Journal of University Teaching & Learning Practice

Volume 18
Issue 8 *Standard Issue 4*

Article 13

2021

The mental wellbeing of optometry and pharmacy students in New Zealand during COVID-19

Philip R. K. Turnbull
University of Auckland, New Zealand, p.turnbull@auckland.ac.nz

Lynne Petersen
University of Auckland, New Zealand, l.petersen@auckland.ac.nz

Andrew V. Collins
University of Auckland, New Zealand, a.collins@auckland.ac.nz

Recommended Citation

Turnbull, P. R., Petersen, L., & Collins, A. V. (2021). The mental wellbeing of optometry and pharmacy students in New Zealand during COVID-19. *Journal of University Teaching & Learning Practice, 18*(8). https://doi.org/10.53761/1.18.8.13

The mental wellbeing of optometry and pharmacy students in New Zealand during COVID-19

Abstract

At a time of transition into adulthood, tertiary study places additional stresses on the mental wellbeing of students. The continual assessment, long teaching hours, and expectation of professionalism that is expected from students within clinical programmes places even more burden on these students. Then in 2020, with the COVID-19 lockdown, there were significant changes to how these programs were delivered. We surveyed the mental wellbeing of our undergraduate students in the Bachelor of Optometry and Bachelor of Pharmacy programmes at the University of Auckland in 2019 and 2020. Using validated screening questionnaires, we found a high level of anxiety and depression in both years, however, in 2020 following the lockdown, anxiety levels in our students decreased. We found that the leading stressor was academic stress, and levels of anxiety were inversely correlated with perceived academic success. Therefore, we believe the lockdown, which provided both a break from clinical stresses and a change in teaching modality to online delivery, provided a period of relief, despite the potential stressful environment regarding COVID-19. To help alleviate the high level of distress in our students, lessons could be learned to decrease the stress levels in our students by continuing with alternative teaching and assessment styles.

Practitioner Notes

1. A substantial proportion of tertiary clinical students face experience anxiety and depression
2. Most of the stress derives from academic pressures
3. During the COVID-19 lockdown, with enforced changes to teaching and evaluation, students experienced a significant reduction in anxiety
4. Modifications to standard clinical teaching methods to include more online and asynchronous assessment methods may improve the mental wellbeing of students

Keywords

Mental Wellbeing, clinical, depression, anxiety

Introduction

The transition from adolescence to adulthood is becoming an increasingly stressful time (Arnett et al., 2014), and attending university places additional stresses on the mental wellbeing of young adults. While the age of onset of mood and anxiety disorders overlaps with the age that most begin their tertiary study (Kessler et al., 2007), compared to the general population, tertiary students are much more likely to experience mental health distress (Ibrahim et al., 2013; Larcombe et al., 2016; Leahy et al., 2010; Stallman, 2008). Our improved appreciation of the impact that mental distress can have on physical wellbeing, productivity, and perception (Chambel & Curral, 2005; Shields, 2001), is driving the desire to understand the extent of the problem, but also develop teaching strategies that may mitigate some distress (Brigati et al., 2020; Hsu & Goldsmith, 2021). In addition to the increased academic challenge, which may not necessarily lead to distress (Shields, 2001), the transition from secondary to tertiary learning requires students to suddenly become more responsible for their own learning, and the pressure that this brings often coincides with other life factors, potentially including moving cities, leaving family and friends, joining new social circles, financial responsibility, and experiencing life as an independent adult.

A recent survey ("*Kei Te Pai?*") run by the New Zealand Union of Students' Associations was completed by 1762 students (Gharibi, 2018). This nationwide survey revealed high levels of mental distress in the study body, and a complex interaction of factors which contribute to mental distress: outcomes that are seen in similar international studies (Mofatteh, 2021). Unfortunately, the *Kei Te Pai?* study underrepresented responses from the University of Auckland, and after discussion with our clinical students, none had taken part in the survey. Therefore, this study aimed to specifically target clinical undergraduate students at the Faculty of Medical & Health Sciences (FMHS), in the University of Auckland, using an abbreviated but similar version of the *Kei Te Pai?* questionnaire.

Clinical students face additional challenges beyond their non-clinical peers, which can, but not always (Bacchi & Licinio, 2015), lead to increased levels of mental distress (AlFaris et al., 2016; de Sousa et al., 2018). Both the Bachelor of Optometry (BOptom, "Bachelor of Optometry - The University of Auckland" 2021) and the Bachelor of Pharmacy (BPharm, "Bachelor of Pharmacy - The University of Auckland" 2021) are limited number second-year entry health programmes, where candidates gain entry via a common competitive first-year Bachelor of Health Science (BPharm only) or Bachelor of Science (BPharm and BOptom) programme, or as graduates of other relevant programmes. These clinical programmes take longer than a typical three-year bachelor's degree; the pharmacy programme takes four years to complete, and the optometry programme takes five years in total. Obviously, this extends any existing academic and financial pressures, but also introduces additional stress from seeing friends in other courses graduating and begin earning income in the world outside of tertiary study.

The final year of the BOptom programme is effectively a clinical intern year where students routinely see patients under supervision in an optometry clinic, while pharmacy graduates complete their intern training post-degree. The later years of these programmes involves larger (30 to 60-point) value courses (where 60-points equals full time study of 40 hours per week) with a

focus on clinical practice. Here students interact with members of the public, who are often unwell themselves. During these interactions, they need to maintain a professional persona, day after day, independent of what might be occurring in their personal life. Patient interactions are also assessed continuously by clinical preceptors, leading to students receiving constant (often negative) feedback or suggestions for improvement.

In the BPharm, learning is done in clinical modules focussed on a particular topic at a time, with learning within that module integrated vertically and horizontally. Many modules are assessed as they are completed, leading to an increased number of assessments throughout the year, and many are conducted as face-to-face tests run under exam conditions, which carries a great deal of stress for students. The BOptom is structured on a more traditional course/semester basis, but also includes a similar high assessment load throughout the year, including one on one direct assessments, as well as end-of-year final examinations. Both programmes allow professional registration upon completion of the degree, but this means that assessments are frequent and often 'must-pass'. Resultingly, failure of a single assessment could compromise an individual's ability to pass the overall course, which could leave students with almost continual test anxiety (Guraya et al., 2018).

There is also a requirement for clinical students to conduct themselves in an ethical and professional manner (FMHS *Fitness to Practise Policy*, 2018) to ensure they are fit to register as health professionals at the end of their degree ("Health Practitioners Competence Assurance Act" 2003). This requirement places additional expectations on the students to remain in good standing even outside the university environment, which can complicate social interactions and limit their recreational activities compared to some of their peers. Other freedoms typically associated with tertiary study are also gone, for example, optional lectures are replaced with compulsory clinical rotations that can be in unfamiliar locations with early start times, creating transportation stress and location anxiety. The workload also increases throughout the programmes, which has the potential to limit personal time for relaxation or relationships. Students also must arrange externships and placements, while also considering future job opportunities in a class that may be competing for the same positions.

To assess the mental wellbeing of the students in our pharmacy and optometry programmes, we initiated a survey with the intention of running it annually. However, COVID-19 made the 2020 academic year quite different from normal. USA undergraduates, who were significantly more impacted than those in New Zealand, showed a significant negative impact of COVID-19 on mental wellness, largely due to the additional stresses that the pandemic introduced to society (Charles et al., 2021; Fruehwirth et al., 2021; Kecojevic et al., 2020). As we fortuitously ran the survey over two concurrent years that straddled the nationwide lockdown, it provided us a unique opportunity to more directly assess the impact that the COVID-19 related disruptions had on our undergraduate clinical students in the University of Auckland, New Zealand.

Methods

Study design

The study design was cross-sectional, measured within a one-week period in the final week of Semester one, over two consecutive years: 2019 (week starting June 10th), and 2020 (week starting June 8th). Survey invitations were sent out to all enrolled students in the undergraduate optometry or pharmacy programmes at the University of Auckland as an announcement using the learning management software Canvas. The first invitation was sent on the morning the survey opened for responses, and a reminder was sent 5 days later, before the survey closed after one week. A short response window was used to minimise the influence of external factors, and the week was selected to minimise overlap with assessments across the two programmes as much as possible, to minimise short-term exam proximity stresses (Thiemann et al., 2020).

This study was given ethical approval by The University of Auckland Human Participants Ethics Committee (reference: 023113), and participants were not compelled to take part and could freely abandon the questionnaire or chose not to answer particular questions. Only responses in which over 80% of the questions were answered were included in the analysis.

COVID-19 interruption

The response window was kept narrow to minimise the impact of external factors, however an unforeseen situation occurred between the two surveys. In response to community transmission of COVID-19, New Zealand went into Alert level 4 lockdown (effectively a stay-at-home order) on March 25, 2020 and remained at Alert level 2 (work and learn at home if possible) until June 9th ("Alert Levels and Updates" n.d.). This had a profound effect on all undergraduate teaching at the University of Auckland, and the impact would likely be reflected in the 2020 survey data which was active as New Zealand exited this lockdown period and began to return to Alert Level 1 (normal activity, no community transmission).

Survey

The survey was anonymous, and all questions were optional. The first section collected demographic information, including their age group, gender, sexual orientation, whether they were New Zealand born, whether they were an international or domestic student, and whether they entered the program through the graduate or undergraduate pathway. Additional programme level questions such as programme of study and year level followed, before questions regarding potential triggers of any distress they feel (including academic stress, family, relationships, living situations, financial difficulties), and whether they have considered dropping out of university because of these factors. There were also free-form text options for most questions. The survey then provided the standardised screening questionnaires for depression (PHQ-9) and generalised anxiety disorder (GAD-7) before questions regarding any formal mental health diagnoses. We

used the recommended criterion of 10 ('moderate') on either scale as a binary threshold for classifying students screening positive for depression or anxiety. At this level, the PHQ-9 has a sensitivity and specificity of 88 percent (Kroenke et al., 2001), and the GAD-7 has a sensitivity of 89 percent and a specificity of 82 percent (Spitzer et al., 2006). The final part of the survey questioned their use of remediation strategies, including medications and the use of university counselling. The full survey is attached as Supplemental Information.

After completing the survey, participants were given the option to enter a draw to win 1 of 4 $50 Westfield vouchers by entering some form of contact information (e.g., email or phone number) into a separate survey which was not linked to the responses in the initial survey. The identity of all participants was kept anonymous by telling winners to report only a provided keyword to reception staff (who were not involved in the study) to collect their prize.

Data analysis

Data was collected in real time in the survey software (Qualtrics, Utah, USA), then exported to RStudio (RStudio Team, 2020) for analysis. The primary outcome measures were the level of anxiety, depression, and a created variable called 'distressed', which was true when a participant screened positive for anxiety and/or depression. The measures were compared between the 2019 and 2020 survey, and across years within each programme. Secondary measures included the influence of socio-demographics on the primary outcome measures, and qualitative pooling of response themes of the freeform text responses. Socio-demographic proportions were compared using two-proportion z-tests, while other attributes were compared using one or two-way ANOVA for parametric variables, or Wilcoxon or Kruskal-Wallis for non-parametric variable comparisons, and Kendall's tau for correlations. Logistic regression was used to determine relative risks of each sociodemographic category on distress. P values < 0.05 were interpreted as significant.

Results

In 2019 we received a 42.0 percent response rate (201/479), while in 2020 we received a 47.8 percent (230/481) response rate. Questions were optional, and not all respondents answered all questions so the number of responses per question varied. However, there was no difference in the survey completion rate between the years; in 2019 83 percent of respondents answered all questions, which was similar in 2020 at 86 percent ($X^2=1.17$, $p = 0.279$). There was no significant difference in the age distribution of the respondents between the survey years ($F_{(1)} = 0.15$, $p = 0.906$), with approximately 39 percent in the age range 16-20, 56 percent between 21-25, 3 percent between 26-30, and 2 percent older than 31 years. There was no significant difference in the distribution of other sociodemographic factors between the 2019 and 2020 years (all $p > 0.1$, Fig 1), and these response rates broadly reflect the underlying student population, although the number of optometry responses ($n = 201$) compared to pharmacy students ($n = 161$) was slightly over-represented in both surveys, likely due to the survey being conducted primarily from the School of Optometry. Postgraduate entry was associated with a reduced relative risk of having distress (RR:

0.270, 95% CI 0.111-0.594, p = 0.002), but no other sociodemographic categories (listed in Figure 1) were modifiers for the risk of distress (all other factors p > 0.4).

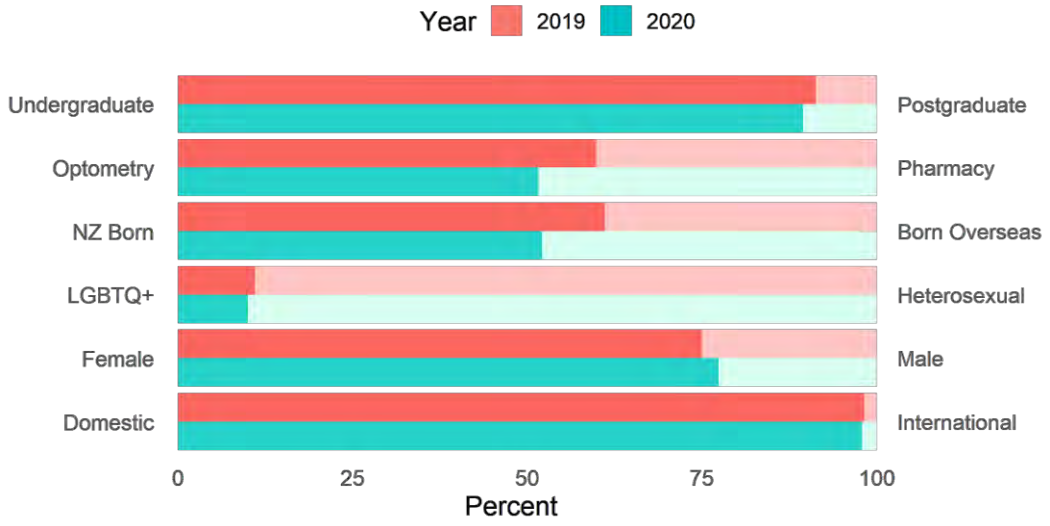

Figure 1:
Socio-demographics of respondents

There were no significant differences in the socio-demographics of the respondents of the 2019 and 2020 surveys (all p-values > 0.1), and the survey demographics broadly agreed with the underlying student population. Undergraduate vs Postgraduate refers to whether this is their first degree, and Domestic vs International refers to their student enrolment status.

Level of distress

In 2019, 55.2 percent of respondents were mentally distressed, with 47.1 percent of the respondents screening positive for anxiety and 36.6 percent screening positive for depression. In 2020, there was slight reduction in the number of mentally distressed students (44.7%), which was due to a significantly lower number of students screening positive for anxiety (27.4%, $X^2 = 14.3$, df = 1, $p < 0.001$, Fig 2a). There was no difference between the survey years in the level of depression (2020: 37.9%, $X^2 = 0.02$, df = 1, p = 0.889). Both depression and anxiety were highly correlated (2019: $r_\tau = 0.544$, $p < 0.001$, 2020: $r_\tau = 0.473$, $p < 0.001$, Fig 2b), with 28.5 percent of respondents screening positive for both in 2019, and 20.5 percent in 2020 ($X^2 = 2.69$, df = 1, p = 0.101). There was no significant difference in the proportion of distressed students between at each year of study within their programme ($F_3 = 1.40$, p = 0.242).

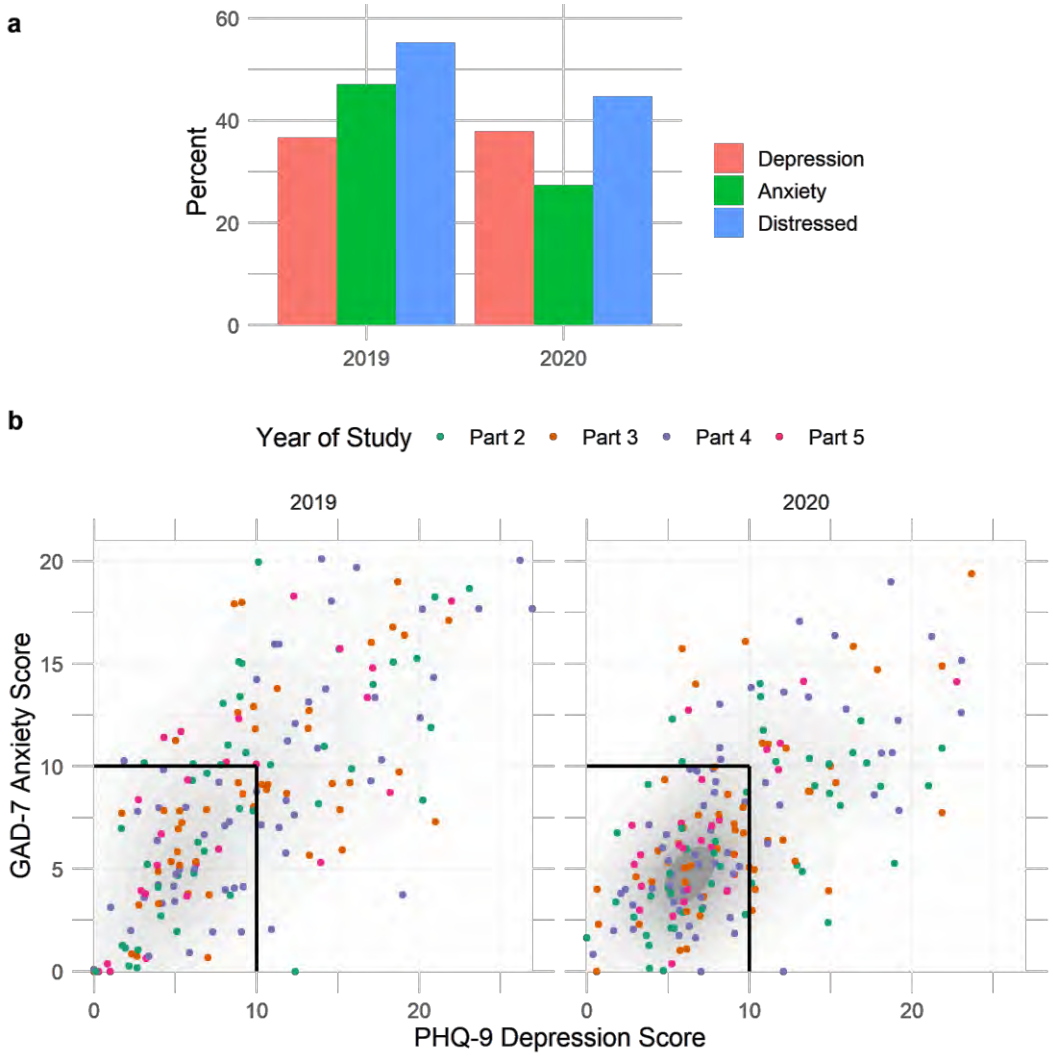

Figure 2
Depression and anxiety scores

a) Proportion of students in each year that screened positive (i.e., a score equal or greater than 10) on the GAD-7 anxiety screening test (out of 21, red) and the PHQ-9 depression screening test (out of 27, green), and those who scored positive on either or both screening tests (blue). b) Anxiety and depression scores were highly correlated. Marked with black lines are the thresholds for a positive screening. In 2020 there was a significant reduction in the number of students screening positive for anxiety.

Formal diagnoses

We asked whether respondents had received a formal diagnosis for a mental health condition. In 2019, 178 respondents answered the question. 67.4 percent said they had never received a formal diagnosis, while 11.8 percent said they had been diagnosed with an anxiety disorder and 11.8

percent with depression. 9 percent had been diagnosed with a different mental health condition, which included eating disorders, insomnia, bipolar, or post-traumatic stress disorder. In 2020, for the 201 responses, 72 percent said they have not received a formal mental health diagnosis. 8.0 percent said they had been diagnosed with an anxiety disorder and 10.4 percent said they had been diagnosed with depression. 9.4 percent had been diagnosed with a different mental health disorder. There was no difference in these proportions between the years (all $p > 0.280$).

Self-rated impact and stressors

Despite the sudden and drastic change in teaching delivery during COVID-19 lockdown, students self-rated their academic performance more highly in 2020 than in 2019, with a larger number of students rating their performance as above average across both optometry and pharmacy programmes ($X^2 = 6.47$, $df = 1$, $p = 0.011$, Fig 3a). The respondents' self-rated academic success was negatively correlated with their level of anxiety scored on the GAD-7 ($r_\tau = -0.105$, $p = 0.013$, Fig 3b). Academic challenges were the greatest contributor to student distress, followed by family pressures, both of which were significantly higher ranking than the other potential stressors ($X^2 = 546$, $df = 10$, $p < 0.001$, Fig 3c). 29 percent of free-form responses mentioned the frequency and distribution of assessments as sources of stress. There was no difference in the weightings of the individual contributors to distress between the 2019 and 2020 (all $p > 0.079$).

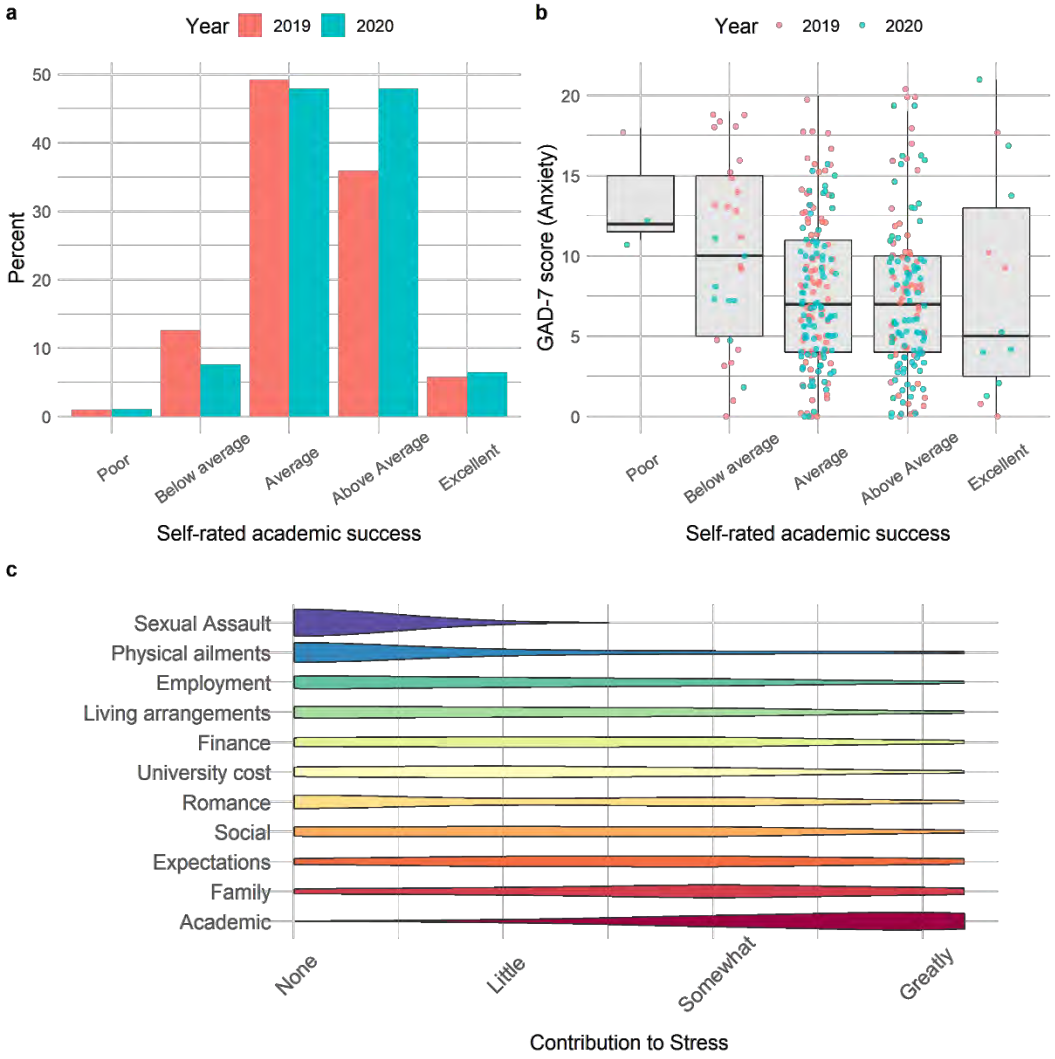

Figure 3
Stress and self-rated academic success

a) Despite the COVID-19 lockdown, students rating their own academic success more highly in 2020 compared to 2019. b) There was a negative correlation between the level of anxiety and a student's self-rated academic success. c) Academic pressure was by far the leading cause of stress, followed by family stresses.

There was no change in the proportion of students who had considered dropping out of their programs before and after COVID-19 (2019: 36.0%, 2020: 29.1%, X^2 =2.07, df = 1, p = 0.150). Reasons for considering dropping out, in decreasing order, were feeling overwhelmed (23.2%), fear of selecting the wrong career (17.4%), and fear of failing (15.6%). Drop out for mental health reasons were at 9.0 percent, just ahead of family or relationship difficulties (5.3%).

Conclusions

As the saying goes, before you can look after others, you must look after yourself, and this seems particularly challenging for clinical students. Our survey revealed a high amount of anxiety and depression in undergraduate students in our clinical programs. While approximately half of students screened positive for either anxiety or depression, less than 15 percent had received a formal diagnosis, a proportion like that seen in US pharmacy students (Hunt & Gable, 2013). The main barriers to seeking professional help were not lack of access nor stigma, but rather a perception that it would not help, or that the distress could be managed through self-management strategies like exercise, music, or religious activities. This is consistent with the cohort being aware of the transient cause of the mental distress, but possibly underappreciating the extent of their symptoms, and undervaluing the benefits that might occur if the distress was managed differently, which has been previously reported (Reavley et al., 2012).

The COVID-19 disruption appears to have had minimal negative impact on the mental wellbeing of this cohort of students, contrary to overseas experiences. This may be in part to the comparatively low levels of COVID-19 in New Zealand compared to other countries at the time of the surveys. However, this could also have been the result of the modified learning environment and techniques; at higher alert levels, there was minimal clinical contact, and all teaching and assessment was online. Assessments were less time-restricted, and the format was generally constrained to open-book quizzes or essays. Another contributing factor could be due to students returning to their family home for the lockdown, which may have helped prevent the increased level of anxiety (Ashraful Islam et al. 2018) due to COVID-19 that was seen elsewhere (Charles et al., 2021; Fruehwirth et al., 2021; Kecojevic et al. 2020).

While anxiety and depression scores were correlated, post-COVID we did not see any reduction in the level of depression, nor the number of students with both anxiety and depression. While there is strong covariance in prevalence and symptomatology between anxiety and depression (Jacobson & Newman, 2017), there are distinct symptoms and dimensions for each (Nitschke et al., 2001). Owing to the relatively proximal timing of the COVID-19 lockdown compared to the overall term at university, it is possible that the timing of our survey detected the earliest reversions of pure generalised anxiety symptoms (Wittchen, 2002) and given sufficient time we may have seen an improvement in depressive symptoms as well (Schleider et al., 2014).

While the levels of distress are high, there may also be some self-selection bias here: high achieving students may enjoy the stress that comes with academic challenges, and since they are aware of the temporary nature of the main stressor (the academic work), decide that professional help is not required. However, about one third of students had considered dropping out, with the top reasons (feeling overwhelmed, selecting the wrong career, or failing) all related to academic pressure and performance. There is clearly a cohort within the programmes who are struggling with the workload, perhaps trapped in a vicious cycle of less effective study due to distress, and poorer academic success.

Most distress that the students experience comes from the academic pressures placed on students within these programs. The main actionable feedback from the survey was better structuring and planning of assessments between the courses within each programme. Challenges to adapting

current teaching and assessment come from the fact there is a lot of compulsory content that needs to be taught, and the assessments need to be sufficiently robust to ensure that graduates are sufficiently trained to meet the external clinical standards required for registration by each profession. We intend to continue these annual surveys to guide our future teaching and assessment strategies.

Acknowledgements

We wish to extend thanks to Sachi Rathod, Sara Brookes, Pooja Nagaraj, Shinae Warren, Reeya Singh, and Rahma Mahdi, who helped run the survey over 2019 and 2020 as part of their undergraduate research project while completing their optometry degree.

References

Alert Levels and updates. (n.d.). Retrieved July 5, 2021, from https://covid19.govt.nz/alert-levels-and-updates/

AlFaris, E., Irfan, F., Qureshi, R., Naeem, N., Alshomrani, A., Ponnamperuma, G., Al Yousufi, N., Al Maflehi, N., Al Naami, M., Jamal, A. & van der Vleuten, C. (2016). Health professions' students have an alarming prevalence of depressive symptoms: exploration of the associated factors. *BMC Medical Education*, *16*(1), 279. https://doi.org/10.1186/s12909-016-0794-y

Arnett, J. J., Žukauskienė, R. & Sugimura, K. (2014). The new life stage of emerging adulthood at ages 18-29 years: implications for mental health. *The Lancet. Psychiatry*, *1*(7), 569–576. https://doi.org/10.1016/S2215-0366(14)00080-7

Ashraful Islam, M., Yun Low, W., Ting Tong, W., Wan Yuen, C. C. & Abdullah, A. (2018). Factors Associated with Depression among University Students in Malaysia: A Cross-sectional Study. *KnE Life Sciences*, 415–427 – 415–427. https://doi.org/10.18502/kls.v4i4.2302

Bacchi, S. & Licinio, J. (2015). Qualitative Literature Review of the Prevalence of Depression in Medical Students Compared to Students in Non-medical Degrees. *Academic Psychiatry: The Journal of the American Association of Directors of Psychiatric Residency Training and the Association for Academic Psychiatry*, *39*(3), 293–299. https://doi.org/10.1007/s40596-014-0241-5

Bachelor of Optometry - The University of Auckland. (2021). https://www.auckland.ac.nz/en/study/study-options/find-a-study-option/bachelor-of-optometry-boptom.html

Bachelor of Pharmacy - The University of Auckland. (2021). https://www.auckland.ac.nz/en/study/study-options/find-a-study-option/bachelor-of-pharmacy-bpharm.html

Brigati, J. R., England, B. J. & Schussler, E. E. (2020). How do undergraduates cope with anxiety resulting from active learning practices in introductory biology? *PloS One*, *15*(8), e0236558. https://doi.org/10.1371/journal.pone.0236558

Chambel, M. J. & Curral, L. (2005). Stress in academic life: Work characteristics as predictors of student well-being and performance. *Applied Psychology = Psychologie Appliquee*, *54*(1), 135–147. https://doi.org/10.1111/j.1464-0597.2005.00200.x

Charles, N. E., Strong, S. J., Burns, L. C., Bullerjahn, M. R. & Serafine, K. M. (2021). Increased mood disorder symptoms, perceived stress, and alcohol use among college students during the COVID-19 pandemic. *Psychiatry Research*, *296*, 113706. https://doi.org/10.1016/j.psychres.2021.113706

de Sousa, J. M., Moreira, C. A. & Telles-Correia, D. (2018). Anxiety, Depression and Academic Performance: A Study Amongst Portuguese Medical Students Versus Non-Medical Students. *Acta Médica Portuguesa*, *31*(9), 454–462. https://actamedicaportuguesa.com/revista/index.php/amp/article/view/9996/5486

FMHS. (2018, November 20). *Fitness to Practise Policy*. https://www.auckland.ac.nz/en/about/the-university/how-university-works/policy-and-administration/teaching-and-learning/fmhs-code-of-fitness-to-practise/fmhs-fitness-to-practise-policy.html

Fruehwirth, J. C., Biswas, S. & Perreira, K. M. (2021). The Covid-19 pandemic and mental health of first-year college students: Examining the effect of Covid-19 stressors using longitudinal data. *PloS One*, *16*(3), e0247999. https://doi.org/10.1371/journal.pone.0247999

Gharibi, K. (2018). *Kei Te Pai? Report on student mental health in Aotearoa*. NZ Union of Students Associations. Retrieved from https://gallery. mailchimp ….

Guraya, S. Y., Guraya, S. S., Habib, F., AlQuiliti, K. W. & Khoshhal, K. I. (2018). Medical students' perception of test anxiety triggered by different assessment modalities. *Medical Teacher*, *40*(sup1), S49–S55. https://doi.org/10.1080/0142159X.2018.1465178

Health Practitioners Competence Assurance Act. (2003). https://www.health.govt.nz/our-work/regulation-health-and-disability-system/health-practitioners-competence-assurance-act

Hsu, J. L. & Goldsmith, G. R. (2021). Instructor Strategies to Alleviate Stress and Anxiety among College and University STEM Students. *CBE Life Sciences Education*, *20*(1), es1. https://doi.org/10.1187/cbe.20-08-0189

Hunt, K. & Gable, K. N. (2013). Prevalence of depressive symptoms and obsessive–compulsive personality traits among pharmacy students. *Currents in Pharmacy Teaching and Learning*, *5*(6), 541–545. https://doi.org/10.1016/j.cptl.2013.07.013

Ibrahim, A. K., Kelly, S. J., Adams, C. E. & Glazebrook, C. (2013). A systematic review of studies of depression prevalence in university students. *Journal of Psychiatric Research*, *47*(3), 391–400. https://doi.org/10.1016/j.jpsychires.2012.11.015

Jacobson, N. C. & Newman, M. G. (2017). Anxiety and depression as bidirectional risk factors for one another: A meta-analysis of longitudinal studies. *Psychological Bulletin*, *143*(11), 1155–1200. https://doi.org/10.1037/bul0000111

Kecojevic, A., Basch, C. H., Sullivan, M. & Davi, N. K. (2020). The impact of the COVID-19 epidemic on mental health of undergraduate students in New Jersey, cross-sectional study. *PloS One*, *15*(9), e0239696. https://doi.org/10.1371/journal.pone.0239696

Kessler, R. C., Amminger, G. P., Aguilar-Gaxiola, S., Alonso, J., Lee, S. & Ustün, T. B. (2007). Age of onset of mental disorders: a review of recent literature. *Current Opinion in Psychiatry*, *20*(4), 359–364. https://doi.org/10.1097/YCO.0b013e32816ebc8c

Kroenke, K., Spitzer, R. L. & Williams, J. B. (2001). The PHQ-9: validity of a brief depression severity measure. *Journal of General Internal Medicine*, *16*(9), 606–613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Larcombe, W., Finch, S., Sore, R., Murray, C. M., Kentish, S., Mulder, R. A., Lee-Stecum, P., Baik, C., Tokatlidis, O. & Williams, D. A. (2016). Prevalence and socio-demographic correlates of psychological distress among students at an Australian university. *Studies in Higher Education*, *41*(6), 1074–1091. https://doi.org/10.1080/03075079.2014.966072

Leahy, C. M., Peterson, R. F., Wilson, I. G., Newbury, J. W., Tonkin, A. L. & Turnbull, D. (2010). Distress levels and self-reported treatment rates for medicine, law, psychology and mechanical engineering tertiary students: cross-sectional study. *The Australian and New Zealand Journal of Psychiatry*, *44*(7), 608–615. https://doi.org/10.3109/00048671003649052

Mofatteh, M. (2021). Risk factors associated with stress, anxiety, and depression among university undergraduate students. *AIMS Public Health*, *8*(1), 36–65. https://doi.org/10.3934/publichealth.2021004

Nitschke, J. B., Heller, W., Imig, J. C., McDonald, R. P. & Miller, G. A. (2001). Distinguishing Dimensions of Anxiety and Depression. *Cognitive Therapy and Research*, *25*(1), 1–22. https://doi.org/10.1023/A:1026485530405

Reavley, N. J., McCann, T. V. & Jorm, A. F. (2012). Mental health literacy in higher education students. *Early Intervention in Psychiatry*, *6*(1), 45–52. https://doi.org/10.1111/j.1751-7893.2011.00314.x

RStudio Team. (2020). *RStudio: Integrated Development Environment for R*. RStudio, PBC. http://www.rstudio.com/

Schleider, J. L., Krause, E. D. & Gillham, J. E. (2014). Sequential comorbidity of anxiety and depression in youth: Present knowledge and future directions. *Current Psychiatry Reviews*, *10*(1), 75–87. https://doi.org/10.2174/1573400509666131217010652

Shields, N. (2001). Stress, active coping, and academic performance among persisting and nonpersisting college students. *Journal of Applied Biobehavioral Research*, *6*(2), 65–81. https://doi.org/10.1111/j.1751-9861.2001.tb00107.x

Spitzer, R. L., Kroenke, K., Williams, J. B. W. & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of Internal Medicine*, *166*(10), 1092–1097. https://doi.org/10.1001/archinte.166.10.1092

Stallman, H. M. (2008). Prevalence of psychological distress in university students--implications for service delivery. *Australian Family Physician*, *37*(8), 673–677. https://www.ncbi.nlm.nih.gov/pubmed/18704221

Thiemann, P., Brimicombe, J., Benson, J. & Quince, T. (2020). When investigating depression and anxiety in undergraduate medical students timing of assessment is an important factor - a multicentre cross-sectional study. *BMC Medical Education*, *20*(1), 125. https://doi.org/10.1186/s12909-020-02029-0

Wittchen, H.-U. (2002). Generalized anxiety disorder: prevalence, burden, and cost to society. *Depression and Anxiety*, *16*(4), 162–171. https://doi.org/10.1002/da.10065