

Mental Well-Being in Students at University of Ruhuna Faculty of Medicine: A Cross-  
Sectional Study

by

Courtney E. Wimberly

Duke Global Health Institute  
Duke University

Date: \_\_\_\_\_

Approved:

\_\_\_\_\_  
Rae Jean Proeschold-Bell, Supervisor

\_\_\_\_\_  
Truls Østbye

\_\_\_\_\_  
Lawrence P. Park

Thesis submitted in partial fulfillment of  
the requirements for the degree of  
Master of Science in the Duke Global Health Institute  
in the Graduate School of Duke University

2019

ABSTRACT

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## **Abstract**

Objective: Though the role of negative mental health has been investigated, positive mental health in medical students remains an under-investigated topic. This study sought to describe and explore mental well-being in a population of medical students in Sri Lanka, by investigating the range and level of both positive and negative mental health and covariates and by comparing the results with those of US studies. Methods: Students at University of Ruhuna Faculty of Medicine completed paper-based, cross-sectional questionnaires that included demographic items, the Mental Health Continuum-Short Form (MHC-SF), the Kessler 10 Psychological Distress Scale (K10), and the Oldenburg Burnout Inventory (OLBI). Analysis took place in Stata and RStudio. Results: Most students were categorized with moderate positive mental health (64.8%) and severe psychological distress (40.4%). Negative and positive mental health outcomes were moderately associated. None of the demographic factors was a significant predictor of positive mental health nor academic performance, and none of the mental health outcomes predicted academic performance. Females reported significantly higher levels of burnout. Conclusions: Medical students in Sri Lanka may experience different levels of positive and negative mental health by year in school. In the current study, final year students reported significantly higher levels of psychological distress and burnout than first year students. Males and older students

were significantly more likely to have poor academic performance. Institutions should monitor medical student well-being and direct resources toward evidence-based activities, allowing students to continue along the upward spiral of well-being and flourish into successful medical practitioners.

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## Acknowledgements

Producing this Master's thesis has been an incredible experience filled with opportunities for learning and connection. I offer my thanks to my Duke faculty mentor, Dr. Truls Ostbye, for believing that I deserved to be in the Master of Science in Global Health program, for offering me the chance to work with his department, and for continuing to advise and support me throughout the development of this project. I would also like to thank Dr. Rae Jean Proeschold-Bell and Dr. Larry Park for agreeing to be on my committee despite their busy schedules and numerous other responsibilities. Thank you to Shayna Clancy and Dr. Ashley Price for their mentorship, guidance, and humor throughout this program. I would like to thank Dean Saman Wimalasundera at the University of Ruhuna for his approval to distribute questionnaires to the medical students. Thank you, also, to the Ethical Review Committee at the Faculty of Medicine for suggesting appropriate changes to and approving my protocol. Thank you to Mrs. Ruvini Kurukulasooriya, project coordinator at the Duke-Ruhuna Collaborative Centre, Faculty of Medicine, University of Ruhuna, for her help in obtaining entry and residence visas, finding and reserving local housing, and for going out of her way to help me submit print copies of my protocol to the Faculty of Medicine Ethical Review Committee before I arrived in Sri Lanka. I would like to thank Dr. Vijitha de Silva for his help throughout the ethical approval process. Without his generosity and aid, this project

likely would never have come to fruition. I would also like to thank Dr. Harshini Rajapakse, Senior Lecturer in Psychiatry, for agreeing to be my onsite supervisor in Galle and for her helpful comments as well as her help with obtaining ethical approval, recruiting participants, and distributing and collecting questionnaires. Finally, I would like to thank my family and friends, both old and new, for keeping me grounded during what I consider to be the most stressful and rewarding chapter of my life to date.

# 1. Introduction

Medical school is an opportunity for students to flourish, but there are multiple stressors that may affect students' experiences and abilities to achieve their full potential. Medical students, medical residents, and physicians report higher levels of psychological distress, burnout, and suicidal ideation than the general population, though most studies yielding these estimates are based in the Global North (Dyrbye, Thomas, & Shanafelt, 2006; Dyrbe et al., 2008; Dyrbye et al., 2014; Moir, Yelder, Sanson, & Chen, 2018). Burnout and distress in medical school and residency can lead to poor mental well-being and may impact provider patient care practices (Dyrbye et al., 2010; Fahrenkopf et al., 2008; Shanafelt, Bradley, Wipf, & Back, 2002). It is important to identify and assess the mental well-being of medical students, including both positive and negative contributors, so points of prevention and intervention may also be identified.

Before the 1990s, psychologists treated individuals based on the disease model – teasing out shortcomings in personalities or genealogies and treating current disorders (Seligman & Csikszentmihalyi, 2000). Positive psychology, rooted in the movement away from the curative toward a more preventive function of the discipline, intends to fill the gaps left by the widely-used disease model (Seligman & Csikszentmihalyi, 2000). Positive psychology research answers questions about what makes a person (or

community or society) happy and what makes him or her suffer, how the two interact (or don't), and how psychologists may intervene, decreasing suffering and building up happiness (Seligman & Csikszentmihalyi, 2000; Seligman et al. 2005). Research in this area focuses on that which contributes to an individual's subjective well-being and overall happiness in addition to contributors of negative mental health. The broaden-and-build theory ascribes positive emotions with the function of building social capital and knowledge via broadening of awareness and being more open to people and experiences, which leads to new thoughts, new relationships, and new endeavors (Fredrickson & Vacharkulksemsuk, 2013). There is evidence that positive emotions contribute to an upward spiral of emotional well-being and that this upward spiral may influence a person's ego resilience, defined as the ability to adapt to changing environments (Cohn et al., 2009). What's more, positive emotions have been shown to regulate the physiologic effects resulting from negative emotional states such as anxiety and fear (Fredrickson & Levenson, 1998; Tugade, Fredrickson, & Barrett, 2004). Positive emotions, too, contribute to an individual's overall mental well-being, and their continued presence can influence an individual's ability to navigate future stressors and experiences of distress.

There is further evidence for a two-continua model of mental health, as proposed by Keyes, which holds that positive and negative mental health exist simultaneously and are related yet lie on parallel continua rather than the same axis, as previously

hypothesized (Keyes, 2002; 2005; 2007). For medical students specifically, Dunn, Inglewicz, & Moutier (2008) propose another conceptual model of mental well-being – a “coping reservoir” into which both positive and negative inputs pour. This results in either the filling or draining of the reserve and determines the resilience of an individual to academic and psychosocial difficulties faced during medical training (Dunn et al., 2008). Dunn et al. (2008) indicate that the disadvantageous effects of burnout and negative mental health may be prevented – and resilience strengthened – through the promotion of mental well-being, not only during academic training but also as students develop into medical residents and practicing physicians.

Burnout resulting from prolonged psychological distress is of rising concern in the literature on medical student well-being. Burnout is traditionally defined as a psychological response to sustained occupational stress and consists of three dimensions: emotional exhaustion, depersonalization, and reduced personal accomplishment (Maslach, Jackson & Leiter, 1997). Recent research indicates that burnout can arise during medical training – arguably, the most formative years of a physician’s career (Dyrbye et al., 2012). Though the higher prevalence of negative mental health has been illuminated, there is scant literature on medical students’ positive mental health, positive emotions, and potential risk factors in this population.

Considering the existing knowledge gap, this study seeks to describe the mental well-being of medical university students in southern Sri Lanka by exploring and

comparing levels of positive and negative mental health and burnout of different years, and to investigate how positive and negative mental health may affect academic performance. Though small, the country of Sri Lanka is home to a booming population – as of 2017, more than 21 million people lived on the island (IHME, n.d.). The country has maintained universal health coverage since the 1950s, even in the wake of a 30-year civil war and devastating tsunami. As a result, Sri Lanka boasts health statistics rivaling those of nations in the Global North. For example, the country's infant mortality rate fell from 46.0 in 1990 to 7.2 in 2017 (IHME, n.d.). As the World Bank notes, no country of similar economic status possesses a better IMR (Smith, 2018).

Unfortunately, and possibly to Sri Lanka's detriment, government healthcare expenditure as of 2015 was still low at approximately 3% of GDP – a value down from 4.14% in 2000 (World Bank, n.d.). Mental health spending as a percentage of GDP is miniscule, perhaps reflecting the culture's level of acceptance of the field. Mental health in Sri Lanka is still stigmatized, particularly in the northeastern part of the island, thanks in part to a lack of education (Siva, 2010). Numbers of workers in the mental health sector are low – the WHO (n.d.) reports 0.29 psychiatrists and 0.09 psychologists per 100,000 population. For context, in Malaysia there are 0.83 psychiatrists and 0.29 psychologists per 100,000 population, and in Thailand, these numbers are 0.44 per 100,000 for both occupations (WHO, n.d.). Nevertheless, according to IHME (n.d.) data nearly 12% of Sri Lankans (almost 3 million people) suffer from a mental disorder.

Aside from prevalence studies, there exists limited literature on the effects of and risk factors for psychological distress in Asian undergraduate populations (Bhat et al., 2018; Peng et al., 2011). There is increasing literature on emotional intelligence in this group (Abe et al., 2013; Ranasinghe et al., 2017). However, to our knowledge, there is only one existing study on positive mental health in a population of Asian medical students, and the effects and potential correlates of positive mental health and psychological distress in Sri Lankan medical students have not been studied (Shi et al., 2016).

This research adds to the growing literature base on positive emotions and positive psychology by investigating mental well-being and its relationship with potential demographic correlates and academic performance in a population of medical students. The study provides a snapshot of the mental well-being of Sri Lanka's next generation of medical professionals and will aid in filling the research gap on positive mental health in both Sri Lankan and Asian populations. This study aimed to assess overall mental well-being in students at the University of Ruhuna Faculty of medicine, to estimate the relationship between potential risk factors and positive mental health, to estimate the effect of mental health on academic performance, and to compare our results with studies on U.S. medical students. Hypotheses developed from our research question and literature review were as follows:



*Hypothesis 1:* First-year medical students will have higher mean scores on the MHC-SF than final year medical students. Secondary relationships of interest are between socioeconomic status and gender with positive mental health.

*Hypothesis 2:* Students with higher mean scores on the MHC-SF and lower mean scores on the K10 and OLBI will perform better academically.

## **2. Methods**

### **2.1 Setting**

This descriptive, cross-sectional study was conducted from July to August 2018 at the University of Ruhuna Faculty of Medicine in Galle, Southern Province, Sri Lanka. The city of Galle, situated on the southwestern coast, is home to a population of over a million individuals, more than half of which work in the rural sector (District Secretariat – Galle, 2016). The Faculty where the study took place is the only medical school in the southern part of the country but admits students from across the island. The MBBS degree at the University of Ruhuna is a five-year hybrid-type program, consisting of three “preclinical” years focused on lectures, laboratory, and introductions to clinicals, and two “clinical” years focusing on lectures, clinical rounds, and professorial appointments. First and second year students engage in practicals in physiology, biochemistry, and anatomy dissections. The third year is a transient period – clinicals are introduced and students have microbiology and parasitology practicals. In the fourth year, students sit for an exam in pharmacology, pathology, and forensic and community medicine. During the final year, students begin professorial appointments and practice medicine, obstetrics and gynecology, pediatrics, surgery, and psychiatry.

## **2.2 Participants**

Participants were eligible to participate in the study if they were currently enrolled in the Faculty of Medicine, were at least 18 years old, and could read English. Participants were recruited via lecture sessions, trainings, and clinicals, where medical students of each year were invited to take and complete the questionnaire and to return it to the Psychiatry Department for pickup. The onsite supervisor and the PI introduced the study and distributed packets containing informed consent forms and questionnaires. To calculate statistical power, we chose the emotional well-being subscale of the Mental Health Continuum-Short Form as our primary outcome and assumed a standard deviation of 1.0 and 50 students per year (n=250). We estimated we could detect a difference between years in mean score of 0.4 (range 0-15) at the 5% significance level and with 95% power.

## **2.3 Procedures**

Once all required approvals were obtained, the study was introduced to potential respondents, and the primary investigator distributed questionnaires. Questionnaires were self-administered and returned to the Department of Psychiatry, where they were held for pickup. The PI periodically returned to the department to retrieve completed questionnaires for data entry. Informed written consent was obtained from all respondents prior to survey completion via a form stapled to the

questionnaire. Consent forms are housed at the Faculty of Medicine and will be retained for six years.

Ethical approval was sought from both the Ethical Review Committee, Faculty of Medicine, University of Ruhuna in Karapitiya, Galle, Sri Lanka, as well as the Campus Institutional Review Board, Duke University, Durham, North Carolina, USA, before data collection commenced. Approval to distribute questionnaires at lecture sessions, clinicals and trainings was obtained from the Dean of the Faculty of Medicine after receiving ethical review approval.

## **2.4 Measures**

### **2.4.1 Demographics**

The mental health scales were prefaced with a short demographics section. We collected information on age, gender, and year in school. As a proxy for socioeconomic status, we asked for mother's and father's highest levels of education. As a proxy for academic performance, we asked for the student's most recent exam score. The consent form and questionnaire used in this study are included in Appendix A. The levels of these ordinal variables and the proportion of students in each are included Table 1 (Results & Appendix B).

#### **2.4.2 Mental Health Continuum-Short Form (MHC-SF)**

The study employed the English version of the Mental Health Continuum-Short Form (MHC-SF) to quantify participants' positive mental health in the past month. The scale is derived from the long form (MHC-LF) and has been validated in US and South African adolescents and university students, French-Canadian postsecondary students, and Chilean adults, and has been successfully translated into and validated in French (Canadian), Chinese, Japanese, Dutch, and Spanish (Basson & Rothman, 2017; Echeverría et al., 2017; Keyes, 2009; Lamers et al., 2011). The MHC-SF consists of three subscales measuring emotional, social, and psychological well-being, respectively (Keyes, 2009). The MHC-SF (Cronbach's alpha = 0.921) is a continuous variable which consists of a composite score of subjective well-being over the past month; however, it also responds to a categorical diagnosis of languishing, flourishing, or moderate mental health (Dyrbye et al., 2012). Responses for the items (e.g., *During the past month, how often did you feel happy?*) are assigned the following values: (0) *Never*, (1) *Once or twice*, (2) *About once a week*, (3) *About 2 or 3 times a week*, (4) *Almost every day*, (5) *Every day*. Sum scores range from 0-70. Mean scores and categorical diagnoses of positive mental health were calculated using the measure's scoring mechanism (Keyes, 2009). Respondents were categorized as flourishing if they experienced  $\geq 1$  of 3 indicators of emotional well-being daily or almost every day and  $\geq 6$  of 11 indicators of either positive social functioning or positive psychological functioning daily or almost every day during the

past month. Respondents experiencing  $\geq 1$  emotional well-being symptom and  $\geq 6$  positive social or psychological functioning symptoms “never” or “once or twice” in this period were categorized with languishing mental health. Respondents scoring in neither of these categories were categorized as having moderate mental health.

### **2.4.3 Kessler 10 Psychological Distress Scale (K10)**

The study used the Kessler K10 Psychological Distress scale to measure symptoms of negative mental health. The K10 is a ten-item scale developed to screen for depressive and anxiety symptoms in general populations and has been validated and used in both the Global North and the Global South (Guo et al., 2015; Easton et al., 2017; Kessler et al., 2002). Responses for each of the Likert-type items are assigned the following values: (5) *All of the time*, (4) *Most of the time*, (3) *Some of the time*, (2) *A little of the time*, and (1) *None of the time* (Kessler et al., 2002). Answers on the K10 were totaled to obtain a composite score ranging from 10 (no distress) to 50 (severe distress) (Kessler et al., 2002). Composite scores correspond to a categorical diagnosis of likely to have “no,” “mild,” “moderate,” or “severe” mental disorder (Victorian Population National Health Survey, 2001). Both mean composite scores and their categorical responses were calculated for analysis.

#### **2.4.4 Oldenburg Burnout Inventory-Student Version (OLBI-S)**

The study employed the English language, student-adapted version of the Oldenburg Burnout Inventory to measure burnout (Demerouti, 2001; Halbesleben & Demerouti, 2005; Reis, Zanthopolou, & Tsaousis, 2015). The scale has been validated to measure burnout in both work and academic settings (Halbesleben & Demerouti, 2005; Reis et al., 2015). The OLBI (Cronbach's alpha = 0.74-0.87) is a 16-item measure with Likert-type responses corresponding to subscales measuring two factors of burnout: exhaustion and disengagement (Bakker & Demerouti, 2007; Halbesleben & Demerouti, 2005; Maroco & Campos, 2012). Eight items are positively worded and eight negatively worded, with positively-worded items reverse scored. Items are scored on a five-point scale ranging from (1) *Strongly disagree* to (5) *Strongly agree*. Higher scores correspond to higher levels of burnout, and subscale scores indicate the degree of exhaustion and disengagement, respectively (Halbesleben & Demerouti, 2005). There are no officially defined cutoff points for the OLBI in the literature. Mean subscale scores and mean composite scores were used for analysis.

#### **2.5 Analysis**

To maintain anonymity, signed consent forms were kept separate from questionnaires during data entry. If consent forms were left unsigned, data from questionnaires attached to these forms were not entered. Data were entered into the secure REDCap database to which only CW had access. After data collection and entry

concluded, consent forms were filed in a locked cabinet in a locked office in the Faculty of Medicine, University of Ruhuna. Questionnaires were shredded after data collection concluded. Data were cleaned using Stata 15. Missing data were also analyzed using this software. Person mean substitution was used to replace missing values if an individual missed two or fewer items on any of the three mental health scales. Missing items were replaced with the average of the individual's answers on the rest of the scale. All variables were checked for normality, skewness, and kurtosis. Then, both composite and categorical scores (if applicable) were calculated.

We hypothesized first-year medical students would report higher mean scores on the MHC-SF than final year medical students. Secondary relationships of interest are between socioeconomic status and gender with positive mental health. T-tests for differences in mean composite score between first and final years were performed for all composite mental health scores. Chi-square tests for independence, linear regression, and linear correlations were performed on categorical MHC-SF and K10 scores relative to students' year in school. Multivariate linear regression was used to investigate the relationships between demographic characteristics, negative mental health burnout and positive mental health. Ordinal and multinomial logistic regression were used to investigate the relationships between demographic characteristics, positive and negative mental health, burnout, and academic performance. For all statistical tests,  $\alpha = 0.05$  was used to determine significance. Stata version 15.1 (StataCorp, College Station, TX)



and RStudio version 1.1.456 (RStudio Team, Boston, MA; R version 3.5.1, R Core Team, Vienna, Austria) were used for analysis.

### 3. Results

#### 3.1 Sample demographic characteristics

A total of 327 students completed questionnaires. The average age in this sample was around 25 years, and most participants (62.6%) were female (Table 1). We aimed to capture 50 students from each year and mostly achieved this aim. In addition, we received more questionnaires from fourth (n=66) and fifth (n=112) year students. For the largest proportion of students, both mother's and father's highest level of education was post-high school or up to advanced level, and most students scored "Pass" or higher on their most recent exam. A full version of Table 1, with all demographic variables and their respective levels, is included in Appendix B.

*Table 1. Study participant demographic characteristics*

<b>Variable</b>	<b>Mean (Range) or Frequency (%)</b>
<b>Age</b>	24.9 (20-28)
<b>Gender</b>	
Female	204 (62.58)
Male	122 (37.42)
<b>Year</b>	
First	49 (15.08)
Second	50 (15.38)
Third	48 (14.77)
Fourth	66 (20.31)
Fifth	112 (34.46)

### **3.2 Overall mental well-being in University of Ruhuna medical students**

Sum scores on the MHC-SF in all 327 observations ranged from 5-69 (out of a possible 0-70) with a mean of 36.4. Continuous scores on the K10 ranged from 10-50 (possible 10-50) with a mean of 27.8. Composite OLBI scores ranged from 22-57 (possible 16-64) with a mean of 41.63. Mean OLBI subscale scores were 20.32 for disengagement and 21.31 for exhaustion, respectively. Mean composite scores, mean composite scores per year, and results of t-tests for differences in mean are included in Tables 2 and 3. T-tests for differences in mean composite score indicated significant differences in mean K10 ( $p = 0.013$ ) and OLBI ( $p = 0.003$ ) score between first and fifth year students. This aligned with our hypothesis that final year students report higher levels of distress and burnout than first year students. There was also a significant difference ( $p = <0.05$ ) in mean composite OLBI subscale scores between first and final year students (Table 3). However, for mean sum scores, we failed to reject the null hypothesis that there was no difference in mean positive mental health score between first and final year students.

*Table 2. Mean composite mental health scores, first and final years (T-tests for difference)*

	Mean [CI]	T-statistic (df)	P-value
<b>MHC-SF</b>			
First	38.4 [35.7, 41.1]	1.7967 (159)	0.074
Final	35.2 [33.2, 37.2]		
<b>K10</b>			
First	24.6 [22.4, 26.9]	-2.4997 (159)	0.013**
Final	27.9 (26.5, 29.4)		
<b>OLBI</b>			
First	40.1 [38.4, 41.9]	-2.5351 (158)	0.003**
Final	42.5 [41.5, 43.5]		

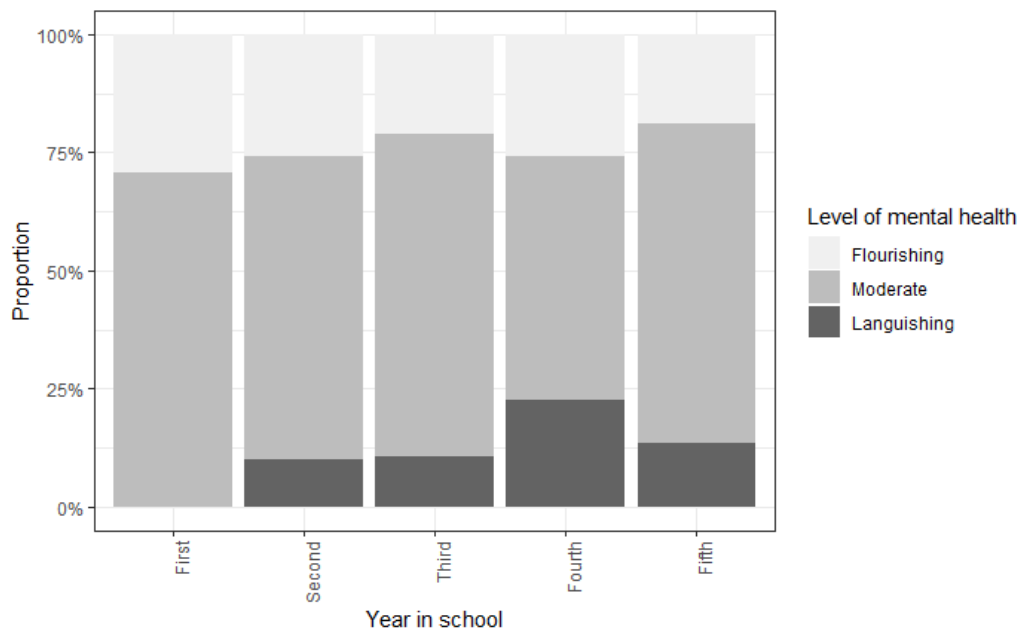
*Table 3. Mean OLBI subscale score, first and final years (T-tests for difference)*

	Mean [CI]	T-statistic (df)	P-value
<b>Disengagement</b>			
First	19.7 [18.9, 20.5]	-2.3956 (158)	0.018**
Final	20.8 [20.3, 21.4]		
<b>Exhaustion</b>			
First	20.4 [19.3, 21.5]	-2.6437 (158)	0.009**
Final	21.7 [21.1, 22.3]		

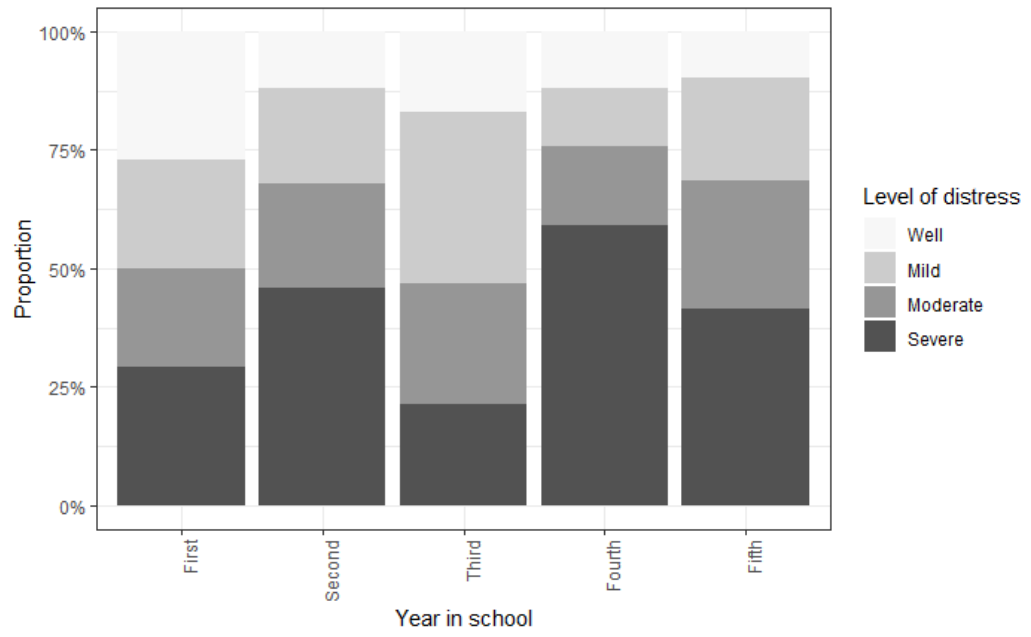
For categorical scores, Chi-square tests for independence, linear regression, and linear tests for trend all indicated significant associations between students' year in school and categories of MHC-SF and K10. Results of these tests are included in Tables 4 and 5. Visualizations of the association between MHC-SF category and year and K10 category and year are shown in Figures 1 and 2. These values offer strong evidence for the hypothesis that final year students report higher levels of distress than first year students and, alternatively, that first year students report higher levels of positive

functioning.

308 students answered the academic performance demographics question. Most students had good academic performance, defined in this study as scoring “Pass” or higher on their most recent exam (Table 1). Of these (n=308) students, approximately 20% (n=62) had flourishing mental health and good academic performance. Nearly 11% (n=34) had languishing mental health and good academic performance, and 3% (n=10) had flourishing mental health and poor academic performance (defined as a “Repeat” exam score). Around 2% (n=6) of students had languishing mental health and poor academic performance.



*Figure 1. Relationship between mental health level (MHC category) and year*



*Figure 2. Relationship between distress level (K10 category) and year*

*Table 4. Proportion of students in MHC-SF category by year in school, all observations - Freq. (%)*

MHC Category	Year						Chi2 Statistic	P-Value	Linear Model		Linear-by-Linear	
	First	Second	Third	Fourth	Fifth	TOTAL			Coef	P-value	Z-Statistic	P-Value
<b>Flourishing</b>	14 (28.6)	13 (26.0)	10 (20.8)	14 (25.8)	21 (18.8)	75	16.7777	0.033**	-0.054	0.015**	2.4225	0.015**
<b>Moderate</b>	35 (71.4)	32 (64.0)	33 (68.8)	34 (51.5)	76 (67.9)	210						
<b>Languishing</b>	0 (-)	5 (10.0)	5 (10.4)	15 (22.7)	15 (13.4)	40						

*Table 5. Proportion of students in K10 category by year in school, all observations (Freq. [Row %])*

K10 Category	Year						Chi2 Statistic	P-Value	Linear Model		Linear-by-Linear	
	First	Second	Third	Fourth	Fifth	TOTAL			Coef	P-value	Z-Statistic	P-Value
<b>Well</b>	14 (28.6)	13 (26.0)	10 (20.8)	14 (25.8)	21 (18.8)	75	29.9376	0.003**	0.106	0.010**	2.5527	0.010**
<b>Mild</b>	35 (71.4)	32 (64.0)	33 (68.8)	34 (51.5)	76 (67.9)	210						
<b>Moderate</b>	10 (20.4)	11 (22.0)	12 (25.0)	11 (16.7)	30 (26.8)	74						
<b>Severe</b>	14 (28.6)	23 (46.0)	10 (20.8)	39 (50.1)	46 (41.1)	132						

### ***3.3 Relationships between distress, burnout, and demographic characteristics and positive mental health***

Coefficients and 95% confidence intervals of ordinary least squares regression estimates for the relationship of composite mental health outcomes are shown in Appendix B. Positive mental health was moderately negatively associated with both negative mental health (coef: -0.44 ) and burnout (coef: -0.43). Also, as anticipated, negative mental health and burnout were moderately positively associated (coef: 0.54). Confidence intervals for these estimates were statistically significant. Scatterplots of relationships between continuous score variables are shown in Appendix B.

Stepwise multivariable linear regression was used to select the best model assessing the effect of potential risk factors on positive mental health (composite MHC-SF score). Coefficients and p-values for the final linear model are shown in Table 6. Adjusting for age, gender, and SES made no difference in the significance of these variables on the outcome. We investigated mother's education as an ordinal and binary variable and explored interaction terms between gender and year in school, as well as between gender and the two SES variables. However, none was significantly associated with the outcome.

We chose to include year in school in the final linear model predicting positive mental health because the relationship between year in school and mental health was of primary interest to our study. Gender was included in the final model regardless of significance because there is evidence that female medical students experience higher



levels of burnout and psychological distress than their male counterparts (Dyrbye et al., 2006a). As shown in Table 6, male participants had a higher, non-significant, mental health score compared to female participants. Age was also included in the final model, though not significantly associated with the outcome, since there is existing evidence that students' negative mental health increases over time (Aktekin et al., 2001). Our regression analysis indicated a decrease in positive mental health scores by year, with a marked difference at fourth and fifth years (Table 6). The same distinction in years in school was observed in linear regression analyses predicting negative mental health and burnout (for results of composite K10 and OLBI scores; see Appendix B, Tables 10 and 11).

*Table 6. Relationships between of demographic characteristics and positive mental health (Linear regression)*

<b>Demographic Characteristic</b>	<b>Coeff</b>	<b>P-value</b>
Age	0.694	0.382
Gender		
Female	REF	REF
Male	0.559	0.702
Year in school		
First	REF	REF
Second	-2.762	0.332
Third	-1.364	0.663
Fourth	-7.544	0.036**
Fifth	-6.922	0.104
<b>Observations</b>	307	
<b>Adjusted R-squared</b>	0.0125	

### **3.4 Relationships between positive mental health, distress, burnout, and demographic characteristics and academic performance**

Logistic regression and ordinal logistic regression were used to determine the best model predicting the effect of potential predictors on academic performance (student's most recent exam score). Ordinal logistic analysis was performed with the full outcome variable (all levels of the ordinal variable) and with a collapsed version with levels *Repeat*, *Pass*, and *Pass+*. Logistic regression analysis was performed with a binary outcome with levels *Repeat* and *Pass+*. Odds ratios (OR) and p-values for the all-level outcome model are shown in Table 7. Estimates and p-values for the collapsed outcomes are included in Appendix B.

Neither positive mental health, negative mental health, burnout, nor SES were associated with the academic performance outcome in any of the models. In all models, gender was significantly negatively associated with academic performance ( $p < 0.05$ ). In all the models, males were more likely (OR =  $< 1.00$ ) to have poor academic performance, defined as a "Repeat" exam score, compared to females. In the all-level and three-level outcome models, gender and year in school were also significantly associated with academic performance ( $p < 0.05$ ). Older students were also more likely (OR =  $< 1.00$ ) to have poor academic performance. Year in school offered the opposite effect – students in higher years were less likely (OR =  $> 1.00$ ) to have poor academic performance. Interestingly, in the all-level outcome model, students whose fathers had higher levels of

education were also significantly less likely (OR = 1.40) to have poor academic performance. In the three-level and binary outcome models, the significance of the observed effect disappeared.

*Table 7. Relationships between mental health and demographic characteristics and academic performance (Ordinal logistic regression; All-level outcome)*

Variable	Repeat		Pass+	
	RRR*	95% CI	RRR	95% CI
<b>Mental Well-being</b>				
MHC Score	0.98	[0.95, 1.02]	0.98	[0.95, 1.00]
K10 Score	1.02	[0.96, 1.07]	0.97	[0.94, 1.02]
OLBI Score	0.99	[0.92, 1.07]	0.99	[0.93, 1.04]
<b>Demographic Characteristics</b>				
Age	1.19	[0.79, 1.79]	0.62 <i>p</i> = <b>0.004</b>	[0.46, 0.86]
Male gender	2.41 <i>p</i> = <b>0.016</b>	[1.18, 4.92]	0.35 <i>p</i> = <b>0.001</b>	[0.18, 0.65]
Year				
First	REF	REF	REF	REF
Second	1.69	[0.40, 7.19]	1.45	[0.46, 4.52]
Third	1.81	[0.35, 9.34]	8.91 <i>p</i> = <b>&lt;0.001</b>	[2.60, 30.49]
Fourth	0.36	[0.05, 2.75]	3.82	[20.3, 79.35]
Fifth	0.95	[0.10, 8.72]	8.20 <i>p</i> = <b>0.015</b>	[3.41, 232.94]
<b>Observations</b>	307			
<b>Log Likelihood</b>	-269.75353			

\*All estimates relative to base outcome, Pass

Multinomial logistic regression was also used to explore the relationship between academic performance and potential covariates. Multinomial regression is sensitive to zero cell values in cross-tabulations of nominal variables. This results in very large estimates and abnormally wide confidence intervals in multinomial logit. Thus, analysis was performed with the three-level academic performance outcome (*Repeat*, *Pass*, *Pass+*). Relative risk ratios and 95% confidence intervals are shown in Table 8.

None of the mental health variables was significantly associated with academic performance. Older students, on average, were more likely to have Repeat scores compared to Pass scores, and they were significantly less likely ( $p = <0.05$ ) to score higher than Pass. As with the ordinal logit model, males were significantly more likely to have Repeat exam scores compared to Pass scores. Males were also significantly less likely to score higher than Pass scores. Second and third year students were more likely to have Repeat exam scores, compared to Pass scores compared to first years, but this effect was not significant. However, both second and third years were also more likely to score higher than Pass, with third years significantly more likely to be in this category. Fourth and fifth years were less likely to have a Repeat score compared to Pass, and both were more likely to score higher than Pass, with fifth years significantly more likely to be in the Pass+ category.

Table 8. Relationships between mental health and demographic characteristics on academic performance (Multinomial logistic regression; 3-Level outcome [Repeat, Pass, Pass+])

	Repeat		Pass+	
	RRR*	95% CI	RRR	95% CI
<b>Mental Well-being</b>				
MHC Score	0.98	[0.95, 1.02]	0.98	[0.95, 1.00]
K10 Score	1.02	[0.96, 1.07]	0.97	[0.94, 1.02]
OLBI Score	0.99	[0.92, 1.07]	0.99	[0.93, 1.04]
<b>Demographic Characteristics</b>				
Age	1.19	[0.79, 1.79]	0.62 <i>p</i> = <b>0.004</b>	[0.46, 0.86]
Male gender	2.41 <i>p</i> = <b>0.016</b>	[1.18, 4.92]	0.35 <i>p</i> = <b>0.001</b>	[0.18, 0.65]
Year				
First	REF	REF	REF	REF
Second	1.69	[0.40, 7.19]	1.45	[0.46, 4.52]
Third	1.81	[0.35, 9.34]	8.91 <i>p</i> = <b>&lt;0.001</b>	[2.60, 30.49]
Fourth	0.36	[0.05, 2.75]	3.82	[20.3, 79.35]
Fifth	0.95	[0.10, 8.72]	8.20 <i>p</i> = <b>0.015</b>	[3.41, 232.94]
<b>Observations</b>	307			
<b>Log Likelihood</b>	-269.75353			

\*All estimates relative to base outcome, Pass

## 4. Discussion

It is well-documented that medical doctors, residents, and students all report higher levels of distress, burnout, and suicidal ideation than the general population (Dyrbye et al., 2006; Dyrbye, et al., 2014). There has been inadequate investigation of the level, range, and effects of positive mental health and its potential covariates in these groups outside the Global North, including among medical students with attention to their year in school and academic performance. This research adds to the growing literature base on positive emotions and positive psychology by investigating mental well-being and its relationship with potential demographic correlates and academic performance in a population of medical students. To our knowledge, this was the first study to describe and assess mental well-being in a population of Sri Lankan medical students. We sought to identify potential predictors of positive and negative mental health and to compare our results with studies on U.S. medical students.

Our findings indicate that final year medical students in this population experience high levels of psychological distress and burnout and that the majority qualify for moderate mental health and not flourishing mental health. In the full sample, most students were of moderate mental health. As expected, mental health outcomes were moderately associated with each other. None of the demographic factors was a significant predictor of positive mental health, and none of the mental health outcomes predicted academic performance. Nevertheless, males and older students were

significantly more likely to have poor academic performance, yet females reported significantly higher levels of burnout. Findings from this study support the hypothesis that final year students would report lower levels of positive mental health and higher levels of distress and burnout than first year students. Tabular analysis supported the hypothesis that students with higher levels of positive mental health and lower levels of distress and burnout would perform better academically; however, logistic regressions indicated no association between mental health variables and academic performance.

Flourishing individuals are thought to have better functioning than moderately mentally healthy individuals, who function better than those who are languishing (Keyes, 2006). In a U.S. study, Keyes et al. (2012) found individuals of flourishing mental health to be most prevalent in their college student population. Similarly, Dyrbye et al. (2012) found most of their U.S. medical students to be flourishing, though a near-equal proportion reported moderate mental health. Our results suggest that a lesser proportion of students are flourishing in the Ruhuna population – in fact, most students in our study were categorized as moderately mentally healthy by MHC-SF score. Because positive mental health is different from negative mental health, these positive mental health findings do not indicate poor mental health. Nevertheless, individuals with less than flourishing mental health, they might not be seeking or taking advantage of resources for increasing positive mental health and resilience in the absence of tangible symptoms of negative mental health.

Students in the present study differentially experienced distress at the beginning and end of medical school, with final year students reporting significantly higher distress. This aligns with the findings of numerous studies reporting that students' negative mental health increases over time (Aktekin et al., 2001; Guthrie et al., 1998; Niemi & Vainiomäki, 2006; Rosal et al., 1997; Tyssen, Vaglum, Gronvold, & Ekeberg, 2001). Unfortunately, there were no studies available for comparison that used the K10 to measure distress in U.S. medical students. However, studies in both Pakistan and Canada found that the largest proportion of their respective sample had normal levels of distress (likely to be well), and among students reporting psychological distress, most were categorized as having mild distress (Qamar et al., 2014; Matheson et al., 2016), although neither of these studies reported findings by year in the program. The similar findings in the Pakistan and Canada populations is reassuring that the estimates obtained are relatively unaffected by fundamental differences in programs between countries, for example, the timing of medical school (undergraduate in Pakistan vs. post-graduate in North America). In the present study, scores on the K10 indicated most students fell into the category of severe psychological distress. Students in the current study also reported higher mean levels of psychological distress than those in the previously mentioned studies.

In the present study, fourth- and fifth-year students not only experienced higher levels of distress but also higher levels of burnout compared to first years. Examining a



population of U.S. medical students using the Maslach Burnout Inventory (MBI), Dyrbye et al. (2006b) found that nearly 45% of their sample met the criteria for burnout. Other studies outside the U.S. have reported low levels of burnout (Guthrie et al., 1998). Dahlin, Joneborg, & Runseon (2007) administered the OLBI to U.S. medical students and found that females were significantly more exhausted than males, which aligns with our finding that females reported significantly more distress and burnout than males. Unfortunately, to our knowledge there are no additional studies available for comparison that employ the OLBI in U.S. medical students. Since there are no clinically defined cut points for the OLBI (The same holds for the most commonly administered measure of burnout, the Maslach Burnout Inventory), we cannot posit whether the observed levels of burnout in our study population are high. However, since higher scoring responses on the OLBI are intended to capture higher levels of disengagement and exhaustion, it is reasonable to assume that the observed significant differences between first and final years are indicative of more burnout in the later years.

The MBBS degree at the University of Ruhuna is a five-year hybrid-type program, consisting of three “preclinical” years focused on lectures, laboratory, and introductions to clinicals, and two “clinical” years focusing on lectures, clinical rounds, and professorial appointments. First and second years engage in practicals in physiology, biochemistry, and anatomy dissections. The third year is a transient period – clinicals are introduced and students have microbiology and parasitology practicals. In

the fourth year, students sit for an exam in pharmacology, pathology, and forensic and community medicine. During the final year, students begin professorial appointments and practice medicine, obstetrics and gynecology, pediatrics, surgery, and psychiatry.

Students in their fourth and fifth years of the MBBS take on much more responsibility than in their preclinical years – including lectures, cumulative examinations, and clinical rounds. The burden of this added responsibility could result in the observed higher levels of distress and burnout and concurrent decline in positive mental health over the course of medical school. Female students who already experience stress due to existing personal responsibilities could be distressed by the new responsibilities introduced in years four and five. Two variables not collected by this study were whether students were married and whether they had children. Attending medical school after marriage is not an uncommon phenomenon for U.S. medical students; however, it *is* uncommon for Sri Lankan students. Collecting data on variables such as these could provide further insight into the differences in mental well-being between genders.

We observed unexpected and reversed effects of parents' education level on negative mental health. Fathers with higher education could indicate more financial stability and confidence in access to resources and support during medical school, leading to less psychological distress. Mothers with higher education could be less connected with the family and, therefore, less supportive of the medical student, leading

to more psychological distress. Also surprising was the fact that negative mental health and burnout were moderately negatively associated with but were not significant predictors of positive mental health. This evidence further supports the two-continua model of mental health – that the axes of positive and negative mental run parallel yet separate, and that the presence of the one does not necessarily indicate the absence of the other, and vice versa (Keyes 2002; 2005; 2007).

#### ***4.1 Implications for practice***

It is important that universities implement accessible prevention and intervention strategies to meet the needs of their medical student populations. In their conceptual model of medical student well-being, Dunn et al. (2008) suggest several replenishing factors that fill the coping reservoir, including psychosocial support, social activities, mentorship, and intellectual stimulation. Dunn et al. (2008) also highlight ways medical schools can use both informal and formal programs to target the coping reservoir and increase resilience, citing as an example the University of California, San Diego, School of Medicine’s Healthy Student Program. Through this program, students have access to “yoga, soccer, healthy snacks on exam days, seminars on coping with stress, and social events” (Dunn et al., 2008). Certain schools also now offer or require as part of the curriculum mindfulness courses (Hassed, de Lisle, Sullivan, & Pier, 2008; Slavin, Schindler, & Chibnall, 2014). Both mindfulness and lovingkindness (or metta) meditation have been shown to increase positive emotions with a dose-response

association (Fredrickson et al., 2008; Fredrickson et al., 2017). Mindfulness-based stress reduction (MSBR) has been shown to decrease symptoms of distress and anxiety in medical students and practicing physicians (Shapiro, Schwartz, & Bonner, 1998).

The University of Ruhuna already offers many of these factors. Currently, the Faculty offers psychosocial support via a Student Support Service (SSS), to which student may reach out. Additional resources include senior student counselors, to whom students experiencing symptoms of negative mental health may be referred by the SSS or their mentors, and referral to a psychiatrist or the school's clinical psychologist, according to the severity and nature of the issue. The Faculty of Medicine also provides facilities for sports, like table tennis, badminton, and cricket, and occasionally holds music, dance, or drama performances for the students' enjoyment. The students must pay a fee to attend these shows. Other opportunities for social engagement include student organizations, including Arts Circle, an outdoor-focused Explorer's Club, and Buddhist Society (H. Rajapakse, personal communication, February 20, 2019).

At the time of data collection, Ruhuna students were randomly paired with a faculty mentor upon entry; however, after receiving some student feedback, the Faculty of Medicine approved their allocation instead to faculty members who are teaching the students (H. Rajapakse, personal communication, February 20, 2019). Monitoring the quality of mentor-mentee relationships is paramount if students are to benefit from encounters. Schools should ensure students are connected to and feel comfortable with

reaching out to faculty advisors while at the same time ensuring that mentors are not overwhelmed by the number of assigned mentees.

Given Sri Lanka's largely Buddhist population and the existent Buddhist student group, a mindfulness program would likely fit well within the culture and curriculum of the Faculty of Medicine. One function of the program could be to promote well-being and increase positive emotions, but an extracurricular course like this could also serve as a point of social interaction and support removed from the hectic day-to-day of medical student life. Dunn and colleagues do not recommend specific interventions for different years in school. Students in this population take on more responsibility during their fourth and fifth years, when clinical rounds are introduced, and might have even less time to devote to extracurriculars. Since evidence from both the current study and existing studies indicates that medical student negative mental health increases over time, students in higher years might benefit from more regular contact with faculty mentors. Mentorship is important for student success throughout medical school; however, students in earlier years who are adjusting to the new environment and level of responsibility might find more replenishment in extracurricular activities like meditation programs. Any extracurricular course requires an instructor, though, and in a setting in which most professors are also practicing clinicians with families, answering the question of who delivers the program might prove difficult. Sourcing meditation instructors from the surrounding community is one potential solution.

We observed differences in levels of mental health in our study population despite the existing extracurricular and psychological support mechanisms at the Faculty of Medicine. Students' time outside classes, laboratory trainings, and clinical rounds is already severely limited. Thus, involvement in extracurricular engagements should be as accessible and mutually beneficial as possible. As noted by Dunn et al. (2008), schools implementing interventions to bolster student well-being should collect data on which activities have the best impact, so already scarce resources may be adequately and effectively distributed and so "efforts can be focused on activities with the most potential to fill the coping reservoir."

#### ***4.2 Implications for further research***

Dunn et al. (2008) identify the level of intellectual stimulation of the medical school curriculum as one source of replenishment for their student coping reservoir. The curriculum for all medical schools in Sri Lanka is the same and is determined at the national level. If there are curriculum-related factors contributing to students' lack of flourishing and high levels of distress and burnout, changes likely would need to occur on a large scale. Moving forward, it will be important to understand how the current curriculum impacts medical student mental well-being and which types of curricula work well for different types of students.

The present study's proximity to stressful events and the occurrence of stressful events prior to study commencement could affect the quality of data collected. Certain

years (ex., fourth years) were sitting for cumulative exams at the time of our data collection. Since all the scales included asked about the past month, it is possible this stressful event (the exam) and happenings in the time leading up to that event could affect students' responses on the scales. Along the same line, special events in individuals' lives – such as the death of a loved one or conflict with a family member or friend – might confound students' experiences of psychological distress, burnout, and positive mental health.

A study collecting data at more than one timepoint could better control for the effect of confounders like those mentioned above. This topic would benefit from a dedicated cohort study, following students from their first to their fifth year, which could allow participants to be compared to themselves at the throughout medical school to describe and monitor changes in mental health. Cohort studies can increase confidence in causal inference where cross-sectional designs fall short.

### ***4.3 Study limitations***

A cross-sectional study design naturally limits causal inference; thus, we cannot be certain that any of the variables in this study effectively cause the others. In addition to design limitations, language and culture may affect the quality of the data collected. Though lectures at the Faculty of Medicine are given in English and though most students have at least a working knowledge of the English language, there was no transcultural translation of these measures before use. Thus, it is possible that some

questions were misinterpreted or altogether inapplicable to the study population.

Another possibility is that the symptoms of positive emotional, social, and psychological functioning measured by the MHC-SF are distinctly different in Sri Lankan culture. It is suggested by the scale's creator that the MHC-SF be administered in English to the population of interest before translation (Keyes, 2009). The present study could serve as a pilot of the English version in Sri Lankan medical student populations. Future research on this topic should include translating measures of positive and negative mental health into Sinhala, making sure to incorporate local idioms and cultural beliefs to ensure complete understanding of questionnaire items, and testing the reliability and stability of these measures throughout.

Finally, our study collected a snapshot of data from a sample of medical students at the southernmost medical university in Sri Lanka. Thus, we acknowledge that these findings might not generalize to the country's entire medical student population. There is a need for schools to investigate the mental health of their students to craft a more accurate and holistic depiction of Sri Lankan medical student mental well-being.



## 5. Conclusion

The role of positive mental health for medical students remains an inadequately investigated topic – to our knowledge, our study is the first to explore the subject in a population of Sri Lankan medical students. This research adds to the growing literature base on positive emotions and positive psychology by investigating mental well-being and its relationship with potential demographic correlates and academic performance in a population of medical students. It is distressing that the majority of students in this study reported high levels of negative mental health and only moderate levels of positive mental health. Though no mental health outcome was associated with academic performance, males and older students were significantly more likely to have poor academic performance. Further research is needed to determine whether measures of mental well-being developed in the Global North, like the MHC-SF, accurately capture symptoms of positive and negative functioning in Sri Lankan culture, though there are promising validation studies in the Asian geographic region (Guo et al., 2015; Lim, 2014). Universities have an obligation to direct resources to support students as they navigate the responsibilities of medical school. Students expected to flourish cannot do so if they are not provided with opportunities and support to replenish their coping reservoirs. This can be done in various ways, from counseling and mentorship to curricular and extracurricular activities. Institutions must actively support students' mental well-being and professional development by enabling them to monitor and care

for their mental and physical health so they may continue along the upward spiral of emotional well-being and flourish into successful medical practitioners.

## **Appendix A**

### *Consent Form to Participate in Research for **Mental well-being in students at University of Ruhuna Faculty of Medicine***

This research study is conducted by Courtney Wimberly, a Master's candidate of the Global Health Institute at Duke University, in collaboration with Dr. Harshini Rajapakse of the Faculty of Medicine at the University of Ruhuna and with Dr. Truls Østbye of the Department of Community and Family Medicine at Duke University.

#### ***Why is this study being done?***

The purpose of this study is to explore the mental well-being of medical university students by examining both positive and negative mental health in students at the Faculty of Medicine.

#### ***What will I be asked to do?***

If you choose to take part in this study, you will complete a four-part questionnaire asking about how you have been feeling over the past four weeks as well as asking basic demographic questions.

#### ***How long will I be in the study?***

We expect your participation in the study to last for the time it takes you to complete the questionnaire and return it to the primary investigator. Most people will complete the questionnaire in about 10 minutes.

#### ***What are the risks and inconveniences and benefits of this study?***

A minor risk to participating in this study is that certain questions may make you feel uncomfortable. You do not have to answer any questions that you do not want to.

#### ***Compensation:***

You will not receive compensation for participating in this study.

#### ***Confidentiality:***

The data we collect from this study will be part of a Master's thesis and may be presented at scientific meetings or published in a scientific journal; however, your identity will not be revealed. A unique study identification number will be assigned to all data we collect from you. We will keep this signed consent form in a separate and secure location from the rest of the data, and results and documentation will be retained for at least six years after the study concludes.

#### ***Voluntary nature of participation:***

Participation in this study is voluntary, and you can choose not to participate at any point. If you agree to be in the study, you may withdraw at any time for any reason.

***Whom do I call if I have questions or problems?***

For questions about the study, contact Dr. Rajapakse during regular business hours at +\*\*  
\*\*\* \*\* or [harshini@med.ruh.ac.lk](mailto:harshini@med.ruh.ac.lk). You may also contact Courtney Wimberly at  
[courtney.wimberly@duke.edu](mailto:courtney.wimberly@duke.edu). For questions about your rights as a participant in this  
research study, contact the University of Ruhuna at +\*\* \*\*\* \*\* or +\*\* \*\*\* \*\*  
\*\*\*\*.

If you agree to take part in the study, please sign and date below.

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Participant's Printed Name and Signature

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Date

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**Section A.**

**Please answer the following questions. For multiple choice answers, please tick only one box.**

**1. Age: \_\_\_\_\_ (years)**

**2. What is your gender?**

- female<sub>0</sub>
- male<sub>1</sub>

**3. Which is your current year in university?**

- First<sub>1</sub>
- Second<sub>2</sub>
- Third<sub>3</sub>
- Fourth<sub>4</sub>
- Fifth<sub>5</sub>

**4. What is the highest level of education completed by your father?**

- No school<sub>0</sub>
- Below grade five<sub>1</sub>
- Fifth to tenth grade<sub>2</sub>
- Up to ordinal level<sub>3</sub>
- Post-high school diploma or up to advanced level<sub>4</sub>
- Medical degree<sub>5</sub>

- Other degree or diploma<sub>6</sub>
- Post-graduate<sub>7</sub>

**5. What is the highest level of education completed by your mother?**

- No school<sub>0</sub>
- Below grade five<sub>1</sub>
- Fifth to tenth grade<sub>2</sub>
- Up to ordinal level<sub>3</sub>
- Post-high school diploma or up to advanced level<sub>4</sub>
- Medical degree<sub>5</sub>
- Other degree or diploma<sub>6</sub>
- Post-graduate<sub>7</sub>

**6. Which class were you awarded after your most recent exam?**

- Repeat<sub>0</sub>
- Pass<sub>1</sub>
- Pass with 2<sup>nd</sup> lower class<sub>2</sub>
- Pass with 2<sup>nd</sup> upper class<sub>3</sub>
- Pass with 1<sup>st</sup> class<sub>4</sub>

**Section B.**

Please answer the following questions are about how you have been feeling **during the past month**. Place a check mark in the box that best represents how often you have experienced or felt the following:

During the past month, how often did you feel ...	NEVER	ONCE OR TWICE	ABOUT ONCE A WEEK	ABOUT 2 OR 3 TIMES A WEEK	ALMOST EVERY DAY	EVERY DAY
<b>7. happy</b>	<input type="checkbox"/> <sub>0</sub>	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>
<b>8. interested in life</b>	<input type="checkbox"/> <sub>0</sub>	<input type="checkbox"/> <sub>1</sub>	<input type="checkbox"/> <sub>2</sub>	<input type="checkbox"/> <sub>3</sub>	<input type="checkbox"/> <sub>4</sub>	<input type="checkbox"/> <sub>5</sub>

<b>9. satisfied with life</b>	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>10. that you had something important to contribute to society</b>	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>11. that you belonged to a community (like a social group, or your neighborhood)</b>	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>12. that our society is a good place, or is becoming a better place, for all people</b>	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>13. that people are basically good</b>	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>14. that the way our society works makes sense to you</b>	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>15. that you liked most parts of your personality</b>	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>16. good at managing the responsibilities of your daily life</b>	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

<b>17. that you had warm and trusting relationships with others</b>	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>18. that you had experiences that challenged you to grow and become a better person</b>	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>19. confident to think or express your own ideas and opinions</b>	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>20. that your life has a sense of direction or meaning to it</b>	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

**Section C.**

Please tick the answer that is correct for you.

	<b>None of the time</b>	<b>A little of the time</b>	<b>Some of the time</b>	<b>Most of the time</b>	<b>All of the time</b>
<b>1. In the past 4 weeks, about how often did you feel tired out for no good reason?</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>2. In the past 4 weeks, about how often did you feel nervous?</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

<b>3. In the past 4 weeks, about how often did you feel so nervous that nothing could calm you down?</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>4. In the past 4 weeks, about how often did you feel hopeless?</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>5. In the past 4 weeks, about how often did you feel restless or fidgety?</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>6. In the past 4 weeks, about how often did you feel so restless you could not sit still?</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>7. In the past 4 weeks, about how often did you feel depressed?</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>8. In the past 4 weeks, about how often did you feel that everything was an effort?</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>9. In the past 4 weeks, about how often did you feel so sad that nothing could cheer you up?</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
<b>10. In the past 4 weeks, about how often did you feel worthless?</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5



**Section D.**

Please indicate how much you agree or disagree with the following statements regarding your studies.

	<b>Totally disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Totally agree</b>
<b>21. I always find new and interesting aspects in my studies</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>22. There are days when I feel tired before I arrive at the university</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>23. It happens more and more often that I talk about my studies in a negative way</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>24. After class, I tend to need more time than in the past in order to relax and feel better</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>25. I can tolerate the pressure of my studies very well</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>26. Lately, I tend to think less and study almost mechanically</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>27. I find my studies to be a positive challenge</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>28. While studying, I often feel emotionally drained</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

<b>29. Over time, one can become disconnected from studying</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>30. After studying, I have enough energy for my leisure activities</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>31. Sometimes I feel sickened by my school tasks</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>32. After class, I usually feel worn out and weary</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>33. This is only type of degree that I can imagine myself doing</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>34. Usually, I can manage the amount of my studies well</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>35. I feel more and more engaged in my studies</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4
<b>36. When I study, I usually feel energized</b>	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4

**This is the end of the questionnaire. Please review your answers for skipped items.  
Thank you for your time!**

## Appendix B

*Table 9. Characteristics of study population. Students at Univ. of Ruhuna (n=327) who completed the one-time paper questionnaire.*

	Number of students (n <sup>a</sup> )	Representative proportion of study population (%)
Gender		
Female	204	62.58
Male	122	37.42
Year		
First	49	15.08
Second	50	15.38
Third	48	14.77
Fourth	66	20.31
Fifth	112	34.46
Father's education		
No school	1	0.31
Below grade five	11	3.36
Fifth to tenth grade	19	5.80
Up to ordinal level	74	22.63
Post-high school/adv. level	139	42.51
Medical degree	7	2.14
Other degree/diploma	60	18.35
Post-graduate degree	16	4.89
Mother's education		
No school	2	0.61
Below grade five	4	1.22
Fifth to tenth grade	9	2.75
Up to ordinal level	66	20.18
Post-high school/adv. level	143	43.73
Medical degree	5	1.53
Other degree/diploma	86	26.30
Post-graduate degree	12	3.67
Most recent exam score		
Repeat	49	15.91
Pass	180	58.44
Pass w/ 2 <sup>nd</sup> lower class	43	13.96
Pass w/ 2 <sup>nd</sup> upper class	28	9.09
Pass w/ 1 <sup>st</sup> class	8	2.60

Mean age was 24.9 with a range of 20-28 years. Means and percentages are relative to the population of students who respond to each question

<sup>a</sup>Numbers correspond to the population of students who respond to each question

**Table 10. Effect of demographic characteristics on negative mental health<sup>a</sup> (Linear regression)**

	Model 1		Model 2	
	Coefficient ( $\beta$ )	P-value	Coefficient ( $\beta$ )	P-value
Age	-0.145	0.777	-0.168	0.741
Gender				
Female	REF	REF	REF	REF
Male	-0.821	0.385	-0.858	0.356
Year in school				
First	REF	REF	REF	REF
Second	4.586	0.013	5.822	0.001**
Third	0.611	0.763	1.581	0.424
Fourth	6.601	0.005**	7.747	0.001**
Fifth	4.436	0.107	5.660	0.038**
Father's education <sup>b</sup>				
High school degree or below	-	-	REF	REF
Post-high or up to adv. level	-	-	-3.277	0.006**
4-year degree or higher	-	-	-5.450	<0.001**
Mother's education				
High school degree or below	-	-	REF	REF
Post-high or up to adv. level	-	-	-0.010	0.994
4-year degree or higher	-	-	3.809	0.009**
Observations	307		307	
Adjusted R-square	0.0615		0.1189	

<sup>a</sup>Composite K10 score

<sup>b</sup>The two SES variables were collapsed to fewer categories for modeling

\*\*significant at 5% level

**Table 11. Effect of demographic characteristics on burnout<sup>a</sup> (Linear regression)**

	<b>Coefficient (<math>\beta</math>)</b>	<b>P-value</b>
Age	-0.309	-0.358
Gender		
Female	REF	REF
Male	-1.470	0.018**
Year in school		
First	REF	REF
Second	1.701	0.160
Third	0.459	0.160
Fourth	4.509	0.003**
Fifth	4.204	0.201**
Observations	288	
Adjusted R-square	0.08479	

<sup>a</sup>composite OLBI score

\*\*significant at 5% level

**Table 12. Effect of positive mental health & demographic characteristics on academic performance (Ordinal logistic regression; 3-Level outcome – Repeat, Pass, Pass+)**

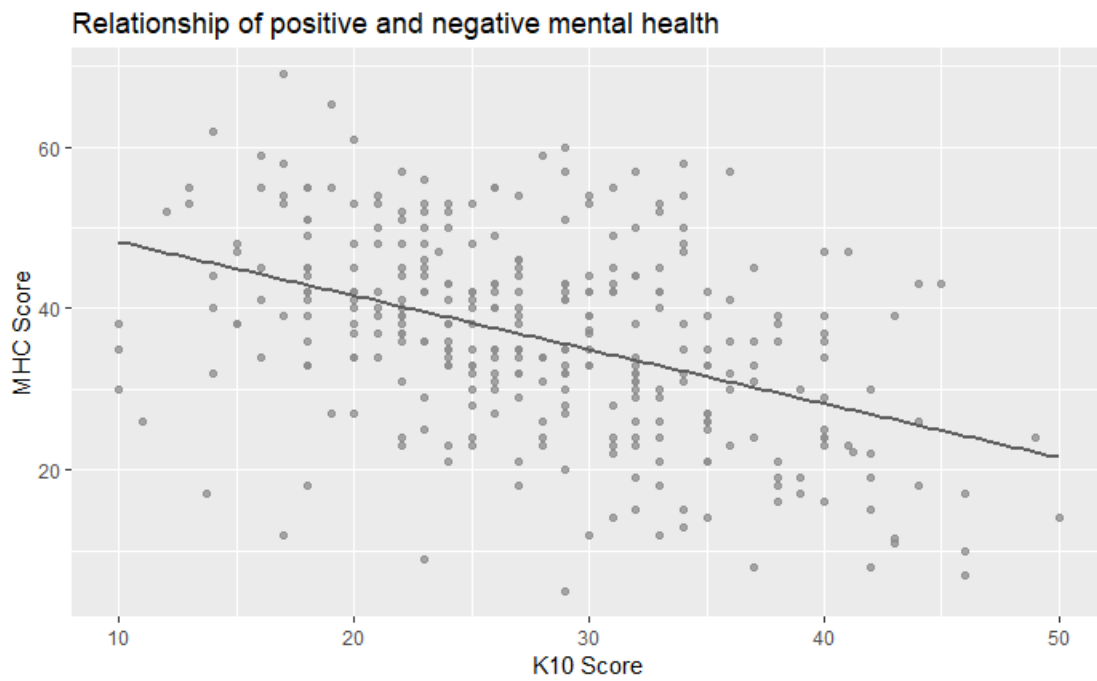
	<b>Model 1</b>		<b>Model 2</b>	
	<b>MHC</b>		<b>Demographics</b>	
	<b>OR</b>	<b>P-value</b>	<b>OR</b>	<b>P-value</b>
MHC Score	1.00	0.710	1.00	0.248
Age	-	-	0.64	<0.001**
Male gender	-	-	0.33	<0.001**
Year	-	-	1.57	0.006**
Observations	307		307	
Log likelihood	-296.95105		-279.34962	

\*\*significant at 5% level

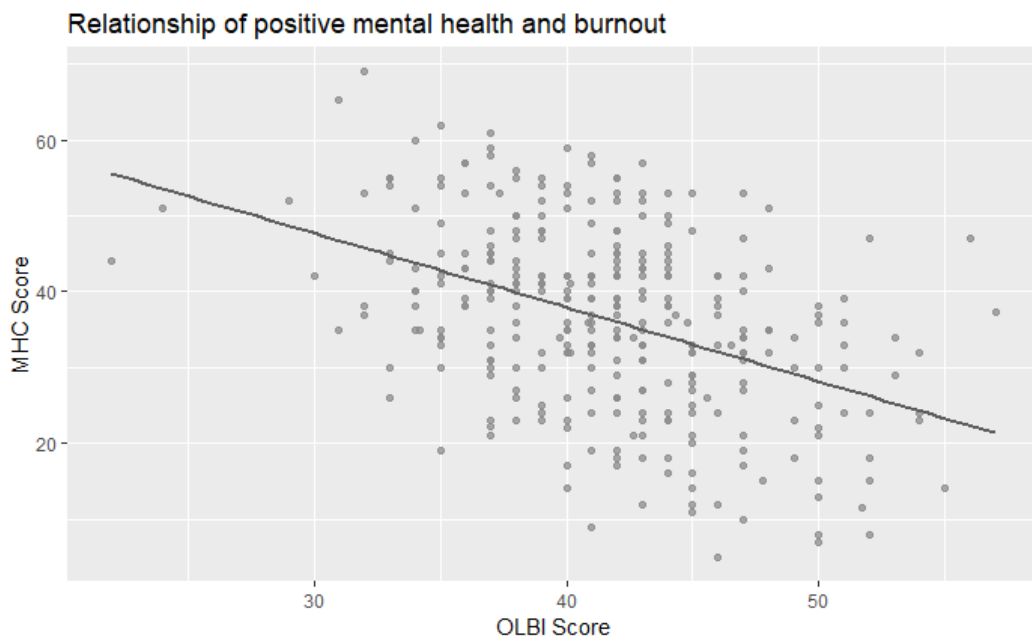
**Table 13. Effect of positive mental health & demographic characteristics on academic performance (Logistic regression; Binary outcome – Repeat, Pass+)**

	Model 1		Model 2	
	MHC		Demographics	
	OR	P-value	OR	P-value
MHC Score	1.01	0.592	1.01	0.621
Age	-	-	0.70	0.065
Male gender	-	-	0.29	<0.001**
Year	-	-	1.39	0.171
Observations	307		307	
Log likelihood	-126.01771		-117.60909	

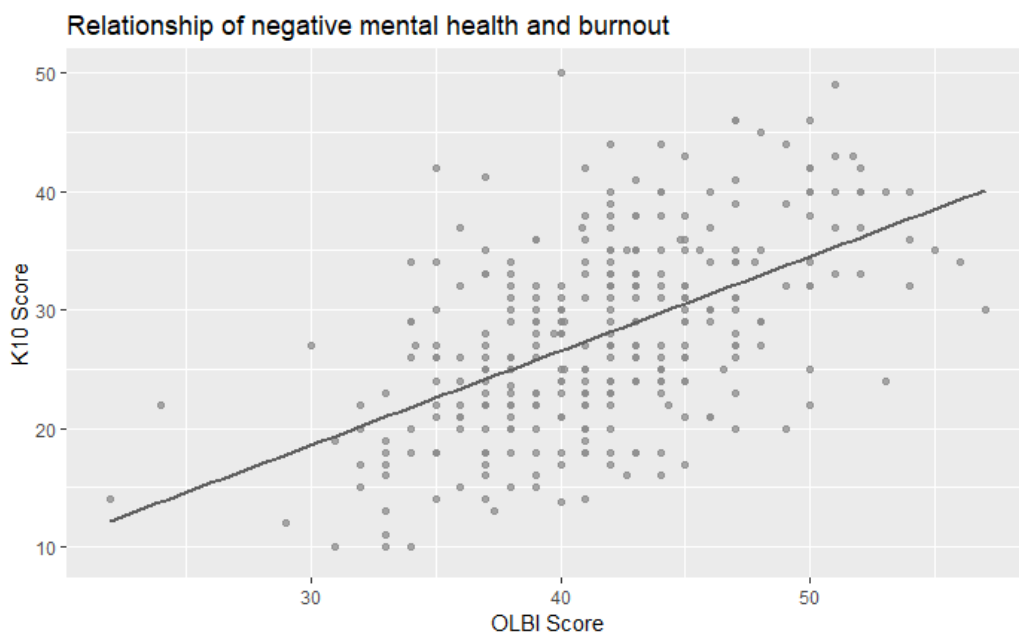
\*\*significant at 5% level



**Figure 3. Relationship between positive and negative mental health (Composite scores)**



*Figure 4. Relationship between positive mental health and burnout (Composite scores)*



*Figure 5. Relationship between negative mental health and burnout (Composite scores)*

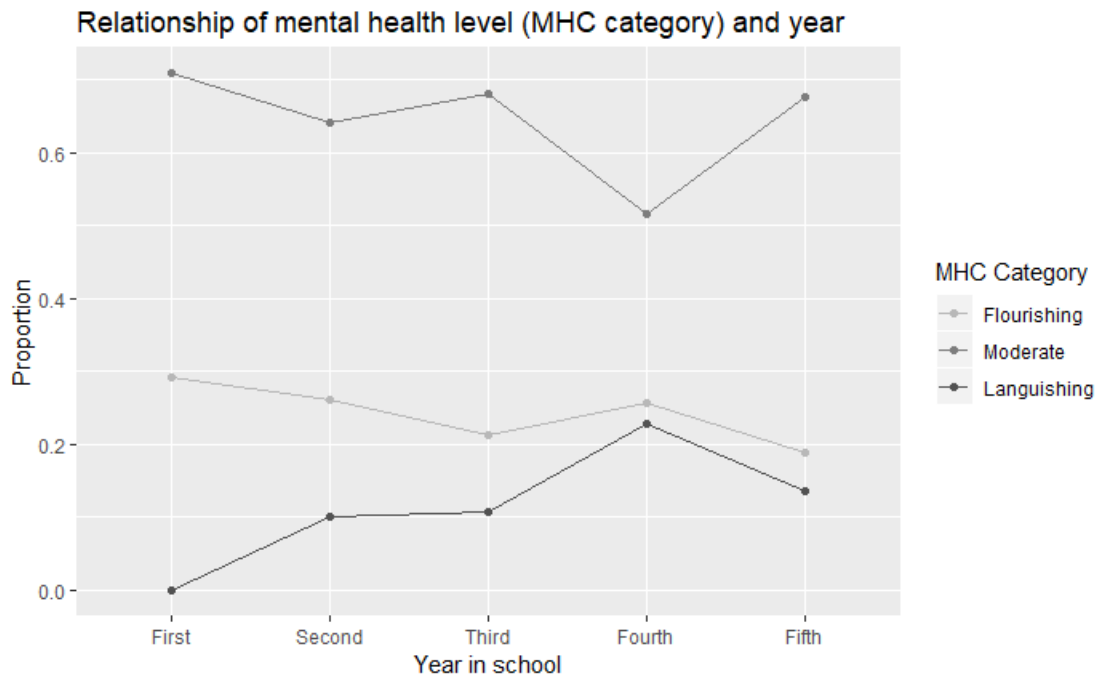


Figure 6. Relationship between mental health level (MHC category) and year



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