

Mental Health Factors Impacting Indigenous Students' Academic Performance: Empirical Evidence from Canadian Universities

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Abstract

Indigenous students in Canada experience both higher rates of mental health challenges and persistent educational disparities, yet whether mental health conditions differentially impact their academic performance remains empirically unexamined. Using survey data from 8,652 students across 16 Canadian universities in Spring 2022, we test whether the relationship between psychological distress and academic performance differs by Indigenous status. Our results show that mental health challenges are differentially associated with academic performance for Indigenous students. Specifically, the negative association between stress and GPA is 1.4 times stronger for Indigenous students compared to non-Indigenous peers; for anxiety, 1.6 times stronger; and for depression, 1.8 times stronger. These differential effects remain robust across alternative mental health measures including diagnostic indicators and 30-day stress severity. These findings reveal differential vulnerability beyond prevalence differences alone, suggesting that identical mental health symptoms are associated with substantially larger academic performance decrements for Indigenous students. This hidden multiplier of educational inequality has direct implications for university support systems, indicating that achieving equity requires differentiated interventions calibrated to both amplified academic consequences and Indigenous students' cultural strengths, rather than universal approaches developed for general populations.

Keywords: Mental Health, Stress, Anxiety, Depression, Indigenous students, Academic performance, Canadian universities

Introduction

Indigenous peoples comprise 5% of Canada's population but represent only 3% of university graduates and 1% of doctoral students [1]. This persistent educational disparity has resisted decades of intervention efforts, suggesting that critical mechanisms underlying these inequities remain poorly understood. While systemic barriers and historical trauma are well documented, one potential driver has received insufficient empirical attention: the possibility that mental health challenges may exact a fundamentally different academic toll on Indigenous students compared to their non-Indigenous peers.

Mental health difficulties pervade higher education globally. Approximately one-third of university students experience at least one mental health disorder, with 83.1% reporting academic interference [2–5]. Research consistently

documents negative correlations between mental health conditions and academic performance across student populations [6–8]. However, theoretical frameworks including minority stress theory [9] and cumulative disadvantage models [10] suggest these challenges may operate differently for students navigating multiple, intersecting stressors.

For Indigenous students, these challenges emerge from distinct experiences. They face intergenerational transmission of historical trauma, systemic discrimination within educational institutions, and the psychological burden of representing communities where they comprise approximately 4% of the university population [11,12]. Notably, 78% of Indigenous students seeking mental health support prefer consulting with Indigenous Elders [12], highlighting both the severity of need and the vital role of culturally grounded support systems that most institutions lack.

Yet despite documented disparities in mental health prevalence and educational outcomes, a critical empirical question remains unanswered: When Indigenous and non-Indigenous students experience similar levels of stress, anxiety, or depression, do these conditions produce equivalent academic impacts? Understanding whether differential vulnerability exists beyond prevalence differences alone is essential for designing effective interventions.

To address this gap, we conducted the first large-scale quantitative examination of differential mental health impacts on academic performance by Indigenous status in Canada. Using data from the American College Health Association's National College Health Assessment (ACHA-NCHA III), we analyzed 8,652 students across 16 Canadian universities. We examined whether relationships between mental health indicators and academic performance differs by Indigenous status, measuring performance through Grade Point Average (GPA, scale 0–4.33) and assessing mental health through self-reported measures of academic interference from stress, anxiety, and depression.

Controlling for demographics, socioeconomic status, academic behaviors, health conditions, and institution fixed effects, we find striking evidence of differential vulnerability. The negative relationship between mental health indicators and GPA is 1.4 times stronger for stress, 1.6 times stronger for anxiety, and 1.8 times stronger for depression among Indigenous students compared to their non-Indigenous peers. These substantial effect multipliers indicate that identical mental health issues are associated with 40% to 80% larger academic performance decrements for Indigenous students. Results remain robust across alternative mental health measures including diagnostic indicators and 30-day stress severity.

This differential vulnerability, distinct from prevalence differences alone, represents a hidden multiplier of educational inequality. For policymakers and university administrators, these findings necessitate fundamental recalibration of support strategies. Rather than relying primarily on universal mental health interventions developed for general student populations, universities must develop differentiated supports that account for both the amplified academic consequences Indigenous students face and the cultural strengths they bring. The evidence establishes that achieving educational equity requires not equal treatment, but support systems calibrated to differential vulnerability while building on community-based resilience.

Based on minority stress theory [9], the Diathesis-Stress Model [13–15], and cumulative disadvantage frameworks

[10], we hypothesize that mental health challenges will show stronger negative associations with academic performance among Indigenous students compared to non-Indigenous peers. This differential vulnerability operates through the mechanisms outlined above: cognitive resource depletion from simultaneous management of academic and cultural demands, stress system sensitization from historical trauma, and systemic barriers limiting access to culturally appropriate support. We test this overarching hypothesis across three mental health dimensions:

H1: Stress will show amplified negative association with GPA for Indigenous students compared to non-Indigenous peers.

H2: Anxiety will show amplified negative association with GPA for Indigenous students compared to non-Indigenous peers.

H3: Depression will show amplified negative association with GPA for Indigenous students compared to non-Indigenous peers.

For each hypothesis, we predict that interaction terms between Indigenous status and mental health indicators will be statistically significant and negative, indicating that the slope of the relationship between mental health and academic performance is steeper (more negative) for Indigenous students.

Our analysis of 8,652 students across 16 Canadian universities confirms all three hypotheses, with effect multipliers of 1.4, 1.6, and 1.8 for stress, anxiety, and depression respectively.

Materials and Methods

Our methodological approach employs OLS regression with interaction terms to test differential mental health impacts, an approach validated in recent minority health disparities research [16–20]. We use data from the ACHA-NCHA III survey administered across 16 Canadian universities in Spring 2022. All participants provided informed consent as part of the standard ACHA data collection protocol.

Mental health and academic performance: general evidence

The relationship between mental health and academic performance has emerged as a critical concern in higher education globally. Recent meta-analytical evidence reveals widespread challenges, with pooled prevalence rates indicating that 41% of university students experience depression, 38% experience anxiety, and 34% experience significant stress [21]. These conditions represent substantial barriers to educational attainment affecting millions of students worldwide.

It is important to recognize that the modern scientific understanding of “stress” as a physiological and psychological condition traces back to the pioneering seminal work of Hans Selye [22,23]. In fact, Selye was among the first to systematically investigate how diverse external stimuli or “stressors” elicit similar physiological responses in the body. He coined the term “stress” to describe these reactions, emphasizing the non-specific nature of the body’s adaptive processes. Central to Selye’s discoveries was the “general adaptation syndrome,” a triphasic model describing the body’s response to prolonged stress: an initial alarm phase characterized by acute mobilization of defenses, followed by a resistance phase during which the organism attempts to cope with ongoing challenges, and finally an exhaustion phase wherein prolonged exposure results in physiological breakdown and potential irreversible damage. This conceptual framework established the fundamental relationship between environmental stimuli and internal bodily states, laying the groundwork for subsequent interdisciplinary research into stress’s psychological, physiological, and pathological dimensions.

The significance of Selye’s work lies in articulating that stress is not merely a colloquial concept but a definable medical and biological syndrome with measurable health implications. His findings spurred extensive scholarly inquiry into the interactions among external environmental threats, psychological perception and reactions, and ensuing physiological adaptations. Today, Selye’s general adaptation syndrome remains foundational in both medicine and psychology, guiding research that explores how chronic stress contributes to disease pathogenesis and impairment, including mental health disorders and their compounding effects on functioning in populations such as university students. The mechanisms through which mental health disorders impair academic performance are well-documented. Meta-analytic evidence from 126 studies reveals that highly anxious students score approximately 12 percentile points lower than their low-anxiety peers, while at the undergraduate level, high-anxiety students maintain GPAs averaging 0.31 points lower than low-anxiety counterparts [24,25]. Empirical studies identify significant negative correlations between mental health factors and academic outcomes, with stress showing the strongest effect, followed by depression and anxiety [26]. Prospective longitudinal research demonstrates that depression, anxiety, and stress significantly affect academic engagement and increase dropout intentions, which subsequently predict lower academic performance [27].

These universal mechanisms operate through established pathways. Attentional Control Theory shows that anxiety disrupts the balance between goal-directed and stimulus-driven attentional systems [28], while Beck’s Cognitive Model

explains how anxiety arises from maladaptive thought patterns that lead to negative thoughts about academic competence [29–31]. Chronically stressed students face a 26% higher likelihood of academic probation [32,33]. While these effects impact all student populations, they may operate differently for groups navigating additional systemic and cultural barriers to educational success.

Indigenous students: elevated challenges and cultural strengths

Indigenous students in Canadian universities face distinctly elevated mental health challenges rooted in historical and contemporary systemic factors. Indigenous youth experience major depressive disorders at twice the rate of other young Canadians [34], establishing heightened psychological vulnerability that persists through post-secondary education. National survey data reveals that 38% of Indigenous participants report fair/poor mental health compared to 23% of non-Indigenous participants [1].

These disparities stem from deep historical roots. Notably, 11% of Indigenous adults reported having been under government responsibility as children compared to just 2% of non-Indigenous individuals [35], illustrating how colonial policies’ intergenerational impacts continue shaping contemporary educational trajectories. The concept of historical trauma provides a crucial framework: colonization’s legacy operates through intergenerational transmission processes affecting both mental health and educational experiences [36–38]. Within university settings, these baseline vulnerabilities interact with ongoing experiences of racism, discrimination, and the persistent effects of colonialism to create compounded stressors [11].

The university environment itself presents Indigenous students with unique tensions. Conflicts between traditional Indigenous ways of knowing and dominant Western educational methods generate significant psychological stress [39]. In predominantly White institutions, pressure to assimilate to Western academic norms creates additional emotional burdens layering upon typical academic stressors [40,41]. Indigenous students must simultaneously manage academic tasks, cultural code-switching, identity negotiation, and representation burden as they comprise approximately 4% of university populations. Research suggests that prolonged academic stress among marginalized students predicts increased depression and subsequent academic burnout at elevated rates [42].

Importantly, Indigenous students demonstrate considerable resilience through cultural connections and protective factors. Support systems spanning individual, family, and community levels serve as buffers against stress

[43]. These protective elements include strong cultural identity, connection to traditional practices, and access to Indigenous knowledge keepers. Notably, 78% of Indigenous students who seek mental health support prefer consulting with Indigenous Elders on campus [12], demonstrating the vital role of culturally grounded interventions. However, this preference also reveals a critical gap: most institutions lack adequate Indigenous mental health services, potentially limiting effectiveness in mitigating academic impacts.

Research gap and study contribution

Despite growing recognition of Indigenous students' unique mental health context, a fundamental empirical question remains unexamined: Do mental health challenges produce differential academic impacts based on Indigenous status? While meta-analytical synthesis confirms relationships between mental health and academic achievement in general populations [44], research has yet to systematically test whether the academic consequences of stress, anxiety, and depression are amplified among Indigenous students. Emerging evidence suggests that stress and anxiety influence academic performance differentially based on demographic characteristics, institutional support structures, and pre-existing vulnerability factors [45], yet specific relationships among Indigenous students remain empirically unexamined.

This gap is consequential. The convergence of evidence points to potential compounded disadvantage where Indigenous students navigate both higher baseline rates of mental health challenges and potentially greater academic performance impacts from these conditions. Understanding whether identical levels of psychological distress produce differential academic outcomes based on Indigenous status represents a crucial empirical question with direct implications for intervention design. This study addresses this gap through the first large-scale quantitative examination of differential mental health impacts on academic performance by Indigenous status in the Canadian environment.

Prior international research on mental health among minority students

While our study focuses on Indigenous students in Canadian universities, situating these findings within the broader international literature on minority student mental health reveals both universal patterns and context-specific mechanisms. Research across diverse national contexts demonstrated that minoritized students consistently faced elevated mental health challenges with amplified academic consequences, though the specific drivers varied by historical, cultural, and institutional contexts.

In the United States, extensive research on racial and ethnic minority students revealed patterns parallel to those observed among Canadian Indigenous students. Smith *et al.* [46] introduced the concept of "racial battle fatigue" to describe the cumulative psychological and physiological strain that African American students experience navigating predominantly White institutions. This phenomenon was conceptually similar to the colonial trauma and systemic barriers faced by Indigenous students in Canada. The chronic stress, distinct from general academic pressure, compounded mental health burdens and intensified academic challenges. A 2011 research demonstrated that campus racial climate significantly affected minority students' psychological well-being and academic outcomes, with discrimination experiences creating unique stressors beyond those faced by majority students [47].

Research from Australia on Aboriginal and Torres Strait Islander university students revealed strikingly similar patterns despite different colonial histories [19], documented substantial mental health challenges among Aboriginal university students, finding that many students had diagnosed mental health conditions that significantly affected their ability to study. Their research revealed that Aboriginal students experienced these stressors while simultaneously navigating predominantly Western institutional structures, managing cultural code-switching, and carrying responsibility to represent their communities. The Dudgeon *et al.* [48] comprehensive review of Aboriginal and Torres Strait Islander mental health emphasized that effective interventions required adherence to Indigenous-specific principles including self-determination, community governance, and cultural reconnection, principles that most mainstream university services did not incorporate. As in Canada, Australian research emphasized that connection to culture, community, and Indigenous knowledge systems served as a protective factor, reinforcing the importance of culturally grounded support.

Beyond Indigenous populations, in the previous decade, research on other minoritized groups revealed comparable amplification patterns. International students demonstrated elevated mental health challenges that significantly impacted academic performance, with mechanisms including cultural adjustment stress, language barriers, discrimination experiences, and social isolation [17,20]. In 2011, meta-analytic evidence confirmed that acculturative stress among international students significantly predicted both psychological distress and diminished academic outcomes [49,50]. Similarly, first-generation college students who often navigated cultural and class-based barriers showed elevated rates of depression and anxiety that more strongly predicted academic difficulties compared to continuing-generation students [51].

However, important contextual differences distinguished Indigenous students' experiences from other minority groups. Unlike international students who may return to home countries, Indigenous students in settler-colonial contexts (Canada, USA, Australia, New Zealand) confronted unique intersections of historical trauma, ongoing systemic oppression, and cultural erasure within educational institutions built on their dispossessed lands. The intergenerational transmission of colonial trauma created vulnerabilities qualitatively different from those faced by other minority groups [52], suggesting that while amplified mental health impacts on academic performance may have been universal across minoritized students, the specific mechanisms and appropriate interventions needed to be tailored to each group's distinct historical and contemporary realities.

The international literature thus provided three critical insights for our Canadian study. First, differential vulnerability where mental health challenges produced larger academic impacts for minoritized students emerged as a robust cross-national phenomenon affecting diverse groups, lending theoretical plausibility to our Canadian findings. Second, the consistent importance of culturally grounded support across contexts reinforced that effective interventions needed to be differentiated rather than universal. The Australian experience with Aboriginal and Torres Strait Islander mental health frameworks [48] and the US research on campus racial climate interventions [47] demonstrated that institutional adaptation could moderate differential vulnerability. Third, while mechanisms showed remarkable consistency (discrimination stress, cultural navigation, identity negotiation), context-specific factors, particularly the intergenerational effects of settler colonialism for Indigenous peoples, required context-specific institutional responses.

Our study extends this international literature by providing the first large-scale quantitative evidence of differential mental health impacts for Indigenous students in the Canadian context, explicitly testing whether amplification exists and quantifying its magnitude through formal interaction analyses. While the international literature strongly suggested such amplification should exist, prior research had not empirically examined these differential effects with sufficient statistical rigor in the Canadian Indigenous context. Our findings of 40–80% larger academic performance decrements align with international patterns while revealing the specific magnitude of differential vulnerability in Canadian universities, essential information for designing appropriately calibrated institutional responses.

Theoretical framework

Theoretical foundation: To establish why mental health challenges might differentially impact Indigenous students'

academic performance, we integrate theories explaining minority stress, vulnerability amplification, and cumulative disadvantage. Minority stress theory posits that stigmatized groups experience unique stressors beyond general life stress—including discrimination, rejection anticipation, and identity threat—that compound rather than simply adds to existing stress [9]. The Diathesis-Stress Model explains how pre-existing vulnerabilities interact with environmental stressors to produce differential outcomes [13–15]. Cumulative disadvantage models establish how early disadvantages cascade into amplified challenges over time [10].

For Indigenous students, these theoretical frameworks suggest that universal mechanisms of mental health impact operate within fundamentally altered contexts. As documented in Section “Indigenous students: elevated challenges and cultural strengths”, mental health substantially impairs academic performance across all students through established cognitive and motivational pathways. However, when Indigenous students experience stress, anxiety, or depression, these conditions arise within environments characterized by historical trauma's intergenerational effects [36–38], ongoing systemic discrimination [11], cultural code-switching demands [39], and assimilation pressures [40,41]. These contextual factors theoretically predict that identical mental health symptoms may produce amplified academic consequences.

Proposed mechanisms of amplification: We propose three mechanisms through which Indigenous students' unique contexts may amplify mental health's academic impacts. While our analysis tests whether differential effects exist, directly testing these mechanisms remains a direction for future research.

First, cognitive resource depletion through cultural navigation suggests that Indigenous students managing academic tasks while simultaneously navigating cultural code-switching and identity negotiation possess fewer compensatory resources when mental health challenges arise. The Attentional Control Theory prediction that anxiety impairs performance [28] may be magnified when students manage both anxiety-related disruptions and intensive cultural navigation demands.

Second, historical trauma and stress system alterations posit that intergenerational transmission of colonial trauma [36,38] creates heightened vulnerability where academic stressors activate both immediate stress responses and deeper trauma-related reactions. This dual activation may intensify stress impacts beyond what stress levels alone would predict.

Third, systemic barriers and re-engagement challenges emphasize how contextual factors shape mental health's functional impact [53]. For Indigenous students relocating

from remote communities, transition stress compounds mental health challenges [54,55]. When mental health conditions reduce motivation, the effort required to persist in culturally incongruent environments may exceed that required in supportive contexts. Given that most institutions lack adequate Indigenous mental health services despite students' strong preferences for culturally grounded support [12], service gaps may amplify academic consequences of untreated conditions.

Data and sample description

Our analysis employs data from the American College Health Association-National College Health Assessment III (ACHA-NCHA III), a comprehensive research initiative documenting students' health-related behaviors and experiences. The ACHA conducted this cross-sectional survey across 16 Canadian universities in Spring 2022, yielding 11,322 initial responses. As survey responses are self-reported, the database contains missing values across various items. After restricting to observations with complete data for key variables (GPA, mental health indicators, and control variables), our analytical sample comprises 8,652 students.¹ Among these, 319 (3.68%) identify as Indigenous (First Nations, Inuit, or Métis), consistent with national university enrollment patterns.

Table 1 presents descriptive statistics for academic performance measured by GPA (0-4.33 scale). Indigenous students average 3.22 compared to 3.39 for non-Indigenous peers, a difference we examine systematically in our regression

¹ The 23% attrition rate (from 11,322 to 8,652 observations) results primarily from missing responses in one or more key variables (GPA, mental health indicators, or control variables). We conducted supplementary analyses to assess whether missingness patterns differ by Indigenous status. Chi-square tests reveal no statistically significant differences in missing data rates between Indigenous and non-Indigenous students ($p=0.34$), suggesting that missing data does not systematically bias our comparative analyses. However, we acknowledge that if students with more severe mental health challenges or lower academic performance were less likely to complete the survey, our estimates may represent lower bounds of the true associations. This limitation is inherent to voluntary cross-sectional surveys and should be considered when interpreting our findings.

analyses. The distributions display negative skewness, indicating concentration of observations at higher GPA levels, with Indigenous students showing somewhat less negative skewness (-1.60 vs. - 2.04) and lower kurtosis (6.21 vs. 8.45), suggesting slightly more dispersed performance.

Mental health indicators derive from three questions asking whether stress, anxiety, or depression affected academic performance within the past 12 months. Responses range from 1 (did not experience issue) to 4 (issue delayed degree progress), with higher values indicating greater academic interference from mental health challenges. **Table 2** displays distributions across these indicators by Indigenous status.

Table 2 reveals consistently higher proportions of Indigenous students reporting elevated mental health challenges. Specifically, 12.5% of Indigenous students report high stress levels compared to 9.1% of non-Indigenous students; for anxiety, 9.1% versus 7.8%; and for depression, 9.1% versus 7.5%. These differences extend across all severity levels, with Indigenous students showing lower proportions reporting no mental health interference and higher proportions reporting moderate to high interference.

Table 3 formally tests mean differences in academic performance and mental health indicators between Indigenous and non-Indigenous students.

Mean difference tests confirm statistically significant gaps across all indicators. Indigenous students report significantly higher average levels of stress (3.25 vs 3.19), anxiety (2.33 vs 2.22), and depression (1.95 vs 1.84), alongside significantly lower GPAs (3.22 vs 3.40). While these descriptive patterns establish prevalence differences, our primary research question examines whether mental health challenges produce differential academic impacts by Indigenous status, a question requiring multivariate analysis with interaction terms.

Statistical analysis

Our empirical strategy tests whether the relationship between mental health and academic performance differs by Indigenous status through a series of regression

Table 1. Descriptive statistics of academic performance (GPA) for Indigenous and non- Indigenous students in Canadian Universities.					
	N	Mean	Standard-deviation	Skewness	Kurtosis
Non-Indigenous	8,333	3.399	0.832	-2.04	8.452
Indigenous	319	3.223	0.895	-1.597	6.213
This table presents descriptive statistics of academic performance measured by students' GPA (Grade Point Average) for Indigenous (N=319) and non-Indigenous (N=8,333) students. The Indigenous/non-Indigenous indicator derives from the question "What is your racial or ethnical identification?" where the Indigenous option is defined as "First Nations, Inuit, Metis" (variable N3Q75A1 in ACHA-NCHA III Database). Canada ACHA-NCHA III is an online cross-sectional national survey of college/university students conducted in Spring 2022. Source: ACHA-NCHA III Database, Spring 2022.					

Table 2. Distributions of Mental Health Indicators (Stress, Anxiety, and Depression) across Indigenous and non-Indigenous Students in Canadian Universities.				
Panel A: Distribution of stress indicators across Indigenous and non-Indigenous students				
	Non-Indigenous Students		Indigenous Students	
Stress levels	N	%	N	%
None	1,589	19.1%	49	15.4%
Low	2,397	28.8%	93	29.2%
Moderate	3,585	43.0%	137	42.9%
High	762	9.1%	40	12.5%
Total	8,333	100	319	100
Panel B: Distribution of anxiety indicators across Indigenous and non-Indigenous students				
	Non-Indigenous Students		Indigenous Students	
Anxiety levels	N	%	N	%
None	2,445	29.3%	84	26.3%
Low	2,219	26.6%	76	23.8%
Moderate	3,021	36.3%	130	40.8%
High	648	7.8%	29	9.1%
Total	8,333	100	319	100
Panel C: Distribution of depression Indicators across Indigenous and non-Indigenous students				
	Non-Indigenous Students		Indigenous Students	
Depression levels	N	%	N	%
None	4,557	54.7%	152	47.6%
Low	1,210	14.5%	58	18.2%
Moderate	1,941	23.3%	80	25.1%
High	625	7.5%	29	9.1%
Total	8,333	100	319	100
This table presents distributions of mental health indicators measured by students' Stress (Panel A), Anxiety (Panel B), and Depression (Panel C) for Indigenous (N=319) and non-Indigenous (N=8,333) students. The three indicators (variables N3Q66Q, N3Q66D, N3Q66G) take values from 1 to 4, with higher values indicating greater mental health interference with academic performance. Labels translate as: None=1, Low=2, Moderate=3, High=4. For variable definitions, see Table I note. Source: ACHA-NCHA III Database, Spring 2022.				

Table 3. Univariate analysis - Test of mean difference of academic performance (GPA) and mental health indicators (stress, anxiety, and depression).			
Variables	Non-Indigenous Students	Indigenous Students	t value
GPA	3.399	3.223	(4.250) ***
Stress	3.190	3.253	(-2.750) ***
Anxiety	2.225	2.330	(-2.607) ***
Depression	1.836	1.953	(-2.600) ***
N	8,333	319	-
This table presents results of mean difference tests for academic performance (GPA) and mental health indicators (Stress, Anxiety, Depression) between Indigenous (N=319) and non-Indigenous (N=8,333) students. For variable definitions, see Tables I-II notes. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels respectively. Source: ACHA-NCHA III Database, Spring 2022.			

specifications. We employ Ordinary Least Squares (OLS) regression with GPA (measured on a 0–4.33 scale) as the dependent variable and mental health indicators (stress, anxiety, depression) as key independent variables. The inclusion of an interaction term between Indigenous status and each mental health indicator allows us to test for differential effects our primary research question.

The baseline specification takes the form:

$$GPA_i = \beta_0 + \beta_1(MentalHealth_i) + \beta_2(Indigenous_i) + \beta_3(Indigenous_i \times MentalHealth_i) + \beta_4(Controls_i) + \theta_j + \varepsilon_i$$

where i indexes individual students, j indexes universities, Mental Health represents each of the three mental health indicators examined separately (stress, anxiety, depression). Indigenous is a binary indicator for Indigenous status, and θ_j represents university fixed effects that control for institution-level heterogeneity. The coefficient of primary interest is β_3 , which captures the differential association between mental health and academic performance for Indigenous students. A negative and significant β_3 indicates that mental health challenges associate with larger performance decrements for Indigenous students compared to non-Indigenous peers.

We estimate this model separately for each mental health indicator, presenting three specifications for each: (1) a baseline model with core demographic and socioeconomic controls, (2) an expanded model adding behavioral variables (study time, attendance, physical activity), and (3) a fully saturated model incorporating health and wellbeing measures. This sequential approach demonstrates robustness of findings to alternative control sets and reveals whether differential vulnerability persists after accounting for potential mediating paths.

To further illustrate differential effects and facilitate interpretation, we subsequently estimate split-sample regressions by Indigenous status. While the interaction term approach tests differential vulnerability formally, split-sample estimation provides direct coefficient estimates for each group, making the magnitude of differential effects transparent. Specifically, we estimate:

$$GPA_i = \beta_0 + \beta_1(MentalHealth_i) + \beta_4(Controls_i) + \theta_j + \varepsilon_i$$

separately for Indigenous and non-Indigenous subsamples. The ratio of coefficients ($\beta_1^{\wedge}Indigenous / \beta_1^{\wedge}non-indigenous$) provides the effect multipliers we report. Though this sacrifices statistical efficiency relative to the pooled interaction model, it offers intuitive interpretability and facilitates calculation of differential effect magnitudes.

We implement several robustness tests to ensure robust inference. First, we employ heteroskedasticity-robust standard errors throughout to account for potential non-

constant variance across observations. Second, university fixed effects control for institution-specific factors such as grading standards, support service quality, and student body composition that might otherwise confound our estimates. Third, our comprehensive control set addresses observable confounders including demographics (sex, citizenship status), socioeconomic status (parental education, food security), academic behaviors (attendance, study time), health factors (BMI, physical activity, special needs), and overall wellbeing. While unobserved factors undoubtedly affect GPA, our specification controls for the most prominent predictors identified in prior literature, providing confidence that estimated differential effects reflect genuine vulnerability amplification rather than omitted variable bias.

Finally, we conduct robustness checks using alternative mental health measures to verify that findings do not depend on a specific measure. Our primary analyses use academic-interference measures (whether stress/anxiety/depression affected academic performance), while robustness specifications employ alternative indicators including 30-day stress severity and clinical diagnosis indicators. Consistency across measures strengthens confidence in findings by demonstrating that differential vulnerability manifests regardless of measurement.

Results

Primary findings

Table 4 presents result from estimating the interaction model across all three mental health indicators. Panels A, B, and C show specifications for stress, anxiety, and depression respectively, with each panel displaying three models incorporating progressively comprehensive control sets.²

The regression results yield several interesting results. Mental health indicators show strong negative associations with academic performance across all specifications. The estimated coefficients for stress, anxiety, and depression are consistently negative, confirming that psychological distress substantially impairs academic outcomes.

The Indigenous status indicator also demonstrates negative and statistically significant coefficients ($p < 0.01$) across all models, indicating lower average GPAs among

² Table 4 displays three specifications per panel: (1) includes baseline demographic and socioeconomic controls (sex, citizenship status, parental education, food security, school seniority, enrollment status); (2) adds behavioral variables (class attendance, home study time, overall mental well-being); and (3) incorporates additional health factors (BMI, physical activity, special needs status). All models include university fixed effects. Robust t-statistics are in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels respectively.

Table 4. Regression of academic performance (GPA) on mental health indicators: stress (Panel A), anxiety (Panel B), and depression.									
	Panel A: Mental Health Indicator = Stress			Panel B: Mental Health Indicator = Anxiety			Panel C: Mental Health Indicator = Depression		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stress	-0.0976*** (-9.946)	-0.1124*** (-11.500)	-0.1151*** (-10.672)						
Anxiety				-0.1007*** (-6.587)	-0.0803*** (-7.238)	-0.0786*** (-7.280)			
Depression							-0.053*** (-9.941)	-0.0591*** (-9.447)	-0.0532*** (-9.910)
Indigenous	-0.0825*** (-3.614)	-0.0966*** (-3.389)	-0.0924*** (-3.226)	-0.094*** (-5.678)	-0.1121*** (-6.071)	-0.1023*** (-5.310)	-0.1299*** (-7.758)	-0.1295*** (-7.7369)	-0.1298*** (-8.196)
Indigenous * Stress	-0.0717*** (-4.958)	-0.0800*** (-4.871)	-0.0728*** (-5.573)	-0.1244*** (-6.826)	-0.1237*** (-5.825)	-0.1288*** (-6.957)	-0.1358*** (-5.033)	-0.1446*** (-5.012)	-0.1401*** (-5.708)
Sex at Birth	-0.1236*** (-6.316)	-0.1311*** (-6.202)	-0.1165*** (-6.544)	-0.1618*** (-5.921)	-0.1662*** (-5.869)	-0.1452*** (-5.987)	-0.148*** (-7.856)	-0.1412*** (-8.136)	-0.1251*** (-7.093)
Citizenship Status	-0.0611*** (-2.692)	-0.0576*** (-2.843)	-0.0552*** (-3.048)	-0.0922*** (-5.513)	-0.0864*** (-5.623)	-0.0843*** (-4.723)	-0.0747*** (-4.948)	-0.0641*** (-5.149)	-0.0693*** (-5.024)
Parents' Education	0.0235*** (4.007)	0.0197*** (4.146)	0.0234*** (3.795)	0.0452*** (4.014)	0.0458*** (3.550)	0.0484*** (4.108)	0.0482*** (4.832)	0.0416*** (5.546)	0.0408*** (4.684)
Food Safety	-0.0338*** (-7.512)	-0.0355*** (-7.468)	-0.0352*** (-8.432)	-0.0619*** (-5.528)	-0.0562*** (-6.535)	-0.059*** (-6.501)	-0.0428*** (-3.539)	-0.0505*** (-3.722)	-0.0414*** (-3.432)
School Seniority	0.0258*** (5.355)	0.0313*** (5.754)	0.0311*** (6.582)	0.0358*** (10.278)	0.0385*** (10.198)	0.0426*** (8.302)	0.0173*** (5.567)	0.0171*** (6.486)	0.0195*** (6.179)
Enrollment Status	-0.1306*** (-3.988)	-0.1156*** (-4.062)	-0.1187*** (-3.825)	-0.1935*** (-4.936)	-0.1873*** (-4.679)	-0.1788*** (-5.193)	-0.1075*** (-4.050)	-0.1096*** (-3.488)	-0.1125*** (-3.870)
School Attendance		0.0208*** (4.032)	0.0244*** (4.015)		0.0295*** (7.141)	0.0297*** (5.998)		0.0615*** (4.798)	0.06*** (4.688)
Study at Home		0.0298*** (12.167)	0.0296*** (10.827)		0.031*** (7.750)	0.0341*** (6.388)		0.0478*** (5.337)	0.0418*** (6.258)
Mental Well-being		0.1017*** (7.915)	0.1246*** (8.968)		0.1637*** (5.533)	0.1571*** (5.972)		0.2346*** (6.652)	0.2085*** (6.694)
BMI			-0.0072*** (-5.651)			-0.0113*** (-7.034)			-0.0199*** (-5.746)
Physical Activity			0.0193*** (2.744)			0.0119*** (3.437)			0.0246*** (3.084)
Special Needs			-0.1384*** (-5.623)			-0.0911*** (-7.268)			-0.0838*** (-4.294)
Constant	5.3109*** (14.115)	5.7779*** (16.692)	5.1963*** (13.671)	6.6888*** (12.454)	6.6296*** (11.203)	6.9976*** (11.557)	3.8248*** (16.532)	5.3088*** (9.611)	4.8979*** (11.860)
University FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,652	8,652	8,652	8,652	8,652	8,652	8,652	8,652	8,652
R-squared	0.125	0.131	0.138	0.117	0.119	0.120	0.106	0.109	0.111
This table presents regression results of GPA on mental health indicators (Stress in Panel A, Anxiety in Panel B, Depression in Panel C) using the full sample (N=8,652). We include Indigenous status indicator, interaction terms (Indigenous × Mental Health Indicator), and controls for demographics, socioeconomic status, academic behaviors, and health factors. See Footnote 2 for specification details. All models include university fixed effects. Robust t-statistics appear in parentheses. Control variable codes: Sex (N3Q67A), BMI, Physical Activity (N3Q8), Class Attendance (N3Q3A), Study Time (N3Q3B), Food Security (USDAFI), Special Needs (N3Q82A), Mental Well-being (MHC_DX), School Seniority (N3Q72), Enrollment Status (N3Q73), Parents' Education (N3Q84), Citizenship Status (N3Q74), University ID (PERMID). For detailed variable descriptions, visit www.acha.org . Source: ACHA-NCHA III Database, Spring 2022.									

Indigenous students even after controlling for mental health and other factors. This persistent effect suggests that Indigenous students face additional challenges beyond those captured by our control variables, potentially reflecting unmeasured factors such as experiences of discrimination, cultural navigation demands, or institutional barriers.

Most critically, the interaction terms between Indigenous status and each mental health indicator are negative and statistically significant at the 1% level across all specifications. This indicates that the relationship between mental health and academic performance is significantly steeper for Indigenous students that is, mental health challenges associate with larger GPA decrements for Indigenous students compared to their non-Indigenous peers. This pattern provides strong empirical support for hypotheses H1, H2, and H3, indicating differential vulnerability beyond simple prevalence differences.

Control variables perform as expected based on prior literature. Academic behaviors, including hours of physical activity, class attendance, and home study time, show positive associations with GPA, while overall mental well-being demonstrates strong positive effects. Socioeconomic factors including parental education and food security also predict academic performance in expected directions. Students facing vulnerabilities such as uncertain citizenship status, food insecurity, higher BMI, part-time enrollment, or special needs accommodations show lower average GPAs. Female students demonstrate higher academic performance than male students, consistent with well- documented gender patterns in higher education.

To further analyze the magnitude of differential effects, we estimate split-sample regressions separately for Indigenous and non-Indigenous students.

Estimated coefficients in **Table 5** reveal striking differentials. Indigenous students experience 1.4 times (-0.1417/-0.0978) greater academic performance decrements from stress, 1.6 times (-0.1301/-0.0782) greater decrements from anxiety, and 1.8 times (- 0.1805/-0.1006) greater decrements from depression relative to non-Indigenous peers. These effect multipliers translate to 40%, 60%, and 80% larger GPA penalties respectively, illustrating the empirically grounded vulnerability of Indigenous students in Canadian higher education. These findings corroborate hypotheses H1, H2, and H3, establishing that differential vulnerability intensifies across mental health dimensions from stress to anxiety to depression.

Robustness analysis

To verify that findings do not depend on specific mental health measures, we re-estimate the models using alternative indicators. Our primary analyses employed academic-interference measures asking whether stress, anxiety, or depression affected academic performance within the past 12 months (responses: 1 = did not experience, 2 = experienced but unaffected, 3 = negatively impacted performance, 4 = delayed degree progress). Alternative measures include: (1) 30-day stress severity rated on a 4-point scale, (2) binary indicator for lifetime anxiety diagnosis by healthcare provider, and (3) binary indicator for lifetime depression diagnosis by healthcare provider. We estimate the split-sample specification (Equation 2) using these alternative indicators.

Table 5. Regression of academic performance (GPA) on mental health indicators [(1) stress, (2) anxiety, and (3) depression] on Indigenous sample (Panel A) and non-Indigenous sample (Panel B).						
	Panel A: Indigenous sample			Panel B: Non-Indigenous sample		
VARIABLES	(1)	(2)	(3)	(1)	(2)	(3)
Stress	-0.1417*** (-4.081)			-0.0978*** (-7.429)		
Anxiety		-0.1301*** (-3.244)			-0.0782*** (-5.617)	
Depression			-0.1805* (-1.811)			-0.1006*** (-5.807)
HE Institutions' Controls	Yes	Yes	Yes	Yes	Yes	Yes
Students' Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	319	319	319	8,333	8,333	8,333
R-squared	0.131	0.122	0.119	0.106	0.097	0.102
This table presents split-sample regression results for Indigenous (N=319, Panel A) and non-Indigenous (N=8,333, Panel B) students. Each column shows a separate mental health indicator: (1) Stress, (2) Anxiety, (3) Depression. Models include the same control variables as Table 4, Column (3). For variable definitions, see Table 4 note. Robust t-statistics in parentheses. Source: ACHA-NCHA III Database, Spring 2022.						

Findings remain consistent with **Table 5**. Mental health indicators show negative associations with GPA across both samples, with Indigenous students demonstrating larger coefficient magnitudes. All coefficients maintain expected signs and achieve statistical significance at conventional levels, though magnitudes differ due to measurement differences. The alternative stress measure yields coefficients of -0.1827 (Indigenous) versus -0.0682 (non-Indigenous), representing a 2.7x multiplier. For anxiety diagnosis, coefficients are -0.0855 versus -0.0497 (1.7x multiplier). Depression diagnosis shows -0.0612 versus -0.0208 (2.9x multiplier). While specific multipliers vary, the consistent pattern provides robust evidence of differential vulnerability.

Discussion

Interpretation of main findings

The R-squared values across our models range from 0.106 to 0.138, indicating that our specifications explain 11-14% of GPA variance. While modest in absolute terms, these values align with established benchmarks for education research and social science more broadly. Ozili [56], argues that R-squared values as low as 0.10 are acceptable in social science research when predictors are statistically significant, as the goal is typically to assess whether specific variables have significant effects rather than to achieve comprehensive prediction of human behavior [57] categorizes R^2 of 0.13 as representing a "medium" effect size, placing our findings squarely within meaningful effect ranges. Social science research commonly accepts R-squared values of 0.10-0.30 because human behavior cannot be accurately predicted in its entirety, in stark contrast to physical sciences where R^2 above 0.60 is expected. Rights and Sterba [58] demonstrated through his classic "variance explanation paradox" that even tiny R-squared values can be meaningful when effects accumulate over time or across repeated instances, precisely applicable to mental health impacts on academic performance throughout a semester or academic year. Given that GPA reflects complex interactions among cognitive abilities, motivation, teaching quality, institutional factors, life circumstances, and countless unmeasured influences, explaining 11–14% of variance through mental health indicators and measured controls represents substantive contribution. The robustness of our key interaction effects across specifications and the statistical significance of our core predictors provide confidence in our conclusions despite modest overall explanatory power.

This study provides the first large-scale empirical evidence that mental health challenges differentially impact Indigenous and non-Indigenous students in Canadian higher education. Analyzing 8,652 students across 16 universities, we show that mental health displays substantially stronger negative associations with academic performance for Indigenous students: 1.4 times for stress, 1.6 times for anxiety, and 1.8

times for depression. These multipliers indicate that identical mental health conditions associate with 40-80% larger GPA decrements for Indigenous students. This differential vulnerability persists across multiple specifications and alternative measures, revealing a pattern distinct from prevalence differences alone.

These findings reveal why educational inequities persist despite decades of intervention. Indigenous peoples comprise 5% of Canada's population but only 3% of university graduates and 1% of doctoral students. Beyond elevated mental health prevalence, Indigenous students face amplified academic consequences from psychological distress, a multiplicative rather than additive disadvantage where mental health compounds existing systemic barriers. The consistency across three mental health dimensions strengthens confidence in this robust phenomenon. Theoretically, these findings support minority stress theory [9] and cumulative disadvantage models [10], showing how intersecting stressors produce amplified rather than cumulative impacts.

Our findings of 40-80% amplified academic impacts align with patterns documented internationally. Similar amplification effects have been observed among Australian Aboriginal students [19,48,59], African American students experiencing racial battle fatigue [46,60], and international students navigating acculturative stress [49,50]. However, our study provides the first quantitative estimates of effect multipliers for Indigenous students in the Canadian context. The consistency of differential vulnerability across diverse minoritized groups, despite different colonial histories and institutional contexts, suggests this represents a robust phenomenon requiring context-specific yet systematically differentiated institutional responses.

Study limitations

Several limitations warrant consideration. First, the cross-sectional design precludes causal inference. Second, self-reported measures may introduce recall bias. Third, despite comprehensive controls, unmeasured confounders (e.g., experiences of discrimination, quality of Indigenous student services) may influence results. Fourth, our data from Spring 2022 across 16 universities may not generalize to all Canadian institutions or other time periods. Finally, we do not directly test the proposed mechanisms (cognitive resource depletion, trauma effects, systemic barriers), which remain theoretical explanations requiring future investigation.

Future research directions

Future research should employ longitudinal designs to establish causal pathways and assess whether intervention effects differ by Indigenous status. Qualitative studies

could illuminate the specific mechanisms through which mental health impacts are amplified. Intervention studies testing culturally grounded support systems would provide evidence for effective approaches. Additionally, comparative research across Indigenous contexts (e.g., US, Australia, New Zealand) could identify universal versus context-specific patterns of differential vulnerability.

Conclusions

This study addressed a fundamental question: Do mental health challenges differentially impact academic performance for Indigenous versus non-Indigenous students in Canadian universities? We hypothesized that stress (H1), anxiety (H2), and depression (H3) would show amplified negative associations with GPA for Indigenous students. Our empirical analysis of 8,652 students across 16 universities strongly supported all three hypotheses, revealing effect multipliers of 1.4 for stress, 1.6 for anxiety, and 1.8 for depression, representing 40-80% larger academic performance decrements for Indigenous students experiencing identical mental health symptoms.

The magnitude of these effect multipliers indicating that Indigenous students experience 40-80% larger GPA impacts from equivalent mental health symptoms has direct implications for university support systems. These findings demonstrate that universal mental health interventions designed for general student populations will be insufficient to achieve educational equity. The quantified amplification of academic consequences establishes that Indigenous students require differentiated support calibrated to these systematically larger impacts. Achieving equity therefore demands not equal treatment, but support systems specifically designed to address the amplified academic vulnerability our results document.

Based on these findings, universities should evaluate whether current systems account for differential vulnerability. Achieving equity requires differentiated rather than universal strategies. Universities should evaluate whether current systems account for differential vulnerability, recognizing that interventions effective for general populations may be insufficient for Indigenous students. Institutional responses should prioritize culturally grounded structures, given that 78% of Indigenous students seeking support prefer consulting Elders [12]. This suggests expanding Indigenous-led services, strengthening connections between health centers and Indigenous student centers, and embedding cultural supports within academic programs.

Institutions should also examine whether assessment structures inadvertently amplify mental health impacts. Critically, universities must build systems recognizing Indigenous students' cultural strengths rather than

adopting deficit frameworks, enabling protective factors to translate into academic success.

The 40-80% amplification indicates that institutional structures inadequately support Indigenous students, not that Indigenous students inadequately cope. Achieving equity requires universities to adapt support systems, assessment methods, and institutional cultures to account for differential vulnerability while building on cultural strengths. Equal treatment cannot produce equitable outcomes when mental health exacts fundamentally different academic tolls. Universities must develop differentiated supports calibrated to amplified consequences, grounded in cultural responsiveness, and designed to ensure Indigenous students' resilience translates into academic success.

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Disclaimer

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