males (7% vs. 3%, $p = .05$, *males;* 10% vs. 7%, $p = .17$, *females*). However, international and domestic students had comparable rates of screening positive for depressive symptoms and lifetime suicidal thoughts at school entry. Comparing Chinese to non-Chinese international students, Chinese students reported significantly fewer symptoms than international students from other countries (11.1% to 23.4% lower in males and 0.4% to 5.8% lower in females for clinically significant symptoms of depression, anxiety, and insomnia). Despite these findings, history of suicide attempts did not differ in the two international student groups (8.1% vs. 8.3% in males; 9.7% vs. 11.1% in females).

Risk factors at entry to university

International students were less likely than domestic students to report a family history of mental illness, especially among females (Table 3). While reported childhood adversities were comparable between the groups and most commonly due to having been bullied by peers, international students were more likely to report a history of physical abuse, especially among females. International students were less likely to report substance misuse (30% vs. 43%, $p = .03$ *males*; 8% vs. 31%, $p < .01$ *females*) and more likely to report not exercising

Table 1. Demographic profile of the cohort at school entry (baseline) and the end of first year (follow-up), by international or domestic student status.

	Baseline sample				Follow-up sample			
	International ($n=297$)		Domestic ($n=2694$)		International ($n=143$)		Domestic ($n=1794$)	
Age[B,L]	No.	(%)*	No.	(%)*	No.	(%)*	No.	(%)*
≤17	31	(10.4)	547	(20.3)	14	(9.8)	388	(21.6)
18-19	251	(84.5)	1977	(73.4)	125	(87.4)	1309	(73.0)
≥20	15	(5.1)	170	(6.3)	4	(2.8)	97	(5.4)
Gender								
Male	100	(33.7)	872	(32.4)	48	(33.6)	481	(26.8)
Female	192	(64.7)	1802	(66.9)	95	(66.4)	1300	(72.5)
Other identity	5	(1.7)	20	(0.8)	0	(0.0)	13	(0.8)
Ethnicity[B,L]								
White	70	(23.7)	1928	(71.7)	38	(26.8)	1259	(70.3)
Asian	194	(65.8)	413	(15.4)	84	(59.2)	289	(16.2)
Multiple	19	(6.4)	266	(9.9)	12	(8.5)	189	(10.6)
Black	5	(1.7)	38	(1.4)	4	(2.8)	27	(1.5)
Other	5	(1.7)	38	(1.4)	5	(2.8)	25	(1.4)
Indigenous	2	(0.7)	7	(0.3)	0	(0.0)	1	(0.1)
Program of study[B,L]								
Arts, Humanities & Social Sciences	128	(43.1)	902	(33.5)	49	(34.3)	573	(31.9)
Life and Physical Sciences	82	(27.6)	764	(28.4)	40	(28.0)	543	(30.3)
Engineering and Applied Science	37	(12.5)	430	(16.0)	25	(17.5)	314	(17.5)
Business	14	(4.7)	325	(12.1)	10	(7.0)	183	(10.2)
Professional Schools†	4	(1.4)	195	(7.2)	3	(2.1)	129	(7.2)
Computing	32	(10.8)	78	(2.9)	16	(11.2)	52	(2.9)
Parental education, highest completed[B,L]								
Degree in Professional School or Doctorate	52	(19.0)	639	(24.5)	34	(25.6)	414	(23.5)
Master's degree	70	(25.6)	614	(23.6)	35	(26.3)	406	(23.0)
Bachelor's degree or trade/apprenticeship	93	(33.9)	1038	(39.9)	31	(23.3)	754	(42.7)
High school or less	59	(21.5)	313	(12.0)	33	(24.8)	190	(10.8)

Notes: (1)
*Percentage based on nonmissing responses, (2)
[B]Distributions for domestic and international students significantly different at baseline (chi-square $p<.05$), (3)
[L]Distributions significantly different at follow-up (chi-square $p<.05$), (4)
†Professional schools include nursing, medicine, and law programs.

regularly compared to domestic students (41% vs. 30%, $p=.03$ *males*; 49% vs. 40%, $p=.04$ *females*).

For psychosocial risk factors, in males, international students on average reported lower self-esteem ($p<.01$) and greater perceived stress ($p<.01$). In females, self-esteem was comparable between the groups, but perceived stress was marginally lower in international females ($p=.07$). International males indicated lower internal loci of control than domestic males ($p<.01$), while there was no difference in scores among females. International students reported similar levels of social support and social competence at entry to university.

Outcomes at completion of first year

Over the first year of study there was a significant increase in symptoms of anxiety, depression and insomnia in both international and domestic students (Table 4). At the completion of first year, international females were less likely than domestic female students to screen positive for anxiety, depression, and insomnia (Table 5). In male students there was no difference in the likelihood of screening positive for anxiety and insomnia, but international males were more likely to screen positive for depression. In males, international students reported higher rates of self-harm and suicide attempts over the academic year. In females, international students had higher reported rates of suicidal ideation, self-harm, and suicide attempts (Table 5).

With respect to school performance, in both males and females international students were more likely than domestic students to report lower school connectedness, have lower cumulative GPAs, and have failed one or more courses (Table 5). Average cumulative GPA over the first year was significantly lower in international compared to domestic students (Mean (SD): 2.69 (0.97) vs. 3.06 (0.88), $p<.01$).

Baseline risk factors associated with mental health and academic outcomes at the end of first year

In both international and domestic students childhood adversity, lower self-esteem, lower social competence, higher perceived stress, substance misuse, lower social support, and a lower internal locus of control were associated with an increased risk of screening positive for anxiety and depression at follow-up. The associated relative risk estimates ranged from 1.22 to 3.22 for international students, and from 1.19 to 2.43 for domestic students (Supplemental Table S1). Risks were similar for low school connectedness, except that substance misuse was associated with a decreased risk of low school connectedness in domestic students only (RR= 0.84; 95% CI: 0.66–1.07). Risk factors were also similar for low cumulative GPA, with a few exceptions (Supplemental Table S1). Low social competence was associated with a nonsignificant reduced risk of having a low GPA in both international and domestic students.

Access to mental health services

At entry to university only small proportions of students indicated receiving treatment or support for their mental health (3% international and 9% domestic; Supplemental Table S2). Over the academic year, a comparable proportion

Table 2. Description of the mental health of international and domestic students at entry to university, by gender.

	Males							Females						
	International ($n=100$)		Domestic ($n=872$)		International vs. domestic students			International ($n=192$)		Domestic ($n=1,802$)		International vs. domestic students		
	n	Col%	*n*	Col%	Diff	(95% CI)	*p**	*n*	Col%	*n*	Col%	Diff	(95% CI)	*p**
Self-rated mental health, *below Avg*	10	10.1	79	9.1	1.0	(−5.2 to 7.3)	.74	21	11.0	304	17.0	−6.0	(−10.7 to 2.4)	.03
History of a Diagnosed Mental Disorder	15	16.1	161	20.1	−4.0	(−11.9 to 4.0)	.36	40	21.9	548	32.7	−10.8	(−17.2 to −4.4)	<.01
Anxiety symptoms														
Minimal/none (0–4)	37	44.1	397	50.5	−6.5	(−17.6 to 4.7)	.35	58	34.5	541	32.2	2.3	(−5.3 to 9.8)	<.01
Mild (5–9)	32	38.1	227	28.9	9.2	(−1.6 to 20.1)		66	39.3	481	28.7	10.6	(2.9 to 18.3)	
Moderate (10–14)	11	13.1	110	14.0	−0.9	(−8.5 to 6.7)		26	15.5	351	20.9	−5.4	(−11.3 to 0.4)	
Severe (15–21)	4	4.8	52	6.6	−1.9	(−6.7 to 3.0)		18	10.7	305	18.2	−7.5	(−12.5 to −2.4)	
Clinically significant anxiety (≥10)	15	17.9	162	20.6	−2.8	(−11.4 to 5.9)	.55	44	26.2	656	39.1	−12.9	(−20.0 to −5.9)	<.01
Associated functional impairment	7	46.7	63	39.1	7.5	(−18.8 to 34)	.57	16	37.2	323	49.5	−12.3	(−27.2 to 2.7)	.12
Depression symptoms														
Minimal/none (0–4)	38	45.8	422	54.0	−8.2	(−19.5 to 3.1)	.70	58	34.7	636	38.0	−3.3	(−10.9 to 4.3)	.26
Mild (5–9)	26	31.3	210	26.9	4.5	(−6.0 to 14.9)		64	38.3	512	30.6	7.7	(0.01 to 15.4)	
Moderate (10–14)	12	14.5	90	11.5	3.0	(−4.9 to 10.8)		22	13.2	289	17.3	−4.1	(−9.5 to 1.3)	
Moderately severe (15–19)	5	6.0	46	5.9	0.1	(−5.2 to 5.5)		12	7.2	139	8.3	−1.1	(−5.3 to 3.0)	
Severe (20–27)	2	2.4	14	1.8	0.6	(−2.8 to 4.1)		11	6.6	97	5.8	0.8	(−3.1 to 4.7)	
Clinically significant depression (≥10)	19	22.9	150	19.2	3.7	(−5.7 to 13.2)	.42	45	27.0	525	31.4	−4.4	(−11.5 to 2.7)	.24
Associated functional impairment	9	47.4	59	39.6	7.8	(−16 to 31.6)	.52	16	35.6	247	47.1	−11.6	(−26.2 to 3.0)	.13
Clinically significant insomnia (SCI ≤16)	9	11.0	94	12.0	−1.1	(−8.2 to 6.1)	.78	17	10.2	350	21.0	−10.8	(−15.8 to −5.9)	<.01
Suicide and self-harm; have you ever…														
Had thoughts about ending your life	17	20.5	186	23.8	−3.3	(−12.5 to 5.9)	.50	59	35.3	515	30.8	4.5	(−3.1 to 12.1)	.23
Self-harmed without intent to end life	10	12.1	63	8.1	4.0	(−3.3 to 11.3)	.21	28	16.8	367	21.9	−5.2	(−11.2 to 0.8)	.12
Attempted to end your life	6	7.2	24	3.1	4.2	(−1.5 to 9.9)	.05	16	9.6	113	6.8	2.8	(−1.8 to 7.5)	.17

Notes: (1) *Chi-square test for difference in proportions comparing international and domestic students, (2) Diff = absolute difference in proportion comparing international to domestic students.

Table 3. Description of risk factors related to mental health and academic outcomes in international and domestic students at entry to university, by gender.

	Males							Females						
	International ($n=100$)		Domestic ($n=872$)		International vs. domestic student			International ($n=192$)		Domestic ($n=1802$)		International vs. domestic student		
	n	col%	*n*	col%	Diff	(95% CI)	*p**	*n*	col%	*n*	col%	Diff	(95% CI)	*p**
Family history of mental disorder	21	22.8	276	34.3	−11.5	(−20.6 to −2.3)	.03	42	24.1	856	49.7	−25.5	(−32.3 to −18.8)	<.01
Childhood adversity	23	27.4	202	25.7	1.6	(−8.4 to 11.7)	.74	54	32.1	550	32.8	−0.7	(−8.1 to 6.7)	.86
Physical abuse	11	13.1	64	8.2	4.9	(−2.5 to 12.4)	.13	23	13.7	102	6.1	7.6	(2.3 to 12.9)	<.01
Bullied or teased badly by peers	17	20.5	150	19.1	1.4	(−7.8 to 10.5)	.77	35	21.0	387	23.1	−2.2	(−8.6 to 4.4)	.53
Sexual abuse (yes vs. no/unsure)	4	4.8	29	3.7	1.3	(−3.8 to 6.4)	.34	15	9.0	225	13.4	−4.6	(−9.7 to 0.5)	.19
Substance misuse	25	30.1	335	42.7	−12.6	(−23.1 to −2.2)	.03	14	8.4	510	30.6	−22.2	(−26.9 to −17.4)	<.01
Lack of regular exercise	34	41.0	232	29.6	11.3	(0.3 to 22.4)	.03	56	48.5	599	40.4	8.1	(0.2 to 16.1)	.04
Self-esteem														
Low (<15)	15	15.3	83	9.7	5.6	(−1.8 to 13.0)	.01	36	19.5	361	20.5	−1.0	(−7.0 to 5.0)	.34
Normal (15-25)	71	72.5	595	69.7	2.8	(−6.6 to 12.1)		129	69.7	1209	68.5	1.2	(−5.7 to 8.2)	
High (>25)	12	12.2	176	20.6	−8.4	(−15.4 to −1.3)		20	10.8	195	11.1	−0.2	(−4.9 to 4.5)	
Self-esteem; *Mean(SD)*	19.3	(5.1)	20.8	(5.2)	Cohen's $d=0.29$		<.01	18.8	(4.9)	18.4	(5.3)	Cohen's $d=0.08$		.35
Social competence; *Mean (SD)*	13.3	(4.0)	13.2	(4.6)	Cohen's $d=0.02$		.91	13.7	(4.4)	13.6	(4.2)	Cohen's $d=0.02$		.90
Social support; *Mean (SD)*	15.3	(3.8)	15.7	(4.5)	Cohen's $d=0.10$		.34	16.1	(3.9)	16.6	(3.8)	Cohen's $d=0.13$		.14
Perceived stress; *Mean (SD)*	6.8	(2.6)	5.9	(2.5)	Cohen's $d=0.35$		<.01	6.8	(2.3)	7.2	(2.7)	Cohen's $d=0.13$		.07
Internal locus of control; *Mean (SD)*	27.3	(6.0)	29.4	(5.7)	Cohen's $d=0.36$		<.01	27.3	(5.4)	27.7	(5.0)	Cohen's $d=0.08$		.36

Notes: (1) *Chi-square test for difference in proportions comparing international and domestic students; t-test for differences in means, (2) Diff = absolute difference in proportion comparing international to domestic students, (3) possible ranges are: self-esteem = 0–30, social competence = 0–20, social support = 0–20, perceived stress = 0–16, locus of control = 0–48.

Table 4. Results of mixed effects regression examining differences in symptoms of anxiety, depression, and sleep problems between international and domestic students over the first year of university, by gender.

	Difference between groups (international vs. domestic)			Change over time			Status × time
Males	*β*	(SE)	*p*	*β*	(SE)	*p*	*p**
Anxiety (GAD-7)	0.14	(0.26)	0.59	0.44	(0.11)	<.01	0.99
Depression (PHQ-9)	0.40	(0.21)	0.06	0.61	(0.10)	<.01	0.69
Sleep problems	−0.19	(0.20)	0.34	0.67	(0.11)	<.01	0.49
Females							
Anxiety (GAD-7)	−0.57	(0.21)	<.01	0.41	(0.07)	<.01	0.61
Depression (PHQ-9)	−0.02	(0.18)	0.93	0.56	(0.06)	<.01	0.76
Sleep problems	−0.89	(0.15)	<.01	0.61	(0.07)	<.01	0.57

Note: (1) All models adjusted for age, (2) Sleep Condition Index re-coded, so higher scores indicate more sleep problems, (3) All variables re-scaled so range= 0–10, (4)
*p-value for interaction between international vs. domestic status and time; $p < .05$ indicates that the change in symptoms from school entry to the end of first year was significantly different in international and domestic students, (5) analyses utilized all available data.

Table 5. Comparison of mental health and academic outcomes in international vs. domestic students at the end of first year, by gender.

	Males						Females					
Outcome	International (*n* = 48)		Domestic (*n* = 481)		Adjusted RR*		International (*n* = 95)		Domestic (*n* = 1,300)		Adjusted RR*	
Mental health	*n*	(%)	*n*	(%)	RR	(95% CI)	*n*	(%)	*n*	(%)	RR	(95% CI)
Anxiety												
Clinically significant (GAD-7 ≥10)	10	(25.0)	113	(26.3)	0.95	(0.50-1.81)	27	(31.0)	536	(44.5)	0.70	(0.47–1.03)
Severe (GAD-7 15–21)	5	(12.5)	40	(9.3)	1.38	(0.54-3.50)	10	(11.5)	258	(21.4)	0.54	(0.29–1.01)
Depression												
Clinically significant (PHQ - 9 ≥10)	15	(36.6)	123	(28.8)	1.27	(0.74-2.17)	26	(30.6)	481	(40.3)	0.76	(0.51–1.13)
Severe (PHQ-9 20-29)	2	(4.9)	13	(3.0)	1.60	(0.36-7.09)	5	(5.9)	104	(8.7)	0.68	(0.28–1.66)
Insomnia												
Clinically significant (SCI ≤16)	7	(17.5)	79	(18.6)	0.95	(0.44-2.05)	18	(21.2)	354	(29.8)	0.71	(0.44–1.15)
Suicide/self-harm; in the past 6 months…												
Had thoughts about ending life	3	(7.5)	53	(12.4)	0.61	(0.19-1.94)	13	(15.3)	171	(14.4)	1.07	(0.61–1.88)
Self-harmed without intent to end life	2	(5.0)	14	(3.3)	1.81	(0.41-8.06)	6	(7.1)	76	(6.4)	1.12	(0.49–2.57)
Attempted to end life	1	(2.5)	5	(1.2)	2.67	(0.30-23.3)	4	(4.7)	16	(1.3)	3.52	(1.18–10.5)
Academic												
Low school connectedness	13	(32.5)	98	(22.6)	1.44	(0.81-2.56)	28	(31.8)	262	(21.7)	1.47	(1.00–2.17)
	(*n* = 99)		**(*n* = 815)**		**Adjusted RR****		**(*n* = 189)**		**(*n* = 1664)**		**Adjusted RR****	
Cumulative grade point average <2.7	38	(38.4)	240	(29.4)	1.23	(0.87-1.75)	69	(36.5)	437	(26.3)	1.32	(1.02–1.71)
Failure of one or more courses	23	(23.0)	116	(14.2)	1.60	(1.01-2.53)	36	(18.8)	146	(8.8)	1.99	(1.37–2.87)

Notes: *(1) Relative risk adjusted for age, (2) **Relative risk adjusted for age and program of study, (3) Full baseline sample used for cumulative GPA and failure of one or more courses, minus students in professional school programs (nursing, medicine, and law).

of international and domestic students reported accessing help for their emotional health. Overall, 13% of students reported accessing some form of university support. The resources accessed most were counseling at student health services (60% international and 71% domestic) and university counseling embedded within their program of study (20% international and 14% domestic). There was no difference in the proportion of international and domestic students who reported needing help but not receiving it or experiencing a delay (36%). Furthermore, rates of reported barriers to care were similar between the groups (Supplemental Table S3).

Feedback from international Chinese students

Overall, the students were not surprised by our main findings. From their perspective, in Chinese society there is a greater focus on physical health and academic success than on mental health. Related to this, international (Chinese) students may be less familiar with how to evaluate their own mental health. Stigma around mental health problems may be higher, fostering denial and lowering reporting of mental health problems. According to one student, in China, people with mental health problems are "…seen as abnormal or even crazy."

Higher rates of attempted suicide

Students shared that there is a cultural expectation in China that people take responsibility and deal with problems independently. "Many people [in China] would not report the issue or ask for help unless the issues are very severe…" and "… people ignore early symptoms of illness, which can then progress into [more] severe stages." These students described unique challenges and stressors related to studying internationally including lack of social support, language barriers, culture shock, high academic expectations (from self, peers, and home), financial stress, and loneliness.

Academic problems

Challenges adapting to different methods of learning and evaluation were mentioned by all students. For example, in China apparently there is a focus on memorization and exam-based evaluation, while Canadian institutions place emphasis on discussion of ideas and applied and self-directed learning. One student shared that "many international students lack the skills to learn by themselves, which creates an enormous amount of stress when they try to follow the Canadian curriculum." If courses rely heavily on written or oral assessments, language may be a major obstacle.

Discussion

This study identified a very high prevalence of mental health concerns at entry to university that increased over the first year in both international and domestic students. Domestic female students seemed at a particular disadvantage, as they rated their mental health the lowest at school entry and had the highest positive screening rates for clinically significant symptoms of anxiety, depression and insomnia at both time points. Self-harm was most common in female students, with international females reporting higher rates than domestic females at completion of first year. Reported lifetime suicide attempts at entry and over the course of the first year were higher in international compared to domestic students, especially in international females.

Findings also highlighted differences in risk profiles, with domestic students reporting higher substance misuse, and international students reporting less regular exercise and higher rates of childhood physical abuse. Further, international males reported greater perceived stress, lower self-esteem and a lower internal locus of control. Associations between these risk factors and lower school performance were strong in both groups. Reported access and perceived barriers to university mental health supports were similar between domestic and international students.

The high rates of mental health symptoms reported by domestic females are not unexpected. Beginning in early adolescence, girls in Canada consistently report higher levels of psychosomatic health complaints and symptoms of anxiety and depression than boys.[29] While the origins of such patterns remains a major focus of debate, such findings have been replicated internationally[2,5] and the gender gap between adolescent and young adult mental health appears to be widening, mostly due to increases in common mental health problems in females.[30]

We had expected to observe similar or higher rates of mental health symptoms among international students, given the stress of adapting to new sociocultural and educational settings.[8] However, international students had similar or lower rates of clinically significant mental health symptoms at entry to university, with a comparable increase in symptoms over the first year. This may be a reporting artifact, as students from some countries may have higher perceived stigma and lower mental health literacy compared to Canadian students, translating into a reluctance and/or inability to identify symptoms.[31] This may be particularly true for students from mainland China, which constitute the majority of the Queen's international student cohort. In our sample, international Chinese students appeared to be less likely to report mental health symptoms than international students from other countries. In contrast, the presence of mental health literacy programs in Canadian secondary schools has increased knowledge and improved attitudes toward mental health, leading to reduced stigma and a higher likelihood of disclosure.[32,33]

The higher reporting of suicide attempts in international compared to domestic males is noteworthy. Higher rates of suicidal behavior may stem from a failure to recognize and/or seek treatment for an emerging mental disorder, allowing distress to rise to a point of crisis.[34] In addition, expectations placed upon international students can be profound, adding stress in situations where there may be less immediate social support and connectedness.[35] Finally, in some countries and cultures, suicide is considered less "taboo."[36]

On average, international students performed at lower levels academically and reported lower school connectedness than domestic students, consistent with a recent study of American college students.[9] Adapting to a new country and academic system can be challenging. Language barriers

reduce a student's ability to perform to their potential academically in an already demanding higher education setting.[8] International students may also be accustomed to learning approaches that emphasize memorization in learning over debate and discussion.[37] In contrast, the Canadian education system increasingly emphasizes self-directed and applied learning and rewards the expression of personal reflections and discussion; an approach that may be new and challenging, especially in a different language.[37]

While the student groups varied somewhat on major determinants of mental illness, there were more commonalities than differences. Adverse childhood experiences have predictable effects on the long-term mental health of young people, irrespective of their cultural background.[38] Similarly, lower levels of exercise, increased substance misuse, and a lower sense of control of one's life had a negative impact on mental health and academic outcomes, irrespective of international or domestic student status. Therefore, preventive initiatives targeting these modifiable risk factors remain priorities for universal approaches to student mental health support.[39]

The use of campus mental health resources was comparable between international and domestic students, which stands in contrast to reports of international students experiencing more barriers to care.[8,40] Recent initiatives to engage and tailor mental health resources to the unique needs of international students in our university may have contributed.

In terms of strengths, our sample size was large and representative, and we achieved high response rates at baseline and follow-up compared with other major North American surveys of College and University students. Response rates of around 20% are common for this type of survey.[41] Symptoms of common mental health disorders were assessed using clinically validated measures. Theoretically important determinants of mental health disorders were assessed in addition to potentially modifiable risk factors that could inform preventive interventions. Our linkage of survey data to the university database provided objective indicators of academic performance. Limitations of our study included a lower participation rate in international students that raises the potential for selection bias. Worse mental health at baseline was associated with loss to follow-up in international students only, which could mean that international students do slightly worse over the first year of study than our findings suggest. At Queen's University, most international students derive from mainland China and therefore findings may not generalize to other universities with a more heterogeneous international student population. Although not measured in this study, differences in acculturation could mediate the associations between international student status and mental health and academic outcomes.[10] Finally, because of reliance on self-report measures, there exists the potential for recall bias and misinterpretation of survey wording by students, particularly those of non-English-speaking backgrounds.

A major implication of our findings pertains to the ubiquitous nature of distressing and impairing mental health symptoms across the university student population and the associated impact on academic performance; which, together, underscore the importance of universal prevention and early intervention. That is, given that the same psychosocial and lifestyle factors predicted mental health and academic outcomes for both domestic and international students, the same core mental health promotion and early intervention initiatives may largely meet the needs of the diverse student population. Another implication is the need to better understand why domestic female students are more likely to screen positive for common mental disorders compared to males and their international counterparts. For international students, higher reporting of suicide attempts is of concern.

Our findings also support the need to develop targeted resources to help international students, at least those from different cultures and first languages, to succeed academically at Canadian institutions. In spite of comparable or lower rates of reported mental health concerns, international students had more academic problems and felt less connected to the university. Targeted academic support and engagement efforts for international students, taking into account cultural differences, past learning experiences and current social and academic challenges seem important.

In summary, transition to university can be a stressful time, irrespective of student gender, culture and country of origin. While there are some differences in the nature of stressors and risk factors, symptoms of common mental health problems and access to student mental health support seem largely comparable between international and domestic students. However, international students appear at particular risk for academic difficulties and lack of engagement in the campus community in the transition to university.

Conflicts of interest

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of Canada and received approval from Queen's University.

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