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Longitudinal Mental Health Outcomes of Third-year Medical Students Rotating Through the Wards During COVID-19

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ARTICLE INFO

Keywords:

Anxiety
Ptd
Depression
Coronavirus
Medical education
Resilience

ABSTRACT

This study investigated third year medical students' psychological well-being during clinical rotations at Mount Sinai hospitals in New York City during the COVID-19 pandemic. All students ($n = 147$) starting rotations (psychiatry, surgery, obstetrics-gynecology, neurology, pediatrics, and medicine) could participate in quarterly, online, anonymous surveys comprised of validated screeners for: psychological symptoms, risk, coping, and protective factors, demographics, COVID-19 worries, and stressful clerkship-related events. Associations between variables were examined with Chi-squared, Fisher's exact, t -, Wilcoxon Rank Sum, one-way ANOVA, and McNemar tests. Significant univariate predictors of psychological distress were included in stepwise multivariable linear regression models. The baseline survey was completed by 110 (74.8%) students; ninety-two (62.6%) completed at least one other survey. During the year, 68 (73.9%) students screened positive for depression, anxiety, or PTSD. The prevalence of psychiatric symptoms peaked in June 2020 without significant changes in average scores over time. COVID-19 worries decreased over time but did not influence psychological symptoms at year-end. Eighty-three students (90.2%) experienced stressful clerkship-related events, which were traumatic and/or COVID-19-related for 26 (28.3%) and 22 students (24.0%), respectively. Baseline psychological distress, childhood emotional abuse, and resilience predicted depression, anxiety, and/or PTSD by year-end. This study highlights the importance of recognizing psychological distress and implementing interventions to support students' well-being.

1. Introduction

The prolonged and life-altering nature of the coronavirus-19 (COVID-19) pandemic has highlighted the psychological toll of large-scale suffering, especially for health care workers (HCWs) on the frontlines. Severe levels of mental distress have been reported by HCWs, struggling with overwhelming patient burden, fear of getting sick, and isolation. Cross-sectional studies across the globe have found that up to 80% of HCWs reported mental distress symptoms with up to 40% of HCWs screening positive for one or more mental disorders such as

anxiety, depression, post-traumatic stress disorder (PTSD), and insomnia (Bassi et al., 2021; Chew et al., 2020; Feingold et al., 2021). Nurses, female providers, and individuals with less healthcare experience, pre-existing mental health conditions, and burnout were more likely to report significant mental distress (Vindegaard and Benros, 2020; Zaka et al., 2020).

Medical students are among the most inexperienced HCWs and therefore at increased risk of psychological distress. One multicenter study in the United States (U.S.) found that 84.1% of medical students surveyed felt at least somewhat anxious due to the pandemic, with a

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significant increase in perceived emotional exhaustion (Harries et al., 2021). Another U.S.-based report published that 30.6% and 24.3% of respondents screened positive for anxiety and depression, respectively, during the pandemic (Halperin et al., 2021). The psychological impacts of COVID have been felt across the globe; in Italy, university students' anxiety and depression increased with progression of days in lockdown (Giusti et al., 2020) and in a Spanish population nearly 48% of adults experienced PTSD in response to COVID-19 confinement (Odrizola-González et al., 2022). The changes experienced due to COVID-19 may impact future outcomes for medical students; one study found that previous psychological problems and loneliness can cause decreases in empathy, a crucial component of good clinical care (Giusti et al., 2021a), while another found that more than 55% of students had significant impairments in concentration and learning abilities due to distance learning (Giusti et al., 2021b).

New York City (NYC) was the epicenter of the U.S.'s initial COVID-19 surge. Between March 2020 and June 2020, medical students at the Icahn School of Medicine at Mount Sinai (ISMMS) in NYC were removed from clinical sites. However, third-year medical students (MS3s) remained on the floors through the second wave of COVID-19 during the winter of 2020, experiencing the stresses of the virus firsthand.

Prior to COVID-19, medical student mental health was already in decline. For example, the rates of anxiety, depression, and PTSD among MS3s at ISMMS in 2006 were 4%, 6%, and 0%, respectively (Haglund et al., 2009). Another study reported the prevalence of medical student depression was 12% in 2009, with 5% of respondents endorsing suicidal ideation (Goebert et al., 2009). In comparison, a 2016 meta-analysis observed depression in 27% of medical students (Rotenstein et al., 2016) and another systematic review (including studies published between 2010 and 2017) identified burnout amongst 44% of medical students (Frajerman et al., 2019). Excessive workload, time management, work-life integration, personal relationships, health problems, and financial concerns are significant sources of stress (Hill et al., 2018). Although students' comfort reporting symptoms of anxiety and depression may have increased over time, across studies, it does appear their mental health has worsened.

Traditionally, during the third year of medical school, students are introduced to clinical responsibilities and experience the stressors associated with medicine firsthand. Given the added complexity of the pandemic, this study aimed to prospectively measure third year medical students' psychological well-being, stressful event exposure, and factors that could influence their longitudinal mental health in the context of the COVID-19 pandemic. We expected that psychological distress would increase during the year, and would be impacted by stressful event exposure and worries about COVID-19.

2. Methods

2.1. Participants

All third-year ISMMS students entering the wards for the first time in July 2020 ($n = 147$) were eligible to participate and were invited to complete quarterly surveys. From July 2020-June 2021, participants completed core clerkship rotations in Medicine, Ambulatory and Geriatric Care, Surgery, Obstetrics-Gynecology, Pediatrics, Neurology, and Psychiatry.

2.2. Procedure

A member of the research team e-mailed study invitations to all eligible students at their institutional address. Students completed the baseline and/or 3 follow-up surveys at 3-month intervals (June 2020, October 2020, February 2021, June 2021) via the Research Electronic Data Capture (REDCap) web application. Participants entered their personal information into a Google Form (not linked to their responses) to receive compensation. Students earned \$75 for each completed

REDCap survey and a \$100 bonus if they completed all four surveys for a total possible compensation of \$400 throughout the study period. The study was approved by the institutional review board at ISMMS (HS#: 20-00,435 | GCO#: 20-0930(0001)).

2.3. Measures

The surveys included validated instruments that measured demographics, psychological symptoms, risk, coping, and protective factors, and worries about the COVID-19 pandemic. Following the baseline survey in June 2020, subsequent surveys administered in October 2020, February 2021, and June 2021 also asked about clerkship-related events experienced in the past three months. The final survey included a measure of personal growth. Similar measures were used in a prior study conducted at ISMMS from 2006 to 2007 (Haglund et al., 2009).

2.3.1. Demographics

Age was manually entered by participants. Gender was measured with three categories: female, male or other. Relationship-status could be indicated by selecting: single, married, single but involved in a romantic relationship, and other. Ethnoracial group membership was measured with seven categories: African-American, Asian, Hispanic/Latino, Native American, White, Other and Prefer not to answer. Participants pursuing dual degrees were asked to specify their enrolled program (i.e. MD/PhD, MD/MPH, MD/MSCR Portal Program, Global Health Scholar, or a Primary Care Scholar).

2.3.2. Psychological symptoms

2.3.2.1. General anxiety disorder-7. The GAD-7 is a 7-item anxiety scale with good reliability (Cronbach $\alpha = 0.92$) and construct validity in our population (Spitzer et al., 2006). Answers to each question (e.g. how often have you been bothered by feeling nervous, anxious or on edge over the past two weeks) are scored on a 4-point scale from 0 (not at all) to 3 (nearly every day). Total scores range from 0 to 21, with anxiety severity categorized by score: 0-4 indicates minimal anxiety, 5-9 indicates mild anxiety, 10-14 indicates moderate anxiety, and 15-21 indicates severe anxiety (Löwe et al., 2008).

2.3.2.2. Patient health questionnaire-8. The PHQ-8 is an 8-item version of the PHQ-9 (Cronbach $\alpha = 0.89$) depression scale (Kroenke et al., 2001). Answers to each question (e.g. how often have you been bothered by feeling little interest or pleasure in doing things over the past two weeks) are scored on a 4-point scale from 0 (not at all) to 3 (nearly every day). Total scores range from 0 to 24: 0-4 indicates no depression, 5-9 indicates mild depression, 10-14 indicates moderate depression, 15-19 indicates moderately severe depression, and 20-24 indicates severe depression (Kroenke et al., 2009).

2.3.2.3. PTSD checklist for the DSM-5. The PCL-5 is a twenty-item screening survey for PTSD, corresponding to DSM-5 symptom criteria. In students at undergraduate universities in the U.S., it has been shown to have good internal consistency (Cronbach $\alpha = 0.94$) and construct validity. Symptoms are grouped into the following clusters: intrusion, avoidance, negative alterations of cognitions and mood, and alterations in arousal and reactivity. Participants indicate how often they've experienced symptoms (e.g. repeated, disturbing memories, thoughts or images of a stressful experience over the past month) on a 5-point scale from 0 (not at all) to 4 (extremely). Scores are summed into a total severity score ranging from 0 to 80, with scores above 31 indicating probable PTSD (Blevins et al., 2015).

2.3.3. Risk factors

2.3.3.1. The life events checklist for the DSM-5. The LEC-5 is a 17-item

screening measure of traumatic life events (e.g. natural disaster, assault with a weapon) known to potentially lead to PTSD or distress. Participants indicate whether the event “happened to me,” “witnessed it,” “learned about it,” “part of my job,” “not sure,” and “doesn’t apply” (National Center for PTSD, 2013).

2.3.3.2. Childhood trauma questionnaire - short form. The CTQ-SF is a 28-item screening measure of childhood maltreatment experiences. Subcategories include minimalization/denial (e.g. had the perfect childhood), physical abuse (e.g. hit hard enough to see a doctor), emotional abuse (e.g. called names), sexual abuse (e.g. was touched sexually), physical neglect (e.g. not enough to eat), and emotional neglect (e.g. felt loved). Participants indicate on a scale from 1 (never true) to 5 (very often true) how true they feel each question reflects their childhood experience, with higher scores indicating more severe trauma (Bernstein et al., 2003).

2.3.3.3. Social adjustment scale, self-report short version. The SAS-SR short is a 24-item survey that measures social functioning across eight domains, including Work For Pay, Housework, Student, Social and Leisure, Family and Outside Home, Primary Relationship, Parental, and Family Unit. The items within each domain covers four types of content over the last two weeks, including performance at expected tasks (e.g. how well have you been able to do your work), friction with people (e.g. have you avoided contact with your relatives), finer aspects of interpersonal relationships (e.g. have you been thinking that you have let down your partner or your children) and feelings and satisfactions (e.g. how often have you felt lonely and wished for more friends). Each item (e.g. how many friends have you seen or been in contact with) is scored from 1 (e.g. nine or more friends) to 5 (e.g. no friends), with higher scores indicating worse social functioning (Gameroff et al., 2012).

2.3.3.4. COVID-19 fears. A scale measuring 21 worries specifically related to the COVID-19 pandemic (e.g. getting infected with COVID, dying from COVID) was created by a team of researchers and clinicians with expertise in internal medicine, psychiatry, psychology, and disaster mental health with high internal stability (Cronbach’s $\alpha=0.94$) of the scale (Feingold et al., 2021). 11 of these questions were used in this survey. On a scale from 1 (not worried at all) to 5 (worried nearly all of the time), participants indicate how often they have specific worries with higher scores indicating more worry.

2.3.3.5. Maslach burnout inventory - Human services survey short form. The MBI-HSS is an inventory for measuring burnout in medical personnel (Leiter et al., 2015). In this study, a two-item short version of the instrument was used. From 0 (never) to 6 (every day), participants indicate how often they felt burned out from their work and became more callous toward people since starting their job, with higher scores indicating more severe burnout.

2.3.3.6. Psychiatric history. Participants were instructed to indicate “yes” or “no” to questions about previous psychiatric diagnoses, previous psychiatric treatment, and current psychiatric treatment.

2.3.4. Coping factors

2.3.4.1. Brief coping scale. The BCOPE is a 28-item inventory of common coping strategies that is subdivided into approach coping (e.g. use of emotional support, humor) and avoidant coping (e.g. denial, substance use). On a scale 1 (I haven’t been doing this at all) to 4 (I’ve been doing this a lot), participants indicate how often they use a particular strategy, with higher scores indicating more use (Carver, 1997).

2.3.4.2. Religious coping scale. The RCOPE is a 14-item questionnaire that evaluates religious coping in the face of life stressors. Coping

strategies are grouped into adaptive coping (e.g. strategies that generally reflect a secure relationship to what the individual considers sacred) and maladaptive coping (e.g. strategies that reflect tension or conflict with the sacred). On a scale of 0 (not at all) to 3 (a great deal), participants indicate the extent to which they use specific methods of religious coping, with higher scores indicating greater use of coping skills in each subtype (Pargament et al., 2011).

2.3.5. Protective factors

2.3.5.1. Connor davidson resilience scale. The CD-RISC-10 is a 10-item scale that measures resilience (e.g. can you adapt to change, do you like challenges), defined as positive adaptation in the face of adversity or trauma (Campbell-Sills and Stein, 2007). Participants indicate how true a question is on a 4-point scale, ranging from 0 (not true at all) to 3 (true nearly all the time), with higher scores indicating more resilience.

2.3.5.2. Revised life orientation test. The LOT-R is a 10-item scale that measures dispositional optimism and pessimism (e.g. is it easy to relax, do you expect things to go your way) (Hinz et al., 2017). Participants indicate if they agree with a question on a 5-point scale, ranging from 0 (strongly disagree) to 4 (strongly agree), with higher scores indicating a greater tendency to expect positive outcomes in life.

2.3.5.3. Ten item personality inventory. The TIPI is a 10-item brief measure of the Big Five personality dimensions: extraversion (e.g. enthusiastic, extroverted), agreeableness (e.g. sympathetic, warm), conscientiousness (e.g. dependable, self-disciplined), emotional stability (e.g. calm, emotionally stable), and openness to experience (e.g. complex, open to new experiences) (Gosling et al., 2003). Scores range from 1 (disagree strongly) to 7 (agree strongly) in each category, with higher scores indicating a stronger personality trait.

2.3.5.4. Multidimensional scale of perceived social support. The MSPSS is a 12-item scale that measures three dimensions of social support: family (e.g. my family tries to help me, they are willing to help me make decisions), friend (e.g. can count on friends when things go wrong, can talk about my problems with friends), and significant other (e.g. there is a special person with whom I share joys and sorrows, they care about my feelings) using a 7-point scale, ranging from 1 (very strongly disagree) to 7 (very strongly agree), with higher scores indicating greater perceived social support (Kazarian and McCabe, 1991).

2.3.5.5. Post-traumatic growth inventory - Short Form. The PGI-SF is a 10-item instrument to assess positive outcomes reported by persons who have experienced traumatic events. It includes factors of New Possibilities, Relating to Others, Personal Strength, Spiritual Change, and Appreciation of Life (Tedeschi and Calhoun, 1996). Participants rate how much they agree with each statement (e.g. I have a greater feeling of self-reliance, I’m stronger than I thought I was) from 0 to 5, where 0 is (I did not experience this change as a result of my crisis) to 5 (I experienced this change to a very great degree as a result of my crisis), with higher scores indicating more positive transformation.

2.3.6. Clerkship related-events

To assess stressful events within clerkships, students reported distressing clerkship-related events at three-month intervals and identified whether any of the events they experienced were traumatic, as defined by the PTSD diagnostic criteria in the DSM-5 (American Psychiatric Association, 2013). Students could also report if any of the events were COVID-19 related. In the final survey, students were asked which type of event and which clerkship were the most distressing.

2.4. Data analysis

We summarized continuous variables using means and standard deviation (SD) and categorical variables as frequencies with proportions. We performed bivariate hypothesis tests to examine the associations between demographics and risk, coping, and protective factors with mental health outcomes using chi-squared tests (or Fisher's exact tests, where appropriate) for categorical variables, and t-tests, Wilcoxon Rank Sum tests, or one-way ANOVA tests for continuous variables. We compared paired survey responses for the main outcomes GAD, MDD, and PTSD across survey time points using McNemar's tests. Additionally, we used ANOVA to test for differences in the mean scores of GAD, MDD and PTSD across the four survey time points. Similar to a recent study on the psychological consequences of COVID on HCWs (Peccoralo et al., 2022), the three outcome measures were further categorized using frequencies and proportions into groups (never, new onset, remitting, chronic) based on the presence or absence of mental health symptoms at baseline/Survey 1 and at the end of the year/Survey 4 ($n = 69$). *Never*: negative screens at Survey 1 and Survey 4; *New Onset*: negative screens at Survey 1, positive screens at Survey 4; *Remitting*: positive screens at Survey 1, negative screens at Survey 4, and *Chronic*: positive screens at Survey 1 and Survey 4. Chi-squared tests were used to compare the bivariate associations of the number of positive and negative screens for each of the outcomes at each time point.

To maintain student anonymity, students answered five security questions and their responses generated a unique code. These codes linked survey responses across the time points using approximate deterministic linkage methods. Surveys were considered linked if they matched exactly on the unique self-generated code, if the unique codes fell within one generalized Levenshtein distance (Levenshtein, 1966), and if the subsequent surveys matched on 4 out of 5 demographic variables.

We performed univariate linear regression to identify which baseline characteristics and subsequent event exposures contributed to symptoms of anxiety, depression, and posttraumatic stress symptoms at the end of the year. The predictors analyzed included (1) baseline PHQ-8, GAD-7, or PCL-5 scores, (2) number of traumatic events, COVID events, and stressful events, (3) specific COVID-19 worries and (4) risk, coping, and protective factors. Significant predictors from the univariate analyses were included in subsequent stepwise multivariable linear regression models. Only those variables that were significant at the $p < 0.05$ after adjustment remained in the final multivariable model. All data analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC) and RStudio Version 2021.09.1 + 372.pro1 Ghost Orchid.

3. Results

3.1. Participants

The class of 2022 consisted of 147 students. One hundred and ten (74.8%) completed the baseline survey. Ninety-two (62.6%) also completed at least one other survey during the 2020–2021 academic year. Ninety-two (62.6%) students completed any two surveys, 84 (57.1%) students completed any three surveys, and 58 (39.5%) students completed all four surveys. Given the sample size of students who completed all four surveys was small, our selected dataset consisted of students who completed the baseline and at least one other survey. Demographic features of the 92 students who completed the baseline survey and at least one other survey are summarized in Table 1. These students' responses are used in subsequent analyses. Any reported percentages refer to the 92 students who completed the baseline and at least one other survey.

3.2. Baseline findings

At baseline, the mean (standard deviation) PCL-5, GAD-7, and PHQ-8

Table 1
Demographic Information.

Variable	
N = 92	
Age	N (%)
Mean \pm SD	26.1 \pm 2.06
Median(IQR)	26 (25–26)
Gender	N (%)
Female	42 (45.7%)
Male	48 (52.2%)
Other	2 (2.2%)
Relationship	N (%)
Single	44 (47.8%)
Married	14 (15.2%)
Single but involved	34 (37.0%)
Other	0 (0.0%)
Race/Ethnicity	N (%)
African-American	10 (10.9%)
Asian	28 (30.4%)
Hispanic/Latino	4 (4.4%)
Native American	0 (0.0%)
White	44 (47.8%)
Other	3 (3.3%)
Prefer not to answer	3 (3.3%)
Dual Degree	N (%)
Yes	17 (18.5%)
No	75 (81.5%)
Dual Degree Specialty	N (%)
MD/PhD	9 (52.9%)
MD/MPH	1 (5.9%)
MD/MSCR Portal Program	5 (29.4%)
Global Health Scholar	1 (5.9%)
Physician Scholar	0 (0.0%)
Primary Care Scholar	1 (5.9%)
Mental Health Outcome	median \pm SD
PCL-5	31.36 \pm 12.12
GAD-7	7.25 \pm 5.65
PHQ-8	5.54 \pm 5.20

PCL-5: Fifth edition (DSM-5)'s PTSD Checklist; GAD-7: 7-Item Generalized Anxiety Disorder Scale; PHQ-8: 8-Item Patient Health Questionnaire.

scores were 31.36 (12.12), 7.25 (5.65), and 5.54 (5.20), respectively. There were no significant differences in PCL-5, GAD-7, or PHQ-8 scores across gender, relationship status, or dual-degree status. There were statistically significant differences in mean PCL-5 scores between races ($p = 0.004$), with the highest among students who selected "prefer not to answer" as their race (49.3 (11.1)).

3.3. Changes in anxiety, depression, and post-traumatic stress throughout the year

Overall, 73.9% ($n = 68$) of students screened positive on at least one outcome measure at some point throughout the year. Of those 68 students, 28 (30.5%) screened positive on one outcome measure, 20 students (21.7%) screened positive on two, and 20 students (21.7%) screened positive on all three. Twenty-four students (26.1%) did not screen positive on the PCL-5, PHQ-8, or GAD-7 at any time point.

Across all three mental health measures, the percentage of participants screening positive was highest at Survey 1 in June 2020. The percentage of participants screening positive on the GAD-7, PHQ-8, and PCL-5 ranged from 24.4%–30.4%, 13.4%–21.7%, and 26.0%–39.0%, respectively. Table 2 describes the number of students reporting any symptoms of GAD, MDD, or PTSD over the academic year, even if these symptoms did not reach clinical threshold. Overall, there was no significant change in mean GAD-7 ($p = 0.55$), PHQ-8 ($p = 0.17$), or PCL ($p = 0.23$) scores across timepoints.

Table 2
Mental Health Outcomes Over Time.

	Survey 1 June 2020 (N = 92)	Survey 2 October 2020 (N = 87)	Survey 3 February 2021 (N = 80)	Survey 4 June 2021 (N = 67)	
GAD-7 Score					
None	36 (39.1%)	40 (46.5%)	31 (38.7%)	27 (40.3%)	
Mild	28 (30.4%)	25 (29.1%)	25 (31.3%)	23 (34.3%)	
Moderate	18 (19.6%)	14 (16.3%)	15 (18.7%)	12 (17.9%)	
Severe	10 (10.9%)	7 (8.1%)	9 (11.3%)	5 (7.5%)	
GAD-7 Cutoff					
Positive Screen (≥10)	28 (30.4%)	21 (24.4%)	24 (30.0%)	17 (25.4%)	
Negative Screen (<10)	64 (69.6%)	65 (75.6%)	56 (70.0%)	50 (74.6%)	
Average score	7.1	6.1	7.1	6.2	
Missing	0	1	0	0	
GAD-7 Average Score	7.3	6.3	6.9	6.6	<i>p</i> = 0.55
PHQ-8 Score					
None	49 (53.3%)	52 (60.5%)	39 (48.7%)	42 (62.7%)	
Mild	23 (25.0%)	22 (25.6%)	28 (35.0%)	16 (23.8%)	
Moderate	14 (15.2%)	7 (8.1%)	7 (8.8%)	6 (9.0%)	
Severe	6 (6.5%)	5 (5.8%)	6 (7.5%)	3 (4.5%)	
PHQ-8 Cutoff					
Positive Screen (≥10)	20 (21.7%)	12 (14.0%)	13 (16.3%)	9 (13.4%)	
Negative Screen (<10)	72 (78.3%)	74 (86.0%)	67 (83.7%)	58 (86.6%)	
Average score	5.5	4.7	5.6	4.4	
Missing	0	1	0	0	
PHQ-8 Average Score	5.8	4.8	5.7	4.6	<i>p</i> = 0.17
PCL-5 Cutoff					
Positive Screen (≥31)	32 (39.0%)	24 (29.3%)	20 (26.0%)	17 (26.6%)	
Negative Screen (<31)	50 (61.0%)	58 (70.7%)	57 (74.0%)	47 (73.4%)	
Missing	10	5	3	3	
PCL-5 Average Score	31.8	29.3	28.1	29	<i>p</i> = 0.23

PCL-5: Fifth edition (DSM-5)'s PTSD Checklist; GAD-7: 7-Item Generalized Anxiety Disorder Scale; PHQ-8:8-Item Patient Health Questionnaire.

Of the students who completed Survey 1 and Survey 4, results for the never, new onset, remitting, and chronic groups are presented in Table 3. The majority of students did not screen positive at the beginning and end of the year for depression (*n* = 49, 71.0%), anxiety (*n* = 42, 60.8%), and PTSD (*n* = 32, 53.3%).

Table 4 compares the number of students who screened positive and negative for each outcome measure (PHQ-8, GAD-7, and PCL-5) at each time point. There were no significant differences for any outcome measure across any time points, with the exception of a difference in prevalence for PTSD between Survey 1 and Survey 3.

Table 3
Never, New Onset, Remitting, and Chronic Groups.

	Students who completed Survey 1 and Survey 4 (N = 69)
PHQ-8	
Never	49 (71.0%)
New Onset	4 (5.8%)
Remitting	10 (14.5%)
Chronic	6 (8.7%)
GAD-7	
Never	42 (60.8%)
New Onset	8 (11.6%)
Remitting	9 (13.0%)
Chronic	10 (14.5%)
PCL-5*	
Never	32 (53.3%)
New Onset	4 (6.7%)
Remitting	11 (18.3%)
Chronic	13 (21.7%)

* Some missing values observed, N = 60

PCL-5: Fifth edition (DSM-5)'s PTSD Checklist; GAD-7: 7-Item Generalized Anxiety Disorder Scale; PHQ-8:8-Item Patient Health Questionnaire.

3.4. Stressful event reporting

Eighty-three students (90.2%) reported experiencing a stressful clerkship-related event at some point throughout the surveys. While 26 of those students (28.3%) further described at least one clerkship-related stressful event as traumatic, 22 (24.0%) described at least one clerkship-related stressful event as related to COVID-19. Fourteen students (15.2%) described at least one event as both traumatic and related to COVID-19. Thirteen students (14.1%) reported a stressful clerkship-related event on all three surveys, 47 students (51.1%) reported a stressful clerkship-related event on two surveys, and 23 students (25.0%) reported a stressful clerkship-related event on one survey. Nine students (9.8%) did not report a clerkship-related stressful event on any survey.

Table 5 describes the number of students who experienced stressful, traumatic, and COVID-19 related events, as well as students' self-identified most distressing events and clerkships. The largest number of students identified their obstetrics-gynecology rotation as causing the greatest distress (*n* = 17, 30.4%). Thirty-three participants (38.0%) stated that their most distressing event was "witnessing a patient suffer from a serious illness," while 15 participants (17.2%) chose "witnessing a patient die."

3.5. COVID-19 worries

Table 6 shows the trend over time for categories of COVID-19 worries. Time had a significant overall effect (*p*<0.05) on 10 out of 11 COVID-19 worry categories, with all worries significantly decreasing across surveys, except for stress related to care for dependents due to COVID-19.

3.6. Identifying potential risk, coping, and protective factors

Table 7 summarizes the univariate regressions in which risk, coping, and protective factors assessed at the beginning of the year and stressful events contributed to anxiety, depression, and PTSD symptoms at the end of the year. Sixteen, 14, and 12 variables met the threshold (*p*<0.05) for entry into the multivariate model predicting endpoint PHQ-8, PCL, and GAD-7 scores, respectively. Eleven variables met threshold for entry into the multivariate model for all three outcomes: baseline score, use of negative coping skills (BCOPE), resilience score (CD-RISC), burnout score (MBI), previous psychiatric diagnosis, current psychiatric treatment, functioning as a student (SAS-SR student), functioning outside of the home (SAS-SR family and outside home), emotional stability (TIPI), COVID-19 worries related to being overwhelmed, and COVID-19

Table 4
Mental Health Outcomes for Positive and Negative Screens at All Timepoints.

<u>PHQSurvey1</u>	<u>PHQSurvey2</u>		p-value	<u>GADSurvey1</u>	<u>GADSurvey2</u>		p-value	<u>PCLSurvey1</u>	<u>PCLSurvey2</u>		p-value
	Negative	Positive	0.2		Negative	Positive	0.5		Negative	Positive	0.1
Negative	55 (71.4%)	6 (7.8%)		Negative	46 (59.7%)	9 (11.7%)		Negative	33 (50.0%)	6 (9.1%)	
Positive	11 (14.3%)	5 (6.5%)		Positive	12 (15.6%)	10 (13.0%)		Positive	13 (18.2%)	14 (21.2%)	
<u>PHQSurvey1</u>	<u>PHQSurvey3</u>		p-value	<u>GADSurvey1</u>	<u>GADSurvey3</u>		p-value	<u>PCLSurvey1</u>	<u>PCLSurvey3</u>		p-value
	Negative	Positive	0.4		Negative	Positive	1.0		Negative	Positive	0.007
Negative	51 (70.0%)	7 (9.6%)		Negative	43 (58.9%)	10 (13.7%)		Negative	35 (54.7%)	4 (6.3%)	
Positive	10 (13.7%)	5 (6.8%)		Positive	10 (13.7%)	10 (13.7%)		Positive	16 (25%)	9 (14.1%)	
<u>PHQSurvey1</u>	<u>PHQSurvey4</u>		p-value	<u>GADSurvey1</u>	<u>GADSurvey4</u>		p-value	<u>PCLSurvey1</u>	<u>PCLSurvey4</u>		p-value
	Negative	Positive	0.1		Negative	Positive	0.8		Negative	Positive	0.07
Negative	49 (71.0%)	4 (5.8%)		Negative	42 (60.9%)	8 (11.6%)		Negative	32 (53.3%)	4 (6.7%)	
Positive	10 (14.5%)	6 (8.7%)		Positive	9 (13.0%)	10 (14.5%)		Positive	11 (18.3%)	13 (21.7%)	
<u>PHQSurvey2</u>	<u>PHQSurvey3</u>		p-value	<u>GADSurvey2</u>	<u>GADSurvey3</u>		p-value	<u>PCLSurvey2</u>	<u>PCLSurvey3</u>		p-value
	Negative	Positive	0.6		Negative	Positive	0.5		Negative	Positive	0.07
Negative	58 (73.4%)	6 (7.6%)		Negative	46 (58.2%)	12 (15.2%)		Negative	41 (56.2%)	6 (8.2%)	
Positive	8 (10.1%)	7 (8.9%)		Positive	9 (11.4%)	12 (15.2%)		Positive	14 (19.2%)	12 (16.4%)	
<u>PHQSurvey2</u>	<u>PHQSurvey4</u>		p-value	<u>GADSurvey2</u>	<u>GADSurvey4</u>		p-value	<u>PCLSurvey2</u>	<u>PCLSurvey4</u>		p-value
	Negative	Positive	0.7		Negative	Positive	0.3		Negative	Positive	0.5
Negative	59 (75.6%)	6 (7.7%)		Negative	50 (64.1%)	10 (12.8%)		Negative	35 (50.0%)	11 (15.7%)	
Positive	7 (9.0%)	6 (7.7%)		Positive	6 (7.7%)	12 (15.4%)		Positive	14 (20.0%)	10 (14.3%)	
<u>PHQSurvey3</u>	<u>PHQSurvey4</u>		p-value	<u>GADSurvey3</u>	<u>GADSurvey4</u>		p-value	<u>PCLSurvey3</u>	<u>PCLSurvey4</u>		p-value
	Negative	Positive	0.7		Negative	Positive	1.0		Negative	Positive	0.2
Negative	64 (79.0%)	3 (3.7%)		Negative	47 (58.0%)	10 (12.3%)		Negative	50 (66.7%)	9 (12.0%)	
Positive	4 (4.9%)	10 (12.3%)		Positive	10 (12.3%)	14 (17.3%)		Positive	4 (5.3%)	12 (16.0%)	

PCL-5: Fifth edition (DSM-5)'s PTSD Checklist; GAD-7: 7-Item Generalized Anxiety Disorder Scale; PHQ-8:8-Item Patient Health Questionnaire.

Table 5
Distressing Events.

<u>RotationName(TOP5)</u>		<u>N (%)</u>
Obstetrics-Gynecology		17 (30.4%)
Surgery		12 (21.4%)
Internal Medicine		11 (19.6%)
Psychiatry		6 (10.7%)
Other		4 (7.1%)
<u>Among student who filled out surveys 3 in February 2021 or 4 in June 2021 (N = 87)</u>		
<u>Clerkship event type</u>		<u>N (%)</u>
Witnessed a patient suffer from a serious illness		33 (38.0%)
Witnessed a patient die		15 (17.2%)
Felt mistreated by a physician		7 (8.0%)
You witnessed a patient(s) being verbally aggressive towards physician(s), staff, or other students		5 (5.7%)
Felt mistreated by support staff		4 (4.6%)
A patient(s) was verbally aggressive with you		4 (4.6%)
You actively participated in stressful/high-risk medical intervention(s)		3 (3.4%)
You witnessed a patient(s) being treated differently based on their race		2 (2.3%)
<u>Among students who had completed the baseline June 2020 survey and at least one other survey (N = 92)</u>		
<u>Students Reporting COVID-19 Related Events</u>		<u>N (%)</u>
Yes		22 (24.0%)
No		70 (76.0%)
<u>Students Reporting Traumatic Events</u>		
Yes		26 (28.3%)
No		66 (71.7%)
<u>Students Reporting Any Clerkship Related Events</u>		
Yes		83 (90.2%)
No		9 (9.8%)
<u>Students Reporting COVID-19-Related & Traumatic Events</u>		
Yes		14 (15.2%)
No		78 (84.8%)

Table 6
COVID-19 Worries Reported Over Time.

		Survey 1 June 2020 (N = 92)	Survey 2 October 2020 (N = 87)	Survey 3 February 2021 (N = 80)	Survey 4 June 2021 (N = 67)	P-value
Infected with COVID	Not worried at all	19 (21.6%)	22 (25.6%)	35 (43.7%)	33 (50.0%)	<0.0001
	Rarely worried	21 (23.9%)	23 (26.7%)	25 (31.3%)	21 (31.8%)	
	Sometimes worried	28 (31.8%)	24 (28.0%)	13 (16.3%)	9 (13.6%)	
	Often worried	14 (15.9%)	16 (18.6%)	6 (7.5%)	3 (4.6%)	
	Worried all the time	6 (6.8%)	1 (1.1%)	1 (1.2%)	0 (0.0%)	
Not knowing if I have COVID	Not worried at all	25 (28.4%)	29 (33.7%)	42 (52.5%)	43 (65.2%)	<0.0001
	Rarely worried	18 (20.4%)	21 (24.4%)	23 (28.7%)	13 (19.7%)	
	Sometimes worried	29 (33.0%)	27 (31.4%)	11 (13.8%)	9 (13.6%)	
	Often worried	14 (16.0%)	7 (8.1%)	4 (5.0%)	1 (1.5%)	
	Worried all the time	2 (2.2%)	2 (2.4%)	0 (0.0%)	0 (0.0%)	
Infected family with COVID	Not worried at all	7 (8.0%)	18 (21.0%)	28 (35.4%)	35 (53.8%)	<0.0001
	Rarely worried	5 (5.7%)	15 (17.4%)	17 (21.5%)	15 (23.1%)	
	Sometimes worried	18 (20.4%)	24 (27.9%)	21 (26.6%)	11 (16.9%)	
	Often worried	33 (37.5%)	21 (24.4%)	9 (11.4%)	4 (6.2%)	
	Worried all the time	25 (28.4%)	8 (9.3%)	4 (5.1%)	0 (0.0%)	
Overwhelmed with COVID	Not worried at all	11 (12.5%)	12 (14.0%)	19 (23.7%)	11 (16.6%)	0.03
	Rarely worried	5 (5.7%)	20 (23.2%)	13 (16.3%)	5 (7.6%)	
	Sometimes worried	28 (31.8%)	19 (22.1%)	21 (26.2%)	17 (25.8%)	
	Often worried	29 (33.0%)	21 (24.4%)	14 (17.5%)	20 (30.3%)	
	Worried all the time	15 (17.0%)	14 (16.3%)	13 (16.3%)	13 (19.7%)	
Seriously ill from COVID	Not worried at all	21 (23.8%)	31 (36.1%)	49 (61.3%)	47 (71.2%)	<0.0001
	Rarely worried	30 (34.1%)	33 (38.4%)	21 (26.3%)	13 (19.7%)	
	Sometimes worried	22 (25.0%)	13 (15.1%)	5 (6.2%)	5 (7.6%)	
	Often worried	8 (9.1%)	8 (9.3%)	4 (5.0%)	1 (1.5%)	
	Worried all the time	7 (8.0%)	1 (1.1%)	1 (1.2%)	0 (0.0%)	
Dying from COVID	Not worried at all	38 (44.2%)	45 (52.3%)	53 (66.3%)	50 (75.7%)	0.0003
	Rarely worried	20 (22.7%)	27 (31.4%)	19 (23.8%)	11 (16.7%)	
	Sometimes worried	19 (21.6%)	11 (12.8%)	6 (7.5%)	5 (7.6%)	
	Often worried	8 (9.1%)	3 (3.5%)	1 (1.2%)	0 (0.0%)	
	Worried all the time	3 (3.4%)	0 (0.0%)	1 (1.2%)	0 (0.0%)	
Not able to visit	Not worried at all	11 (12.5%)	14 (16.3%)	32 (40.5%)	34 (51.5%)	<0.0001
	Rarely worried	16 (18.1%)	24 (27.9%)	19 (24.0%)	11 (16.7%)	
	Sometimes worried	30 (34.1%)	24 (27.9%)	14 (17.7%)	11 (16.7%)	
	Often worried	16 (18.2%)	13 (15.1%)	10 (12.7%)	6 (9.1%)	
	Worried all the time	15 (17.1%)	11 (12.8%)	4 (5.1%)	4 (6.0%)	
Finances	Not worried at all	25 (28.4%)	28 (32.6%)	39 (48.8%)	43 (65.1%)	0.0001
	Rarely worried	20 (22.7%)	29 (33.7%)	20 (25.0%)	13 (19.7%)	
	Sometimes worried	21 (23.8%)	17 (19.7%)	9 (11.3%)	1 (1.5%)	
	Often worried	12 (13.6%)	8 (9.3%)	8 (10.0%)	5 (7.6%)	
	Worried all the time	10 (11.4%)	4 (4.7%)	4 (5.0%)	4 (6.1%)	
Personal relationships	Not worried at all	27 (30.7%)	15 (17.4%)	21 (26.3%)	33 (50.0%)	0.005
	Rarely worried	17 (19.3%)	27 (31.4%)	20 (25.0%)	16 (24.2%)	
	Sometimes worried	21 (23.9%)	26 (30.3%)	22 (27.5%)	11 (16.7%)	
	Often worried	15 (17.1%)	15 (17.4%)	14 (17.5%)	3 (4.6%)	
	Worried all the time	8 (9.0%)	3 (3.5%)	3 (3.7%)	3 (4.6%)	
Care for dependents	Not worried at all	61 (69.3%)	58 (67.4%)	59 (74.7%)	51 (78.5%)	0.1
	Rarely worried	6 (6.9%)	13 (15.1%)	14 (17.7%)	10 (15.4%)	
	Sometimes worried	9 (10.2%)	8 (9.3%)	2 (2.5%)	2 (3.1%)	
	Often worried	6 (6.8%)	4 (4.7%)	3 (3.8%)	1 (1.5%)	
	Worried all the time	6 (6.8%)	3 (3.5%)	1 (1.3%)	1 (1.5%)	

(continued on next page)

Table 6 (continued)

		Survey 1 June 2020 (N = 92)	Survey 2 October 2020 (N = 87)	Survey 3 February 2021 (N = 80)	Survey 4 June 2021 (N = 67)	P-value
Career	Not worried at all	22 (25.0%)	18 (20.9%)	32 (40.0%)	35 (53.0%)	0.006
	Rarely worried	21 (23.9%)	31 (36.1%)	17 (21.3%)	12 (18.2%)	
	Sometimes worried	26 (29.6%)	22 (25.6%)	15 (18.7%)	11 (16.7%)	
	Often worried	9 (10.2%)	10 (11.6%)	9 (11.3%)	5 (7.6%)	
	Worried all the time	10 (11.4%)	5 (5.8%)	7 (8.7%)	3 (4.6%)	

Table 7
Univariate Regression.

Measure	June 2021 Endpoint PHQ Score N = 67		June 2021 Endpoint GAD Score N = 67		June 2021 Endpoint PCL Score N = 67	
	β (se)	P value	β (se)	P value	β (se)	P value
Baseline score	0.48 (0.09)	<0.0001	0.55 (0.11)	<0.0001	0.73 (0.13)	<0.0001
Covid event*	-0.60 (1.27)	0.64	1.41 (1.49)	0.9	-1.90 (4.20)	0.6
Traumatic event*	-0.14 (1.22)	0.9	0.89 (1.43)	0.5	5.42 (3.89)	0.17
Any event*	-1.10 (3.32)	0.74	0.20 (3.89)	0.9	1.50 (10.67)	0.8
LOT-R	-0.26 (0.16)	0.12	-0.19 (0.19)	0.32	-0.47 (0.54)	0.39
B-COPE +	-0.01 (0.07)	0.84	-0.05 (0.08)	0.56	-0.03 (0.24)	0.9
B-COPE -	0.26 (0.12)	0.03	0.53 (0.12)	0.0001	0.74 (0.39)	0.06
R-COPE +	0.04 (0.09)	0.63	0.04 (0.10)	0.68	-0.40 (0.29)	0.17
R-COPE -	0.12 (0.21)	0.56	0.22 (0.25)	0.36	1.03 (0.68)	0.13
CD-RISC	-0.23 (0.09)	0.02	-0.38 (0.10)	0.0005	-0.50 (0.32)	0.12
MSPSS	-0.09 (0.04)	0.03	-0.03 (0.05)	0.5	-0.35 (0.12)	0.008
MBI	0.61 (0.18)	0.001	0.86 (0.20)	<0.0001	1.52 (0.61)	0.02
AUDIT-C	-0.35 (0.32)	0.3	0.84 (0.37)	0.03	-0.40 (1.08)	0.71
PGI	-0.03 (0.05)	0.5	0.02 (0.06)	0.7	0.07 (0.18)	0.7
Previous Psychiatric Diagnosis	1.63 (1.58)	0.3	4.76 (1.80)	0.01	8.32 (5.12)	0.1
Previous Psychiatric Treatment	1.24 (1.20)	0.3	1.94 (1.41)	0.2	5.08 (3.94)	0.2
Current Psychiatric Treatment	2.34 (1.58)	0.1	3.50 (1.77)	0.05	7.00 (4.96)	0.2
SAS-SR						
Work for pay	0.31 (0.55)	0.58	-0.14 (0.65)	0.83	2.83 (1.79)	0.12
Housework	0.17 (0.45)	0.71	-0.18 (0.53)	0.74	1.11 (1.49)	0.46
Student	1.02 (0.48)	0.04	1.08 (0.57)	0.07	2.54 (1.62)	0.12
Social and leisure	-0.11 (0.22)	0.63	-0.08 (0.26)	0.76	0.56 (0.74)	0.44
Family and outside home	0.43 (0.23)	0.06	0.72 (0.27)	0.009	1.93 (0.76)	0.01
Primary relationship	0.61 (0.35)	0.08	0.34 (0.41)	0.4	1.32 (1.16)	0.26
Parental	0.55 (0.23)	0.02	0.25 (0.28)	0.38	0.88 (0.79)	0.27
Family unit	-0.48 (0.28)	0.09	-0.29 (0.33)	0.39	-1.00 (0.97)	0.3
CTQ						
Minimalization/Denial	-0.13 (0.23)	0.56	-0.02 (0.27)	0.9	-1.06 (0.77)	0.17
Emotional abuse	0.39 (0.13)	0.003	0.17 (0.16)	0.3	1.74 (0.39)	<0.0001
Physical abuse	0.52 (0.24)	0.04	0.29 (0.29)	0.31	2.26 (0.76)	0.005
Sexual abuse	-0.13 (0.35)	0.72	-0.16 (0.42)	0.7	-0.88 (1.16)	0.45
Emotional neglect	-0.13 (0.15)	0.4	-0.07 (0.18)	0.67	-1.32 (0.47)	0.007
Physical neglect	-0.13 (0.44)	0.75	0.04 (0.53)	0.93	-0.08 (1.44)	0.96
TIPI						
Extraversion	0.01 (0.36)	0.9	-0.16 (0.42)	0.71	-1.26 (1.21)	0.29
Agreeableness	-0.28 (0.50)	0.57	-0.41 (0.59)	0.5	-1.19 (1.67)	0.47
Conscientiousness	-0.56 (0.46)	0.2	-0.82 (0.54)	0.1	-1.24 (1.51)	0.41
Emotional stability	-1.28 (0.40)	0.002	-1.87 (0.45)	0.0001	-3.93 (1.33)	0.004
Openness to experiences	-0.47 (0.49)	0.34	0.49 (0.58)	0.39	1.83 (1.64)	0.27
COVID-19 worries						
Infected with COVID	-0.50 (0.49)	0.31	0.09 (0.59)	0.87	-1.26 (1.69)	0.46
Not knowing if I have COVID	0.25 (0.54)	0.64	1.02 (0.63)	0.1	0.01 (1.81)	0.9
Infecting family	0.09 (0.48)	0.84	0.53 (0.57)	0.36	0.55 (1.68)	0.74
Overwhelmed	0.76 (0.47)	0.1	1.40 (0.54)	0.01	2.88 (1.56)	0.07
Seriously ill	-0.07 (0.52)	0.8	0.18 (0.61)	0.77	1.14 (1.78)	0.53
Dying from COVID	-0.68 (0.54)	0.21	-0.13 (0.65)	0.84	-0.83 (1.92)	0.67
Not able to visit loved ones	-0.08 (0.46)	0.86	0.02 (0.55)	0.96	-1.06 (1.57)	0.5
Finances	0.90 (0.43)	0.04	0.78 (0.52)	0.14	2.86 (1.47)	0.05
Personal relationships	0.42 (0.45)	0.3	0.37 (0.54)	0.49	0.68 (1.57)	0.67
Care for children/dependents	0.02 (0.48)	0.97	-0.02 (0.57)	0.97	1.53 (1.69)	0.37
Affect career	-0.002 (0.48)	0.9	0.56 (0.56)	0.32	-0.99 (1.64)	0.54

* This is a categorical variable (yes/no) and the reference group used

PCL-5: Fifth edition (DSM-5)'s PTSD Checklist; GAD-7: 7-Item Generalized Anxiety Disorder Scale; PHQ-8: 8-Item Patient Health Questionnaire; LOT-R: Revised Life Orientation Test; BCOPE+: positive coping skills, Brief COPE; BCOPE -: negative coping skills, Brief COPE; RCOPE +: positive coping skills, Religious COPE; RCOPE -: negative coping skills, Religious COPE; CD-RISC: Connor-Davidson Resilience Scale; MSPSS: Multidimensional Scale of Perceived Social Support; MBI: Maslach Burnout Inventory; AUDIT-C: Alcohol Use Disorders Identification Test - Concise; PGI: Posttraumatic Growth Inventory; SAS-SR: Social Adjustment Scale Self-Report; CTQ: Childhood Trauma Questionnaire; TIPI: Ten Item Personality Inventory.

worries related to finances.

Predictors of endpoint PHQ-8 scores in multivariable regression include higher baseline PHQ-8 scores ($b = 0.44$, $SE=0.10$, $p = 0.0001$) and higher CTQ emotional abuse scores ($b = 0.28$, $SE=0.12$, $p = 0.023$). The adjusted R^2 of the model is 0.31. Predictors of endpoint GAD-7 scores in multivariable regression include higher baseline GAD-7 scores ($b = 0.47$, $SE=0.11$, $p<0.001$) and lower CD-RISC scores ($b=-0.25$, $SE=0.10$, $p = 0.017$). The adjusted R^2 of the model is 0.33. Predictors of endpoint PCL-5 scores in multivariable regression include higher baseline PCL-5 scores ($b = 0.60$, $SE=0.14$, $p<0.001$) and higher CTQ emotional abuse scores ($b = 1.05$, $SE=0.39$, $p = 0.009$). The adjusted R^2 of the model is 0.43.

4. Discussion

This study prospectively measured MS3s' well-being, worries about COVID, and exposure to stressful events during their first experiences on clinical rotations. We examined how experiencing stressful, traumatic, and COVID-related events over time affected participants' well-being. Lastly, we explored individual risk, coping, and protective factors that could possibly influence our outcome measures.

4.1. Mental health outcomes

Overall, 73.9% of students screened positive for clinically significant symptoms of depression, anxiety, or PTSD at some point throughout the year. The greatest number of students screened positive for psychological distress in June 2020, prior to the start of their clinical rotations. At this time, their reported symptoms of MDD were similar to results across class-years at 16 allopathic medical institutions in Washington and New York State (Christophers et al., 2021), the general population (Czeisler et al., 2020), and frontline healthcare professionals (Feingold et al., 2021). However, MS3s at ISMMS reported significantly more GAD and fewer PTSD-related symptoms than any of these other groups. June 2020 may have been a particularly challenging time; students were concerned about the effects of COVID-19 on their health, finances, and careers, and many were socially isolated while quarantining off-campus and studying for their first United States Medical Licensing Examination. Additionally, during this period of time, the murders of George Floyd, Breonna Taylor, Ahmaud Arbery, and other Black Americans highlighted the systemic racism in the U.S. and sparked protests against police brutality across the globe. This exposure to violence and racism may have contributed to higher, yet nonsignificant, PCL scores in minority participants in our sample.

Stability in mental health outcomes over the year was unexpected, as we hypothesized COVID-19 would compound the stressors of third year and negatively impact psychological outcomes. The only significant difference in psychological outcomes for the entire year was the number of students who screened positive for PTSD in June 2020 (Survey 1) to February 2022 (Survey 3). Our small sample size and not clinical significance likely accounts for this finding, given the number of people who screened positive for PTSD at years end in June 2021 (Survey 4) was not significantly different from the baseline in June 2020 (Survey 1). Longitudinal studies of mental health during the COVID-19 pandemic have not been consistent; some have reported that depression increased from Spring 2020 to Spring 2021 (Ettman et al., 2022), some report that mental health decreased from April 2020 to September 2020 (Stroud and Gutman, 2021), and others report that depression, anxiety, PTSD, and insomnia were stable in HCWs between November 2020 and February 2021 (Jordan et al., 2021). For our population, the significant decrease in COVID-19 fears in 10 of 11 domains may have contributed; these fears may have lessened due to the development of vaccines, availability of testing, and decrease in deaths. Changes to curriculum and mental health resources implemented in the past decade in response to the 2006–2007 well-being study at ISMMS may also have enhanced students' capacity to withstand difficult events. Additionally, despite more

directly confronting COVID-19, medical students may have suffered fewer interruptions to their life than the general population, as students interacted in-person with others daily, possibly reducing feelings of isolation.

Notably, the majority of our study participants are not members of groups at-risk for longitudinal mental distress due to COVID-19, including but not limited to: being college-aged or 18–23 (American Psychological Association, 2020a, 2020b), belonging to an ethnic or racial minority group (Czeisler et al., 2020), cohabitating (Asmundson et al., 2020), having unstable housing (Nguyen et al., 2020), being unemployed (Solomou and Constantinidou, 2020), or having job insecurity (Wilson et al., 2020). As medical students, our cohort possessed protective factors such as healthcare knowledge and early adoption of precautionary measures (Geng et al., 2021; Pouralizadeh et al., 2020; Racine et al., 2021). These factors may have contributed to our students' ability to adapt to the changing environment after initial stress.

To our knowledge, no other group has reported the longitudinal psychological impact of COVID-19 on medical students rotating through hospital wards over a full year. The only previous study to follow medical student mental health over a clinical year was conducted at ISMMS from 2006 to 2007 by Haglund and colleagues. Like them, we found no significant differences in average anxiety and PTSD scores over the year. The prevalence of depression, anxiety, and PTSD was higher in our study. While we found that average depression scores remained stable over the year, Haglund found higher depression scores at year's end, though this increase was small. Both studies found that traumatic events were not associated with worse psychological outcomes. However, in this study, 28% of students experienced at least one traumatic event, a sharp decrease from the 63% of students in Haglund's study (Haglund et al., 2009).

4.2. Predictive factors

Baseline psychopathology predicted endpoint psychological distress (i.e., higher baseline PHQ-8, GAD-7, and PCL-5 scores were associated with higher endpoint MDD, GAD, and PTSD, respectively). This was expected, as individuals with pre-existing psychological struggles are more likely to experience major negative impacts of the COVID-19 pandemic (Kaiser Family Foundation, 2020). Additionally, experiencing childhood emotional abuse was associated with higher levels of depression and PTSD, but not with anxiety. Children who experience emotional abuse may develop enduring, distorted beliefs that bias information processing and are more likely to develop psychopathology (Alloy et al., 2000; Beck, 2005; Gibb et al., 2003; Reichert and Flannery-Schroeder, 2014). It was surprising that emotional abuse was not predictive of anxiety, as previous studies have suggested that emotional dysregulation mediates the relationship between childhood emotional abuse and anxiety (Soenke et al., 2010). It may be that our participants' adaptive emotional regulation strategies were protective.

Lower baseline resilience was associated with higher levels of anxiety. Resilience is the tendency to adapt to adversity and maintain a healthy level of functioning, and it follows that an inability to recover from and withstand stressors leads to worse psychological outcomes. Surprisingly and in contrast with the literature (Thompson et al., 2018), there was no association between resilience and either PTSD or depression. It may be that the unique and chronic nature of the pandemic and continued exposure to stressful and traumatic events may weaken the buffer that resilience provides against psychological distress.

4.3. Limitations

Our study has limitations. The primary limitation with our study was that our sample size was relatively small and sporadic, as thirty-eight percent of MS3s were not included in this analysis. In order to account for this limitation, the data needed to be aggregated when looking at change in order to get a large enough sample size. Future studies should

attempt to recruit from a larger participant pool, possibly from multiple medical schools. With a larger sample size, more sophisticated methods of data analysis could be used to look at trajectories, such as latent growth mixture modeling. Other limitations are that psychologically distressed individuals may have been less likely to participate, given the activation energy required. We also included an original “Worries About COVID-19” scale, which has high internal stability but has not been reproduced by other groups. Lastly, our student population was predominantly white, male, single, and around age 25, which may impact external validity.

4.4. Conclusions

Psychological distress was prevalent but stable for MS3s rotating on Mount Sinai Hospital’s wards during the COVID-19 pandemic. Importantly, the mental distress of our population was not correlated with any traumas or stress related to the pandemic or even clinical experiences. Rather than disaster exposure, it was what our subjects brought to their third year of medical school that mattered most for their mental health, particularly their childhood trauma, prior psychiatric distress, and resilience. This speaks to the need for wellness interventions to address stress that goes well beyond the pandemic. Medical educators could consider incorporating resilience training into medical school curriculum or educating students about the role of trauma and previous psychological distress in rendering them more vulnerable during their clerkship rotations and other potential stressors. Additionally, this study highlights the importance of guaranteeing support for medical students, whether through in person or telehealth counseling services, to address both pre-trauma risk factors and well-being as well as potentially damaging psychological effects of traumatic events. Future studies may investigate if other factors mediate the relationship between prior vulnerabilities and psychiatric disorders or the effectiveness of targeted strategies to promote medical student wellness during times of crises. They may also evaluate if medical students’ distress is heightened during rotations on certain specialties to identify critical intervention time points.

Funding

This study was funded by the Office of Well-being and Resilience at the Icahn School of Medicine at Mount Sinai. Jonathan Ripp and Dennis Charney are leaders of the Office of Well-being and Resilience and assisted in study design, interpretation of the data, and decision to submit the article for publication.

Conflicts of Interest

The author(s) declare(s) that they have no competing interests. They would, however, like to disclose that Dr. Charney is named as co-inventor on patents filed by the Icahn School of Medicine at Mount Sinai (ISMMS) relating to the treatment for treatment-resistant depression, suicidal ideation and other disorders. ISMMS has entered into a licensing agreement with Janssen Pharmaceuticals, Inc. and it has and will receive payments from Janssen under the license agreement related to these patents for the treatment of treatment-resistant depression and suicidal ideation. Consistent with the ISMMS Faculty Handbook (the medical school policy), Dr. Charney is entitled to a portion of the payments received by the ISMMS. Since SPRAVATO has received regulatory approval for treatment-resistant depression, ISMMS and thus, through the ISMMS, Dr. Charney, will be entitled to additional payments, beyond those already received, under the license agreement. Dr. Charney is a named co-inventor on several patents filed by ISMMS for a cognitive training intervention to treat depression and related psychiatric disorders. The ISMMS has entered into a licensing agreement with Click Therapeutics, Inc. and has and will receive payments related to the use of this cognitive training intervention for the treatment of psychiatric

disorders. In accordance with the ISMMS Faculty Handbook, Dr. Charney has received a portion of these payments and is entitled to a portion of any additional payments that the medical school might receive from this license with Click Therapeutics. Dr. Charney is a named co-inventor on a patent application filed by the ISMMS for the use of intranasally administered Neuropeptide Y (NPY) for the treatment of mood and anxiety disorders. This intellectual property has not been licensed. Dr. Charney is a named co-inventor on a patent application in the US, and several issued patents outside the US filed by the ISMMS related to the use of ketamine for the treatment of post-traumatic stress disorder (PTSD). This intellectual property has not been licensed. Dr. Charney is a named co-inventor on a patent application filed by ISMMS for systems and methods for providing a resilience building application to support mental health of subjects. This intellectual property has not been licensed.

Acknowledgments

The authors wish to thank Kira Schidmt for her administrative efforts, as well as Dr. David Muller and the Medical Education team at the Icahn School of Medicine at Mount Sinai for their thoughtful feedback on this work.

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