



# **24-hour movement guideline adherence and mental health: A cross-sectional study of emerging adults with chronic health conditions and disabilities**

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## **ABSTRACT**

**Background.** Recent work has shown that individuals with chronic health conditions and disabilities (CCD) meet the 24-hr movement guidelines at lower rates than population norms; however, the evidence base remains limited across different stages of the lifespan and very few studies have examined associations with mental health outcomes.

**Objective.** This study examined 24-hour movement guideline adherence among emerging adults with CCD compared to those without and associations between guideline adherence and indicators of mental health.

**Methods.** This cross-sectional study used data from the 2020 cycle of the Canadian Campus Wellbeing Survey. A total of 20,630 emerging adults enrolled at 20 post-secondary institutions (Mean age=21.7±2.92 years; 66.8% female), including 6,077 who identified with a CCD, self-reported their movement behaviors (physical activity, sedentary behaviors, sleep) and completed measures of psychological distress and mental wellbeing. Logistic regressions models were computed to examine differences in guideline adherence. Propensity score weighted linear regression models were computed to examine associations between guideline adherence and indicators of mental health.

**Results.** Emerging adults with CCD had significantly lower odds of meeting the 24-hr movement guidelines compared to their peers, and disparities in guideline adherence were most pronounced among those with multimorbidity. Guideline adherence was associated with significantly more favorable scores for psychological distress and mental wellbeing among those with and without CCD.

**Conclusions.** Findings suggest emerging adults with CCD engage in less healthy movement behavior patterns than their peers, yet they appear to experience similar mental health benefits when they do meet the 24-hr movement guidelines.

## **INTRODUCTION**

Emerging adulthood is a particularly stressful life stage from 18 to 29 years of age,<sup>1</sup> perhaps even more so for those who attend post-secondary education. Despite gaining autonomy, this major transitional period represents one in which emerging adults commonly move away from home, thus losing the structure or guidance often provided by caregivers, take on new responsibilities, and experience increased financial stress. Therefore, it is no surprise that this period is marked by a sharp rise in psychological distress and declines in overall wellbeing.<sup>2</sup> Research suggests that 21-37% of post-secondary students report having been diagnosed with one or more mental health disorders in the previous year.<sup>3</sup> In fact, the onset of most mental health disorders occur by age 24,<sup>4</sup> meaning that emerging adults are already in a vulnerable position apart from the challenges of attending higher education. The mental health challenges experienced by some emerging adults may even manifest into suicidal ideation and planning. Specifically, meta-analytic evidence suggests that one in six post-secondary students report having experienced some form of suicidal ideation, with almost 45% reporting having experienced suicidal ideation in the past year – a pattern significantly higher than observed for the general population.<sup>5</sup> Collectively, these results underscore the need to identify risk factors that may prevent or reduce the mental health burden that attending post-secondary education might place on emerging adults.

Despite the high prevalence of mental health disorders among post-secondary students,<sup>3</sup> mental health challenges may be exacerbated for those with chronic health conditions and disabilities (CCD). Recent studies have shown that emerging adults with CCD

experience mental health disorders and suicidal ideation at significantly higher rates than the general population.<sup>6,7</sup> Despite these challenges, risk factors that stand to improve the mental health and wellbeing of post-secondary students with CCD have received limited attention. As a result, substantial knowledge gaps need to be addressed so that evidence-informed interventions can help this population realize their full potential.

The field of behavioral medicine has received increased attention over the past two decades for its potential to understand modifiable risk factors that may contribute to poor mental health.<sup>8</sup> Specifically, movement behaviors – which consist of physical activity, sedentary behaviors, and sleep – are a cluster of health behaviors that have been shown to play a significant role in mental health, both independently, and, more recently, as a collective.<sup>9,10</sup> The emphasis on taking an integrative approach to understand the interactive impact of movement behaviors on health began in 2016 with the release of Canadian 24-hour Movement Guidelines for Children and Youth.<sup>11</sup> The first guidelines for adults were released more recently in 2020.<sup>12</sup> These guidelines represent threshold-based recommendations for how much physical activity, sedentary behavior (recreational screen time and sitting), and sleep adults should engage in over the course of a whole “healthy” day. Recent evidence has begun to establish the mental health benefits conferred by adherence to these guidelines for children and youth.<sup>13,14</sup> However, few studies have examined the mental health benefits among emerging adults,<sup>15,16</sup> let alone those with CCD.

The prevalence of CCD is expected to continue to rise, which has sparked a call for researchers to address existing knowledge gaps in our understanding of the relationship between movement behaviors and health outcomes among this population.<sup>17</sup> Since emerging adults with CCD are at greater risk of mental health disorders than their non-disabled peers,<sup>6,7</sup> exploring the associations between movement behaviors and indicators of mental health stands to provide insight into the magnitude of the benefits (or lack thereof) that they may experience. At this point it is unknown what the relative benefits are for this population compared to emerging adults without CCD. Such findings will help to better inform future public health policies and campaigns tailored for and targeting individuals with CCD.

Therefore, the aims of this study are to: 1) examine adherence to the 24-hour movement guidelines among emerging adults with CCD attending post-secondary education compared to those without CCD; 2) determine the influence of different diagnoses as well as multimorbidity on guideline adherence; and 3) investigate associations between guideline adherence and indicators of mental health and wellbeing.

## **METHOD**

### **Data Source and Study Design**

The present study was a pre-registered secondary analysis of cross-sectional data from the first deployment of the Canadian Campus Wellbeing Survey (CCWS). The CCWS was specifically developed as a surveillance system to help monitor the health and well-being of Canadian post-secondary students over time. The first cycle of the CCWS included 20 post-secondary institutions (PSI) consisting of 8 universities and 12 colleges or technical institutes. Each PSI selected their desired student sampling strategy based on the size and needs of their institution. Additional information about the CCWS study design, methods, survey measures and data access policy can be found at <https://www.ccws-becc.ca/>, with specific details of the survey tool's development also outlined elsewhere.<sup>18</sup> The CCWS was approved by the Behavioral Research Ethics Board at the University of British Columbia, in addition to each participating PSI. Complete preregistration details for this study can be found at <https://osf.io/2bk4f>.

## **Participants**

Across the 20 PSIs, 165,997 students were invited to participate in the online survey, with 24,760 student respondents (overall response rate = 14.9%). Students between the ages of 18 to 29 years (i.e., emerging adults) were included in the present study. Accounting for our inclusion criteria of age, a total of 20,630 participants remained, 6,077 of whom reported a CCD (29.5%). Participants were considered to have identified with a CCD status if they affirmatively responded to having any of the following disabilities or ongoing medical conditions that affect their everyday functioning: physical disability, blind/visually impaired, deaf/hard of hearing, mental health condition, neurological (learning disability, ASD, Traumatic Brain Injury, ADHD, etc.) disability, chronic health condition (Crohn's, HIV, etc.), or another condition not listed. Blind/visually impaired and deaf/hard of hearing were combined to represent sensory disabilities as per the four major disability types (developmental/neurological, physical, sensory, behavioral/emotional).<sup>19</sup> A multimorbidity classification was assigned for participants who reported more than one CCD.

The sample consisted of primarily full-time (82.5%), female (66.8%) students living off-campus (89.4%) with parents who graduated from college/university (76.5%) (Table 1). The majority of the sample identified as White, East-Southeast Asian, or South Asian. Subtle differences were observed across emerging adults with and without CCD. Specifically, those with CCD were more likely to be female and White, domestic students, have parents with higher levels of education, yet experience greater financial stress.

## **Measures**

### ***Measurement of Movement Behaviors***

Students who met the moderate-to-vigorous physical activity (MVPA), sleep, recreational screen time, and sedentary time guidelines were categorized as meeting all of the 24-hour movement guidelines.

**Physical activity.** MVPA was measured using the International Physical Activity Questionnaire (IPAQ).<sup>20,21</sup> Participants responded to four items that assessed the frequency (days) and duration (hours and/or minutes on an average day) of their moderate and vigorous physical activity performed in bouts of greater than 10-minutes over the past seven days. The scoring rules for IPAQ were applied to participants' data so that daily MVPA was capped to a maximum value of 180 min. Students were classified as having met the guideline for MVPA if they achieved at least 150 min/week of MVPA.

**Screen Time.** Recreational screen time was measured using modified items from the International Sedentary Assessment Tool.<sup>22</sup> Students responded to two items that asked how many hours and/or minutes on average they spent watching TV or using a computer, tablet, or smartphone during their free time over the past seven days. Students who reported engaging in three hours or less of recreational screen time were classified as having met screen time guidelines.

**Sedentary Time.** Sedentary time was measured using modified items from the International Sedentary Assessment Tool.<sup>22</sup> Students responded to two items that asked how many hours and/or minutes they usually spent sitting during the full day over the last seven days. Students who reported engaging in eight hours or less of sitting time per day were classified as having met sedentary time guidelines.

**Sleep.** Participants responded to four items that assessed what time they typically went to sleep and woke up during weekdays and on the weekend over the past seven days. Times were reported to the nearest half-hour. Average daily sleep was calculated using the following formula:  $(5 \times \text{hours of sleep on weekdays} + 2 \times \text{hours of sleep on weekends}) / 7$ . Students who, on average, reported getting seven to nine hours of sleep per night were classified as having met the guideline for sleep.

### **Mental Health**

**Psychological Distress.** Psychological distress was assessed with the 10-item Kessler Psychological Distress Scale (K10).<sup>23</sup> The K10 consists of 10 items that assess symptoms of depression and anxiety to yield a global measure of distress that a person had experienced over the past 30 days. Example items included, "How often did you feel nervous?" and "How often did you feel depressed?" Participants responded to each item using a 5-point scale ranging from 1 (*None of the time*) to 5 (*All the time*). Responses were summed to obtain a score between 10 to 50, with higher scores reflecting higher levels of psychological distress.

**Mental Wellbeing.** Mental wellbeing was assessed with the Warwick-Edinburgh Mental Well-being Scale (WEMWBS).<sup>24</sup> The WEMWBS consists of 14 items that assess emotional, social, and psychological wellbeing over the past two weeks. Each item is positively phrased (e.g., I've been feeling optimistic about the future). Participants responded to each item using a 5-point scale ranging from 1 (*None of the time*) to 5 (*All the time*). Responses were

summed to obtain a score between 14 to 70, with higher scores reflecting greater mental wellbeing.

## Data analysis

All analyses were performed in R (Version 4.1.1) and R Studio (Version 2022.02.3). First, we inspected the data for missingness using the *mice* package.<sup>25</sup> Data were considered missing at random and multiple imputation by chained equations using classification and regression trees was computed using the *mice* package to replace missing values. A total of 20 multiply imputed datasets were created as per recommendations to set  $m > 100$  times the highest fraction of missing information (16.3% for physical activity).<sup>26</sup> Descriptive statistics were computed for the full sample as well as for emerging adults with and without CCD. Demographic variables were compared between emerging adults with and without CCD using general linear models for continuous variables and Rao-Scott adjusted chi-square tests for categorical variables.

To investigate Objective 1, the *GLMMadaptive package*<sup>27</sup> was used for computing separate multilevel logistic regression models to determine if adherence to each of the 24-hr movement guidelines and concurrent adherence to all guidelines differed between emerging adults with and without CCD. For Objective 2, participants with CCD were separated based on their self-identified health status and the presence of multimorbidity, resulting in seven distinct groups, and separate multilevel logistic regression analyses were computed to evaluate differences in adherence to each of the 24-hr movement guidelines as well as concurrent adherence to all guidelines for each of these groups compared to emerging adults without a CCD. For Objectives 1 and 2, the *parameters package*<sup>28</sup> was used to pool the results from each of the multiply imputed datasets as per Rubin's Rules.<sup>29</sup> Each model was adjusted for the full covariate set.

For Objective 3 we computed average treatment effects on the treated (ATT) to better understand the influence of 24-hr movement guideline adherence on indicators of mental health. Simply stated, ATTs represented how much mental health improved (or worsened) among the typical participant who adhered to a certain guideline relative to if they had not adhered to that guideline (i.e., counterfactual argument).<sup>30</sup> To do so, covariate data were first preprocessed using the *MatchThem package*<sup>31</sup> to calculate covariate balanced propensity score weights. Assigning propensity score weights to each participant allowed us to balance the observed covariates across different values of the treatment variable (i.e., whether or not participants met respective movement guidelines). Lack of covariate balance is common in observational studies, and covariate balanced propensity score weighting can be used to unconfound comparisons through covariate balance optimization.<sup>32,33</sup> The *survey package*<sup>34</sup> was then used to compute separate multilevel linear regression analyses to explore associations between 24-hour movement guideline adherence and psychological distress as

well as mental wellbeing for emerging adults with and without CCD. The full covariate set, in addition to disability status (models examining emerging adults with CCD only) and adherence to the other 24-hr movement guidelines not being modeled (models examining independent guideline adherence only), were included in the propensity score weighted linear regression models to allow for doubly robust estimation.<sup>35</sup> ATTs were presented as beta coefficients with standard errors. Statistical significance was set at  $\alpha < 0.05$  for all analyses.

## **RESULTS**

### **24-Hour Movement Guideline Adherence**

#### ***Objective 1***

Emerging adults with CCD were 23% less likely to meet all four movement guidelines concurrently than peers without CCD (Table 2). Specifically, those with a CCD had significantly lower odds of meeting the sleep (16% lower), sitting (9% lower), and screen time (19% lower) guidelines, whereas physical activity guideline adherence was similar.

#### ***Objective 2***

Decomposing the CCD group into subgroups based on condition/disability type to further examine differences in 24-hr movement guidelines revealed additional important insights. The odds of meeting each of the movement guidelines (15-29% lower) as well as all four concurrent guidelines (34% lower) were significantly lower for those in the multimorbidity group compared to those without CCD (Table 2). Those with mental health and developmental disabilities had 19% and 26% lower odds of meeting the sleep guideline as well as 22% and 41% lower odds of meeting all concurrent guidelines, respectively. Finally, those with sensory disabilities had 25% lower odds of meeting the screen time guidelines, and the likelihood of meeting the physical activity guideline was 34% lower among those with physical disabilities. All other relationships did not reach our criterion for statistical significance.

#### **Objective 3: 24-hour Movement Guideline Adherence and Mental Health**

Meeting all four guidelines concurrently was associated with the greatest reductions in psychological distress for emerging adults with CCD (Beta =  $-1.92 \pm 0.36$  SE) and those without (Beta =  $-1.56 \pm 0.23$  SE). The most favorable scores for mental wellbeing were also observed with meeting all four guidelines concurrently for both emerging adults with CCD (Beta =  $2.68 \pm 0.46$  SE) and those without (Beta =  $1.97 \pm 0.28$  SE).

Among emerging adults with CCD, independent adherence to the physical activity (Beta =  $-0.69 \pm 0.25$  SE), sleep (Beta =  $-1.47 \pm 0.15$  SE), screen time (Beta =  $-0.50 \pm 0.23$  SE) and sitting time (Beta =  $-1.07 \pm 0.23$  SE) guidelines were associated with significantly lower psychological distress. Similar patterns of results were observed for mental wellbeing in emerging adults with

CCD in that adherence to the physical activity (Beta =  $1.69 \pm 0.32$  SE), sleep (Beta =  $1.43 \pm 0.18$  SE), screen time (Beta =  $0.70 \pm 0.35$  SE) and sitting time (Beta =  $1.76 \pm 0.29$  SE) guidelines were associated with significantly more favorable scores.

Among emerging adults without CCD, independent adherence to the physical activity (Beta =  $-0.98 \pm 0.17$  SE), sleep (Beta =  $-1.47 \pm 0.14$  SE), screen time (Beta =  $-0.92 \pm 0.15$  SE) and sitting time (Beta =  $-0.63 \pm 0.15$  SE) guidelines were associated with significantly lower psychological distress. Similar patterns of results were observed for mental wellbeing in that adherence to the physical activity (Beta =  $1.75 \pm 0.21$  SE), sleep (Beta =  $1.43 \pm 0.18$  SE), screen time (Beta =  $1.05 \pm 0.22$  SE) and sitting time (Beta =  $1.38 \pm 0.28$  SE) guidelines were associated with more favorable scores.

## **DISCUSSION**

The results from the present study showed that when grouped together, emerging adults with various CCD met the guidelines for sleep, screen time, and sitting time as well as all four guidelines concurrently at lower rates than their peers. In contrast, there were no differences in physical activity guideline adherence. This study also contributes to the literature demonstrating links between 24-hr movement guideline adherence and mental health outcomes. Specifically, individual and concurrent guideline adherence were all associated with significantly lower scores for psychological distress and significantly higher scores for mental wellbeing among emerging adults regardless of identified health status. Overall, these findings address key gaps in our current knowledge regarding associations between 24-hr movement guideline adherence and indicators of mental health among emerging adults with CCD, which is essential for developing future evidence-informed, condition-specific guidelines.

The present study was the first to examine adherence to 24-hr movement guidelines for emerging adults with CCD attending post-secondary education. Findings generally support previous research on movement behaviors among children and youth with CCD,<sup>36-39</sup> in that this population also reports significantly lower adherence to the 24-hr movement guidelines than population norms. The lone exception was that physical activity guideline adherence was similar among emerging adults with and without CCD, despite the barriers often experienced by individuals living with CCD. However, closer inspection of the results suggests there may be anywhere from a null effect to 14% lower odds of physical activity guideline adherence (i.e., 95% CI of 0.86 to 1.01). Nevertheless, it is evident that among the 20 post-secondary campuses sampled across Canada, emerging adults with CCD generally engage in less healthy behavioral patterns, potentially making this group more susceptible to poor health outcomes, and thus highlighting the need for targeted and tailored health promotion campaigns aimed at this population.

One noteworthy finding when investigating 24-hr movement guideline adherence among each respective CCD was the impact of those living with multimorbidity. Specifically, those with multimorbidity were 15-29% less likely to meet each movement



guideline and had 34% lower odds of meeting all four concurrent guidelines. Although the CCWS did not include items to assess the severity of CCD, which has been linked to guideline adherence among children and youth with neurodevelopmental disorders,<sup>37</sup> it is reasonable to postulate that the medical complexities experienced by emerging adults with multiple conditions plays a role in their poorer guideline adherence. These findings suggest that additional resources should be allocated to emerging adults with multimorbidity who are attending post-secondary education considering they may stand to benefit the most from intervention.

Although likelihoods of reduced 24-hr guideline adherence were not observed as consistently among emerging adults who reported a lone mental, sensory, developmental, or physical disability diagnosis, these relationships should not be overlooked. Subgroup sample sizes for developmental and physical disabilities were small; thus, estimates lack precision due to limited statistical power. As a result, we may have failed to detect some important effects for no other reason than potential type two errors. Conversely, it appears that those living with chronic health conditions may engage in healthier movement behavior patterns. While we lacked specific details regarding what these chronic condition diagnoses were, it is possible that these conditions do not involve impairments that may render individuals unable to perform (or avoid) certain activities that contribute to 24-hr movement behavior adherence. For example, Chron's disease likely poses a smaller barrier to physical activity engagement than living with a physical disability. Future research should consider collecting additional information on condition severity regarding the degree to which it affects activities of daily living and qualitative data about barriers to meeting each of the four guidelines. Such information could improve our current understanding of why individuals with certain CCD are more (or less) likely to adhere to specific guidelines than others.

Evidence from the present study also assists in identifying which movement behaviors are most beneficial for different aspects of mental health among emerging adults with CCD. For example, among emerging adults with CCD, meeting the sleep guideline had the most robust effect on psychological distress, whereas physical activity, sitting time, and sleep guideline adherence were associated with the strongest effects on mental wellbeing. Given that adherence to each of the guidelines and concurrent adherence to all four guidelines were consistently associated with favorable benefits for psychological distress and mental wellbeing among this population, it is imperative that campus-led health promotion campaigns consider an integrated 24-hr movement approach to alleviate the mental health burden they experience.

Examining associations between 24-hr movement guideline adherence and indicators of mental health among emerging adults with and without CCD provide important insight into the strength of these relationships, particularly among an understudied population known to experience a high mental health burden. Although subtle differences exist, for the most part, the mental health benefits of 24-hr movement guideline adherence were relatively similar

across these two populations. It should be noted, however, that some relationships may be more robust among emerging adults with CCD than those without. For example, and perhaps most importantly, concurrent adherence to all four guidelines was associated with stronger effects for both psychological distress and mental wellbeing. This difference may be partially driven by larger effects observed for sitting time. Conversely, adherence to certain guidelines had greater effects on emerging adults without CCD. Larger associations were found for screen time guideline adherence with both indicators of mental health and meeting the physical activity guideline was associated with greater reductions in psychological distress. Despite the subtle differences in effects between populations, these findings lend some credibility to existing movement behavior guidelines for individuals with CCD that were inferred from evidence from the general population in that the benefits for mental health may be similar – at least among emerging adults attending post-secondary education in Canada.

While this study has several strengths, there were also limitations. First, self-reported measures of movement behaviors such as physical activity are often over-estimated.<sup>40</sup> This limitation could be addressed in future studies using device-based measures, although given the size of the CCWS sample, self-reported measures were more feasible. Second, scores for psychological distress and wellbeing may have been influenced by a seasonal effect such as completion during stressful parts of the academic term (e.g., midterms, final exams), which might result in a poorer representation of participant's mental health and wellbeing. Third, all CCD diagnoses were self-reported and lacked specificity with regards to the severity by which their everyday functioning was impacted. Participants were only asked to report diagnoses that affected their everyday functioning, and we therefore lack insight into the potential role of impairment severity. The CCWS was developed with the broader post-secondary student population in mind; thus, only general information regarding student health conditions were ascertained. Future studies are encouraged to include measures that assess the severity by which students' everyday functioning is impaired and to partner with campus health clinics to review medical records to confirm diagnoses. Such procedures would ultimately reduce bias in estimates. Finally, it should be acknowledged that the CCWS was not nationally representative sample of post-secondary students, and therefore our findings may not be generalizable to all emerging adults attending post-secondary education in Canada.

In conclusion, we found that emerging adults with CCD attending post-secondary education meet the guidelines for sleep, screen time, and sitting time as well as all four guidelines concurrently at lower rates than their peers. Our findings also suggest there are beneficial associations between 24-hr movement guideline adherence and indicators of mental health, which appear to be consistent among emerging adults with and without CCD. Collectively, these results will help to inform the dearth of evidence that has examined links between 24-hr movement guidelines and health among adults with CCD to date. As similar studies continue to be published, policymakers will no longer need to rely on evidence from

studies of the general population when informing guideline development for individuals with CCD.

## **Contributions**

Conceptualization (DB, PM), Methodology (DB, PM, BT), Formal analysis (DB), Data curation (DB), Writing – original draft (DB, CP, PM, MK, BT), Supervision (DB)

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None.

## **Data and Supplementary Material Accessibility**

The CCWS dataset is available through protected access (<https://www.ccws-becc.ca/>). All R code for the analyses is available at <https://osf.io/afmwp>.

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Table 1. *Descriptive statistics for sociodemographic variables, movement behaviors and indicators of mental health.*

Variable	Full Sample (N = 20,630)	General Population (n = 14,553)	Individuals with CCD (n = 6,077)	p value
Age				.18
Mean (SD)	21.7 (2.92)	21.6 (2.93)	21.7 (2.90)	
Gender				<.001
Female	13789 (66.8%)	9,443 (64.9%)	4346 (71.5%)	
Male	6571 (31.9%)	5035 (34.6%)	1536 (25.3%)	
Other	270 (1.3%)	75 (0.5%)	195 (3.2%)	
Race/Ethnicity				<.001
White	6594 (32.0%)	3945 (27.1%)	2649 (43.6%)	
Black	415 (2.0%)	300 (2.1%)	115 (1.9%)	
East/Southeast Asian	5625 (27.3%)	4372 (30.0%)	1253 (20.6%)	
Canadian Indigenous	220 (1.1%)	138 (0.9%)	82 (1.4%)	
Latino	516 (2.5%)	372 (2.6%)	144 (2.4%)	
Middle Eastern	636 (3.1%)	466 (3.2%)	170 (2.8%)	
South Asian	4260 (20.6%)	3463 (23.8%)	797 (13.1%)	
Mixed	1707 (8.3%)	1035 (7.1%)	672 (11.1%)	
Other	656 (3.2%)	461 (3.2%)	195 (3.2%)	
CCD Diagnosis				
Developmental	521 (2.5%)	0 (0%)	521 (8.6%)	
Mental	2638 (12.8%)	0 (0%)	2638 (43.4%)	
Multimorbid	1463 (7.1%)	0 (0%)	1463(24.1%)	
Physical	168 (0.8%)	0 (0%)	168 (2.8%)	
Chronic Health Condition	235 (1.1%)	0 (0%)	235 (3.9%)	
Sensory	331 (1.6%)	0 (0%)	331 (5.5%)	
Other	720 (3.5%)	0 (0%)	720 (11.8%)	
None	14553 (70.5%)	14553 (100%)	0 (0%)	
Parental Education				.005
High school or less	4843 (23.5%)	3531 (24.3%)	1312 (21.6%)	
Completed post-secondary	11083 (53.7%)	7784 (53.5%)	3299 (54.3%)	
Completed Graduate or Professional degree	4704 (22.8%)	3238 (22.2%)	1466 (24.1%)	



Variable	Full Sample ( <i>N</i> = 20,630)	General Population ( <i>n</i> = 14,553)	Individuals with CCD ( <i>n</i> = 6,077)	<i>p</i> value
Student Status				.04
Full-time	17017 (82.5%)	12129 (83.3%)	4888 (80.4%)	
Part-time	3613 (17.5%)	2424 (16.7%)	1189 (19.6%)	
New to Institution (yes)	5572 (27.0%)	4035 (27.7%)	1537 (25.3%)	.04
Residence				.08
Off campus	18436 (89.4%)	12990 (89.3%)	5446 (89.6%)	
On campus	2077 (10.1%)	1497 (10.3%)	580 (9.6%)	
Unstable	118 (0.6%)	67 (0.5%)	51 (0.8%)	
Weekly Work Hours				.54
Mean (SD)	9.96 (10.9)	10.0 (10.9)	9.78 (10.8)	
Financial Stress				<.001
None	2291 (11.1%)	1759 (12.1%)	532 (8.8%)	
Very little	4096 (19.9%)	3061 (21.0%)	1035 (17.0%)	
Some	6080 (29.5%)	4340 (29.8%)	1740 (28.6%)	
Quite a bit	4197 (20.3%)	2868 (19.7%)	1329 (21.9%)	
A great deal	3968 (19.2%)	2526 (17.4%)	1442 (23.7%)	
Psychological Distress				
Mean (SD)	26.0 (8.27)	24.6 (7.83)	29.5 (8.28)	
Mental Wellbeing				
Mean (SD)	45.0 (10.2)	46.4 (9.94)	41.5 (10.1)	
Physical Activity (hr/day)				
Mean (SD)	0.70 (0.63)	0.70 (0.63)	0.71 (0.63)	
Recreational Screen Time (hr/day)				
Mean (SD)	4.73 (2.72)	4.66 (2.70)	4.90 (2.78)	
Sitting Time (hr/day)				
Mean (SD)	7.92 (3.43)	7.84 (3.43)	8.10 (3.43)	
Sleep Duration (hr/day)				
Mean (SD)	7.94 (1.35)	7.92 (1.31)	8.00 (1.44)	

CCD = chronic conditions and disabilities

Table 2. 24-hr movement guideline adherence for emerging adults with chronic health conditions and disabilities compared to those without.

	Physical Activity		Sleep		Screen Time		Sitting Time		Concurrent Guideline Adherence	
	Proportion % (SE)	aOR (95% CI)	Proportion % (SE)	aOR (95% CI)	Proportion % (SE)	aOR (95% CI)	Proportion % (SE)	aOR (95% CI)	Proportion % (SE)	aOR (95% CI)
Emerging adults without CCD	62.0 (61.2, 62.8)	1.0	60.9 (60.1, 61.7)	1.0	36.8 (36.0, 37.6)	1.0	57.7 (56.9, 58.5)	1.0	8.4 (8.0, 8.9)	1.0
Emerging adults with CCD	63.3 (62.1, 64.5)	0.93 (0.86, 1.01)	58.3 (57.1, 59.6)	<b>0.84 (0.77, 0.90)</b>	34.1 (33.0, 35.3)	<b>0.81 (0.75, 0.87)</b>	55.3 (54.0, 56.5)	<b>0.91 (0.84, 0.98)</b>	7.6 (7.0, 8.3)	<b>0.77 (0.68, 0.88)</b>
Emerging adults with CCD by group										
Mental	62.9 (61.1, 64.7)	.92 (.84, 1.03)	57.7 (55.8, 59.6)	<b>.81 (.73, .90)</b>	33.9 (32.1, 35.7)	<b>.78 (.71, .87)</b>	54.6 (52.7, 56.5)	.80 (.60, 1.08)	7.9 (6.9, 8.9)	<b>.78 (.66, .92)</b>
Developmental	67.7 (63.6, 71.6)	1.02 (.82, 1.28)	56.4 (52.2, 60.6)	<b>.74 (.61, .91)</b>	34.8 (30.9, 39.0)	.87 (.69, 1.10)	54.1 (49.8, 58.3)	.86 (.70, 1.06)	6.0 (4.3, 8.4)	<b>.59 (.38, .90)</b>
Physical	55.9 (48.3, 63.2)	<b>.66 (.46, .96)</b>	56.7 (49.1, 63.9)	.76 (.53, 1.08)	32.7 (26.1, 40.1)	.81 (.55, 1.20)	55.7 (48.1, 63.0)	.91 (.63, 1.32)	5.3 (2.8, 9.8)	.51 (.22, 1.17)
Sensory	62.0 (56.7, 67.1)	.99 (.76, 1.31)	59.2 (53.9, 64.4)	.95 (.73, 1.25)	29.9 (25.2, 35.1)	<b>.75 (.56, .99)</b>	59.6 (54.2, 64.7)	1.12 (.86, 1.46)	5.7 (3.7, 8.7)	.72 (.42, 1.25)
Chronic health condition	67.8 (61.6, 73.4)	1.15 (.84, 1.60)	61.8 (55.5, 67.8)	.93 (.69, 1.27)	39.6 (33.5, 45.9)	1.03 (.76, 1.39)	52.4 (46.0, 58.7)	.80 (.60, 1.08)	8.9 (5.9, 13.2)	.87 (.53, 1.42)
Other	64.3 (60.8, 67.7)	1.04 (.86, 1.27)	62.7 (59.1, 66.2)	1.05 (.88, 1.27)	39.0 (35.5, 42.6)	1.05 (.88, 1.26)	61.0 (57.4, 64.5)	1.12 (.92, 1.34)	10.2 (8.2, 12.6)	1.19 (.90, 1.58)
Multimorbid	62.4 (59.9, 64.9)	<b>.85 (.74, .98)</b>	54.9 (54.9, 59.9)	<b>.79 (.69, .90)</b>	32.2 (29.9, 34.7)	<b>.71 (.61, .81)</b>	53.6 (51.1, 56.2)	<b>.84 (.73, .95)</b>	7.0 (5.8, 8.4)	<b>.66 (.52, .84)</b>

aOR = adjusted Odds Ratio; CCD = chronic conditions and disabilities; bold text signifies significance at  $p < .05$