Assessment of Burnout in Medical Students Using the Maslach Burnout Inventory-Student Survey: A Cross-Sectional Data Analysis

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Abstract

Background: Medical student burnout can cause emotional and physical exhaustion and detachment. The objectives of this study were to evaluate burnout using the Maslach Burnout Inventory-Student Survey (MBI-SS). Factors that may predict burnout and wellness initiatives that may reduce burnout were assessed.

Methods: The MBI-SS was administered to all medical students (Classes 2019 to 2022) at the University of Illinois College of Medicine (UICOM) from February to May 2019. Factor analysis and internal consistency of the MBI-SS were assessed. Mean MSBI-SS subscale scores for burnout were calculated for cynicism (CY), emotional exhaustion (EE), and academic efficacy (AE). Multiple regression analysis was used to identify student factors that may predict burnout.

Results: A total of 273 (21.6%) UICOM students completed the survey and 110 (40.3%) respondents reported self-perceived burnout. MBI-SS subscale scores were significantly higher for CY and EE, and significantly lower for AE between students who did or did not report burnout. Mean ± SD subscale scores for CY, EE, and AE in burnout students were 14.44 ± 5.59, 23.23 ± 4.74, and 24.81 ± 5.35, separately. In comparison, mean ± SD subscale scores for CY, EE, and AE in non-burnout students were 7.59 ± 5.16, 14.96 ± 5.71, and 28.74 ± 3.21, separately. Regression analysis denoted significant associations between burnout and being out-of-phase in the curriculum, the effectiveness of wellness initiatives, and strength of motivation for medical school (SMMS) in both the two- and three-dimensional MBI-SS models. Gender was significantly associated with burnout in only the two-dimensional model.

Conclusions: Self-reported burnout in medical students at UICOM was validated using the MBI-SS. Being out-of-phase in the curriculum, being female, rating wellness initiatives as less effective, and demonstrating lower motivation for continued medical school education may be used as predictors of medical student burnout. This investigation may act as a guide for measuring burnout in medical student populations and how the implementation of wellness initiatives may ameliorate burnout.

Background

The rate of self-reported burnout among physicians in the United States increased from 40 to 51% from 2013 to 2017, respectively (1). Healthcare practitioner burnout may be characterized as ‘various degrees of emotional exhaustion, depersonalization and a low sense of personal accomplishment’ (2). Physician burnout can decrease the accuracy of medical diagnoses, impede effective patient-physician communication, and increase the number of unnecessary medical procedures (3). The annual economic impact of physician burnout has been estimated at $3.4 billion dollars with this loss expected to increase alongside worsening rates of burnout (4). Several investigations have attempted to address the origin of physician burnout and it has been reported that the phenomenon may begin manifesting as early as medical school.

The responsibilities of a medical student, in comparison to a resident or attending physician, are greatly limited due to their lack of knowledge and clinical experience, nevertheless, medical students are expected to perform at a level that may seem unachievable. Corish estimated that the volume of medical knowledge has doubled every 73 days since 2010 (5). Gradually, this new medical knowledge is integrated within the curriculum and students are expected to master the information for their United States Medical Licensing Examination (USMLE). The score a student receives on the USMLE, especially STEP 1, is directly correlated with their ability to matriculate in their desired specialty and the stress associated with the examination has been shown to negatively impact a student's wellbeing (6). Aside from the stressors of class and the boards, most medical students do not truly anticipate what will be expected of them prior to matriculation. In fact, some studies suggest that approximately half of all medical students may be suffering from burnout before beginning residency (7,8). Loneliness, depression, isolation, an inability to relate to one's peers, and feelings of apathy and depersonalization are all adverse attributes that have been self-reported in investigations of large medical student populations (9). These attributes have been shown to decrease the quality of care delivered to a patient and therefore, require immediate correction before a medical student is granted increased autonomy during residency.

Given the serious implications of medical student burnout, it is necessary to identify predictors that may influence the phenomenon. Acquiring a better understanding of the predictors of burnout may allow for resolutions to be developed that target the most severe causes. If the most significant causes are addressed, it may be possible to reduce the rate of burnout and improve the well-being of the future physicians throughout their undergraduate and graduate medical education.

Current Study
The purpose of this investigation was to evaluate medical student burnout using the Maslach Burnout Inventory-Student Survey (MBI-SS) within a single medical school system. The research questions this paper sought to address are as follows: (RQ1) Can the MBI-SS be used to predict burnout in medical school students; (RQ2) Are there any associations between burnout and demographic factors that can be used to predict burnout among medical students; and (RQ3) Are the use of wellness initiatives sufficient for reducing burnout among medical students?

Methods

Study design and setting

The study was approved by the Internal Review Board (IRB) at the University of Illinois at Rockford (UI-Rockford). All year medical students (M1-M4 and MD/PhD), totaling 1,359 students, at the University of Illinois College of Medicine (UICOM) were asked to complete the cross-sectional survey. UICOM has four distinct campuses: Chicago, Peoria, Rockford, and Urbana-Champaign. MD/PhD students and all students at Urbana-Champaign were excluded (95 students) from the final analysis due to low response rates of < 6% and < 3%, respectively. The study was conducted from February 2019 to May 2019. The survey was hosted on the web-based application, Google Forms. A non-probability sampling method was used by sending several campus-wide emails to students requesting their voluntary participation. A non-probability sampling method was used to decrease the likelihood of selection bias for students who are less responsive to a single email. Four, $25 apparel items were offered as an incentive to complete the survey. Students were randomly selected for the incentive. Strengthening the reporting of observational (STROBE) guidelines for observational studies were followed throughout.

Measures

The survey (see appendix) was a mix of demographic, career-oriented, medical specialty, MBI-SS, and SMMS questions. The 16-item MBI-SS is a validated tool used to measure burnout in student populations. The MBI-SS (Mind Garden Inc., Menlo Park, CA) consists of three subscales to evaluate the different domains of burnout: emotional exhaustion (i.e. the draining of emotional resources because of demanding interpersonal contacts with others), cynicism (i.e. negative, callous, and cynical attitude towards the recipients of one's care or services), and academic efficacy (i.e. tendency to evaluate one's accomplishments with recipients negatively) (10). Responses are provided on a 7-point Likert scale with higher values referencing more frequent occurrences. Higher scores for CY and EE while lower scores for AE suggest burnout. Item 13 was deleted from the MBI-SS based on prior investigations finding it to be ambivalent and unsound (11–13).

The 15-item SMMS is a self-report tool that evaluates the strength of motivation medical students have for training in medical school. The SMMS consists of three subscales that evaluate different domains of motivation: willingness to sacrifice (i.e. the willingness of a student to sacrifice for his/her medical study), readiness to start (i.e. the readiness and will to enter/continue medical study), and persistence (i.e. the persistence in medical study in spite of unfriendly circumstances during or after the study (14). Responses are provided on a 5-point Likert scale and subscale scores can range from 5 to 25. Higher values suggest greater motivation to continue training in medical school.

Data analysis

All data was exported from Google Survey to Excel v365 (Microsoft Corporation, Redmond, WA). All analyses were performed using SPSS v25 (IBM Corporation, Armonk, NY). Descriptive summary statistics were calculated for all student demographics. Normality of data was evaluated using the Shapiro-Wilk test. A $P$-value less than 0.05 was considered significant.

MBI-SS score calculation

Reverse scoring for the MBI-SS was performed as previously described (15). Two calculation methods, the summation (SUM) and average (AVE) method, are two validated techniques to compare burnout scores between respondents. MBI-SS scores were calculated using each method to determine if self-perceived burnout differed using the Student's t-test for independent groups. The two-dimensional MBI-SS model is the addition of EE and CY, while the three-dimensional model is the addition of all subscales, EE, CY, and AE. No significant difference was noted using either method when comparing subscale scores, in addition to the two- and three-dimensional burnout score. MBI-SS scores reported herein were calculated as means ± standard deviation (SD) using the SUM method.

Internal consistency of MBI-SS using Cronbach's alpha
Cronbach’s alpha was used to calculate internal consistency of all MBI-SS items and subscales. Reliability scores of \( \geq 0.5 \) were considered acceptable with higher scores indicating greater internal consistency (16).

**Factor analysis of MBI-SS using correlation matrix**

Statistical data reduction and analysis was performed on the data to explain the correlation between the summated scores in the three subscales (EE, CY, and AE) as previously described (13). Items with a loading of greater than 0.40 were considered significant. Oblique rotation of the matrix in the factor analysis was performed to account for potential cross-loadings between the MBI-SS subscales. Oblique rotation of the matrix assumed that the 3 MBI-SS subscales were not independent.

**Multiple regression of MBI-SS**

The association between demographic factors, educational debt, effectiveness of wellness initiatives, the SMMS toolkit, and MBI-SS scores was examined using a series of linear regression models. MBI-SS subscales, two-factor, and three-factor scores were coded as dependent variables. All variables entered the models and beta coefficients with t-values were outputted to assess correlations.

**SMMS score calculation**

Reverse scoring for the validated SMMS was performed as previously described (17). SMMS subscales (sacrifice, readiness to start, and persistence) were summated to develop a three-dimensional model of motivation. Mean ± SD of the summated SMMS score were reported.

**Results**

The survey was completed by 273 out of 1,264 (21.6%) UICOM students. Response rates by student demographics are shown in Table 1.
### Table 1
Student demographics, n = 273

| Variable                                           | n  | % of respondents |
|----------------------------------------------------|----|------------------|
| **Campus**                                         |    |                  |
| Chicago                                            | 125| 15.8             |
| Rockford                                           | 86 | 38.6             |
| Peoria                                             | 62 | 25.3             |
| **Year of Enrollment**                             |    |                  |
| M1                                                 | 88 | 26.5             |
| M2                                                 | 54 | 16.3             |
| M3                                                 | 79 | 25.2             |
| M4                                                 | 52 | 18.2             |
| **Time Off Before Matriculation (in years)**       |    |                  |
| 0                                                  | 112| 41.0             |
| 1                                                  | 77 | 28.2             |
| 2                                                  | 42 | 15.4             |
| 3                                                  | 17 | 6.2              |
| 4                                                  | 11 | 4.0              |
| 5                                                  | 7  | 2.6              |
| ≥ 6                                                | 7  | 2.6              |
| **Gender**                                         |    |                  |
| Male                                               | 112| 40.9             |
| Female                                             | 158| 57.7             |
| No Response                                        | 3  | 1.1              |
| **Age Group (in years)**                           |    |                  |
| 21–23                                              | 57 | 20.9             |
| 24–26                                              | 144| 52.7             |
| 27–29                                              | 51 | 18.7             |
| 30–32                                              | 13 | 4.8              |
| 33–35                                              | 3  | 1.1              |
| ≥ 36                                               | 3  | 1.1              |
| **Educational Debt (USD)**                         |    |                  |
| $0                                                 | 43 | 15.7             |
| $1 - $100,000                                      | 89 | 32.5             |
| $100,000 - $200,000                                | 68 | 24.8             |
| $200,000 - $300,000                                | 47 | 17.2             |
A total of 107 (39.2%) students reported self-perceived burnout. Internal reliability (Cronbach's alpha) coefficients of the MBI-SS subscales were 0.834 for EE, 0.769 for AE, and 0.858 for CY. Minimum acceptable value for reliability coefficient was 0.5 with values greater than 0.75 being preferable (16). Statistical significance ($P$-value < 0.003) was identified between self-perceived burnout and non-burnout students in all MBI-SS items, in addition to the three subscales. Mean ± SD for all MBI-SS items and subscale scores with reliability coefficients are listed in Table 2.

### Table 2
Descriptive statistics of MBI-SS with internal consistency, $n = 273$

| Burnout       | Non-Burnout | $P$-Value$^a$ | Cronbach's Alpha$^b$ |
|---------------|-------------|---------------|-----------------------|
| Emotional Exhaustion | 23.23 ± 4.74 | 14.96 ± 5.71 | 0.001 | 0.834 |
| ITEM 1        | 4.59 ± 1.09 | 2.69 ± 1.40  | 0.001 | 0.687 |
| ITEM 2        | 5.0 ± 1.12  | 3.62 ± 1.56  | 0.001 | 0.690 |
| ITEM 3        | 4.91 ± 1.27 | 3.60 ± 1.59  | 0.001 | 0.687 |
| ITEM 4        | 4.11 ± 1.36 | 2.57 ± 1.33  | 0.001 | 0.686 |
| ITEM 5        | 4.64 ± 1.13 | 2.49 ± 1.42  | 0.001 | 0.682 |
| Academic Efficacy | 24.81 ± 5.35 | 28.74 ± 3.21 | 0.001 | 0.769 |
| ITEM 1        | 4.58 ± 1.29 | 5.18 ± 0.97  | 0.001 | 0.723 |
| ITEM 2        | 3.66 ± 1.52 | 4.25 ± 1.37  | 0.002 | 0.725 |
| ITEM 3        | 4.10 ± 1.55 | 4.82 ± 1.16  | 0.001 | 0.722 |
| ITEM 4        | 4.13 ± 1.51 | 4.91 ± 1.18  | 0.001 | 0.730 |
| ITEM 5        | 4.77 ± 1.14 | 5.17 ± 0.88  | 0.003 | 0.724 |
| ITEM 6        | 3.65 ± 1.25 | 4.47 ± 1.21  | 0.001 | 0.725 |
| Cynicism      | 14.44 ± 5.59 | 7.59 ± 5.16  | 0.001 | 0.858 |
| ITEM 1        | 3.86 ± 1.77 | 1.75 ± 1.47  | 0.001 | 0.681 |
| ITEM 2        | 4.22 ± 1.61 | 2.34 ± 1.53  | 0.001 | 0.679 |
| ITEM 3        | 3.81 ± 1.67 | 2.03 ± 1.70  | 0.001 | 0.680 |
| ITEM 4        | 2.54 ± 1.81 | 1.51 ± 1.48  | 0.001 | 0.725 |

Results of MBI-SS factor analysis are summarized in Table 3. Item loadings were comparable to prior publications using the 15-item MBI-SS and all items were significant (13,18,19). Items 1–5 were considered as EE and loaded negatively with AE and positively with CY. Items 6–11 were considered AE and loaded negatively with both EE and CY. Items 12–15 were considered CY and loaded positively with EE and negatively with AE. Correlations between the MBI-SS subscales were similar to prior publications and are shown in Table 4. The subscale AE was negatively correlated with the EE and CY subscales while the EE and CY subscales were positively correlated.
Table 3
MBI-SS factor analysis loadings, n = 273

| Emotional Exhaustion | Academic Efficacy | Cynicism |
|----------------------|-------------------|----------|
| ITEM 1               | 0.839             | -0.377   | 0.650   |
| ITEM 2               | 0.819             | -0.341   | 0.560   |
| ITEM 3               | 0.828             | -0.309   | 0.606   |
| ITEM 4               | 0.814             | -0.349   | 0.705   |
| ITEM 5               | 0.881             | -0.379   | 0.701   |

Academic Efficacy

| ITEM 6               | -0.234            | 0.627    | -0.285  |
| ITEM 7               | -0.258            | 0.703    | -0.318  |
| ITEM 8               | -0.236            | 0.698    | -0.239  |
| ITEM 9               | -0.398            | 0.693    | -0.402  |
| ITEM 10              | -0.281            | 0.639    | -0.389  |
| ITEM 11              | -0.340            | 0.790    | -0.358  |

Cynicism

| ITEM 12              | 0.739             | -0.465   | 0.861   |
| ITEM 13              | 0.764             | -0.474   | 0.903   |
| ITEM 14              | 0.647             | -0.366   | 0.879   |
| ITEM 15              | 0.478             | -0.313   | 0.776   |

Table 4
MBI-SS subscale correlations, n = 273

|                  | Emotional Exhaustion | Academic Efficacy |
|------------------|----------------------|-------------------|
| Academic Efficacy| -0.421               |                   |
| Cynicism         | 0.770                | -0.486            |

MBI-SS subscale scores were calculated for student demographics, effect of burnout on desired specialty, and awareness of wellness initiatives (Table 5). High EE, CY, and AE subscale scores were assessed to determine the percent of student demographics affected by high levels of burnout, using one SD above the mean for EE and CY and one SD below the mean for AE as indicators of severe burnout. Significance was identified for self-perceived burnout between years of enrollment ($P$-value = 0.005) gender ($P$-value = 0.001), and effect of desired specialty ($P$-value = 0.001). No significance was noted for self-perceived burnout between campus ($P$-value = 0.177), ethnicity ($P$-value = 0.062), having children ($P$-value = 0.050), being religious/spiritual ($P$-value = 0.162), and awareness of wellness initiatives ($P$-value = 0.362).
Table 5

MBI-SS subscale scores and association between self-reported burnout, \( n = 273 \)

|                          | Emotional Exhaustion | Cynicism | Academic Efficacy |
|--------------------------|----------------------|----------|------------------|
|                          | Mean ± SD            | High EE score n (%) | Mean ± SD | High CY score n (%) | Mean ± SD | High AE score n (%) | Burnout n (%) | \( \chi^2 \)-statistic\(^b\) (P-value\(^c\)) |
| All responses (\( n = 273 \)) | 18.3 ± 6.67          | 23 (8.4) | 10.41 ± 6.29 | 23 (8.4) | 27.11 ± 5.34 | 27 (9.9) | 107 (39.2) |
| **Campus**               |                      |          |                  |          |                  |          |          |
| Chicago (\( n = 125 \))  | 18.56 ± 7.12         | 13 (10.4) | 10.86 ± 6.11 | 16 (12.8) | 27.4 ± 5.4 | 13 (10.4) | 56 (44.8) | 3.46 (0.177) |
| Peoria (\( n = 59 \))    | 17.55 ± 6.45         | 3 (5.1)  | 9.26 ± 5.84 | 1 (1.7)  | 26.66 ± 6.86 | 8 (13.6) | 33 (38.8) |          |
| Rockford (\( n = 85 \))  | 18.48 ± 6.19         | 7 (8.2)  | 10.67 ± 5.78 | 6 (7.1)  | 27.03 ± 5.45 | 6 (7.1)  | 18 (30.5) |          |
| **Year of enrollment**   |                      |          |                  |          |                  |          |          |
| M1 (\( n = 88 \))        | 17.39 ± 6.44         | 4 (4.6)  | 8.67 ± 6.07 | 7 (8)    | 27.77 ± 4.68 | 6 (6.8)  | 26 (29.5) | 12.66 (0.005) |
| M2 (\( n = 51 \))        | 19.3 ± 6.86          | 4 (7.8)  | 10.91 ± 5.9 | 2 (3.9)  | 25.65 ± 6.1 | 10 (19.6) | 23 (45.1) |          |
| M3 (\( n = 78 \))        | 20.1 ± 6.04          | 9 (11.5) | 12.46 ± 6.40 | 10 (12.8) | 26.68 ± 5.24 | 7 (9)    | 42 (53.8) |          |
| M4 (\( n = 52 \))        | 16.13 ± 7.08         | 6 (11.6) | 9.85 ± 5.89 | 4 (7.7)  | 28.17 ± 5.47 | 4 (7.7)  | 16 (30.8) |          |
| **Gender**               |                      |          |                  |          |                  |          |          |
| Male (\( n = 110 \))     | 17.22 ± 6.63         | 6 (5.5)  | 9.81 ± 6.16 | 7 (6.4)  | 27.63 ± 5.24 | 8 (7.3)  | 30 (27.3) | 11.69 (0.001) |
| Female (\( n = 156 \))   | 19.07 ± 6.68         | 17 (10.9)| 10.8 ± 6.3  | 15 (9.6) | 26.7 ± 5.46 | 19 (12.2) | 75 (48.1) |          |
| **Ethnicity**            |                      |          |                  |          |                  |          |          |
| Asian (\( n = 59 \))     | 18.86 ± 7.14         | 6 (15.4) | 11.02 ± 6.67 | 6 (15.4) | 25.76 ± 5.73 | 10 (25.6) | 27 (45.8) | 8.97 (0.062) |
| Black/AA (\( n = 12 \))  | 16.75 ± 8.79         | 2 (5.1)  | 10.17 ± 8.5 | 3 (7.7)  | 27.92 ± 4.68 | 1 (2.6)  | 5 (41.7)  |          |
| Hispanic/Mexican (\( n = 22 \)) | 18 ± 6           | 1 (2.6)  | 11.45 ± 4.62 | 1 (2.6)  | 27.27 ± 5.4 | 1 (2.6)  | 7 (31.8)  |          |
| White (\( n = 166 \))    | 18.13 ± 6.55         | 13 (33.3)| 10.06 ± 6.2  | 13 (33.3) | 27.7 ± 5.05 | 12 (30.8) | 58 (34.9) |          |
| Other (\( n = 14 \))     | 19.79 ± 5.62         | 1 (2.6)  | 11 ± 5.62   | 0 (0)    | 24.93 ± 6.63 | 3 (7.7)  | 10 (71.4) |          |
| **Children**             |                      |          |                  |          |                  |          |          |
| Yes (\( n = 10 \))       | 14.54 ± 5.8          | 0 (0)    | 7.91 ± 5.56 | 1 (10)   | 27.91 ± 3.88 | 0 (0)    | 1 (10)   | 3.84 (0.050) |
| No (\( n = 259 \))       | 18.46 ± 6.68         | 23 (8.9) | 10.54 ± 6.27 | 22 (8.5) | 27.08 ± 5.4 | 27 (10.4) | 106 (40.9) |          |
| **Religion/Spiritual**   |                      |          |                  |          |                  |          |          |
| Yes (\( n = 122 \))      | 17.96 ± 6.88         | 13 (10.7)| 10.29 ± 6.2  | 11 (9)   | 27.3 ± 5.74 | 14 (11.5) | 44 (36.1) | 1.96 (0.162) |
Multiple regression analysis of the two- and three-dimensional MBI-SS models are shown in Table 6. The independent variables (Model 1), out-of-phase (P-value = 0.002) in the curriculum, gender (P-value = 0.035), the effectiveness of wellness initiatives (P-value = 0.006), and the SMMS toolkit (P-value = 0.001), were significantly associated with the two-dimensional MBI-SS model. Being out-of-phase (B = -13.3) in the curriculum, rating the wellness initiatives as effective (B = -2.8), and high ratings of the SMMS toolkit (B = -0.5) were negatively associated with two-dimensional MBI-SS model. Gender (B = 3.7), specifically being female, was positively associated with two-dimensional MBI-SS model. The independent variables (Model 2), out-of-phase (P-value = 0.001) in the curriculum, the effectiveness of wellness initiatives (P-value = 0.048), and the SMMS toolkit (P-value = 0.001), were significantly associated with the three-dimensional MBI-SS model. All variables, being out-of-phase (B = -11.7) in the curriculum, rating the wellness initiatives as effective (B = -1.9), and high ratings of the SMMS toolkit (B = -0.3) were negatively associated with three-dimensional MBI-SS model.

Multiple regression analysis of MBI-SS subscale scores was evaluated to determine if any significance in the two- and three-dimensional MBI-SS models were due to individual or a combination of subscale scores (Table 7). The independent variables (Model 3), out-of-phase (P-value = 0.006) in the curriculum, gender (P-value = 0.017), the effectiveness of wellness initiatives (P-value = 0.016), and the SMMS...
toolkit (P-value = 0.001), were significantly associated with the EE subscale. Negative associations between being out-of-phase (B = -6.5) in the curriculum, rating the wellness initiatives as effective (B = -1.3), and high ratings of the SMMS toolkit (B = -0.2) were noted with the EE subscale. Again, gender (B = 2.3), especially being female, was positively associated with the EE subscale. The independent variables (Model 4), the effectiveness of wellness initiatives (P-value = 0.024) and the SMMS toolkit (P-value = 0.001), were significantly associated with the AE subscale. Both rating the wellness initiatives as effective (B = 1.1) and high ratings of the SMMS toolkit (B = 0.2) were positively associated with the AE subscale. The independent variables (Model 5), out-of-phase (P-value = 0.002) in the curriculum, the effectiveness of wellness initiatives (P-value = 0.005), and the SMMS toolkit (P-value = 0.001), were significantly associated with the CY subscale. Being out-of-phase (B = -6.8) in the curriculum, rating the wellness initiatives as effective (B = -2.8), and high ratings of the SMMS toolkit (B = -0.3) were negatively associated with the CY subscale.

**Table 7**
Regression analysis of MBI-SS subscales for continuous variables, n = 273

|                          | Emotional Exhaustion | Academic Efficacy | Cynicism |
|--------------------------|----------------------|-------------------|----------|
|                          | Unstandardized       | t                  | P-value  | Unstandardized       | t                  | P-value  | Unstandardized       | t                  | P-value  |
| Year of enrollment       | -0.751               | -1.231             | 0.22     | 0.874               | 1.658              | 0.099     | -0.352               | -0.629             | 0.53     |
| Campus                   | 0.374                | 0.593              | 0.554    | -1.076              | -1.977             | 0.05      | 0.135                | 0.233              | 0.816    |
| Out-of-Phase             | -6.497               | -2.801             | **0.006**| 1.632               | 0.815              | 0.416     | -6.785               | -3.192             | **0.002**|
| Time off before matriculation | 1.647               | 1.406              | 0.162    | -1.793              | -1.772             | 0.078     | 1.251                | 1.165              | 0.246    |
| Gender                   | 2.344                | 2.413              | **0.017**| -1.112              | -1.327             | 0.186     | 1.352                | 1.519              | 0.131    |
| Age                      | 0.045                | 0.189              | 0.85     | 0.287               | 1.387              | 0.167     | -0.094               | -0.428             | 0.669    |
| Relationship status      | 0.033                | 0.027              | 0.979    | -1.732              | -1.616             | 0.108     | -0.252               | -0.222             | 0.825    |
| Children currently       | 1.558                | 0.583              | 0.56     | -0.802              | -0.348             | 0.728     | -0.036               | -0.015             | 0.988    |
| Religious/Spiritual      | 0.598                | 0.575              | 0.566    | -0.011              | -0.012             | 0.99      | 0.203                | 0.213              | 0.831    |
| Educational debt         | 0.623                | 0.957              | 0.34     | -0.701              | -1.248             | 0.214     | 0.842                | 1.411              | 0.16     |
| Effectiveness of wellness initiatives | -1.351           | -2.425             | **0.016**| 1.094               | 2.275              | **0.024**| -1.454               | -2.847             | **0.005**|
| SMMS Toolkit             | -0.233               | -5.081             | **0.001**| 0.201               | 5.525              | **0.001**| -0.282               | -6.806             | **0.001**|

**Discussion**

Herbert Freudenberger was the first to describe burnout in 1974 as a `state of mental and physical exhaustion caused by one's professional life'(20). The definition of burnout changes slightly depending on the population under investigation, yet, the underlying description explained by Freudenberger remains consistent. In the current study, burnout was described as `feeling exhausted because of study demands, having a cynical and detached attitude toward one's study, and feeling incompetent as a medical student'. High values for EE and CY while low values for AE were considered consistent with burnout. The main findings of this study were that the MBI-SS is a validated tool to assess medical student burnout and student demographics may be used to predict burnout.

**MBI-SS prediction of burnout in medical students**

The MBI is a validated tool to measure burnout (10). Several MBI surveys are available to measure burnout in different populations. The Human Services Survey is the most widely used MBI version and primarily examines burnout in the health professions, i.e. physicians, nurses, social workers, etc. (15). Most investigations examining burnout in medical students have used the MBI-HSS given a student's responsibility of providing care to patients (21). Our population was comprised of both preclinical and clinical year medical students who had differing levels of experience interacting with patients. The MBI-SS, which is an adaptation of the General Survey, was used in this investigation to examine how the rigors of medical education influence burnout, regardless of their interactions with patients.
Significance between burnout and non-burnout students was noted for all MBI-SS items, subscales, two- and three-dimensional models. Year of enrollment was found to be associated with burnout with rates increasing until M3 and then sharply decreasing during M4. This observation was most likely due to M2 and M3 students preparing for the first USMLE board exam and preparing for away rotations, respectively. Most M4 students were finished with residency interviews and were awaiting their match results when the survey was distributed. Gender, specifically being female, was found to be associated with higher levels of burnout. This finding is similar to prior investigations demonstrating that females are more likely to report higher levels of emotional exhaustion (25–28). Males have been shown to under report burnout and this may have affected gender differences in the current study. Surprisingly, students who reported burnout were more likely to switch their medical specialties to one they considered ‘less desirable’. This could have serious implications for any specialty that is experiencing decreased residency matriculation rates among allopathic medical students, such as general surgery (2).

The loading of the 15-item MBI-SS was similar to previous investigations focusing on medical students (13). EE and CY were found to be positively correlated, while EE and CY were negatively correlated with AE. As expected, EE and CY should both increase in an individual with burnout. In comparison, a student’s AE should decrease with increased values of EE and CY. The negative between burnout and motivation for continued medical education was confirmed using the SMMS toolkit. Significance between burnout and the SMMS was noted between all subscales, in conjunction with the two- and three-dimensional models.

**Student demographics as predictors of burnout**

Multiple regression analysis was used to predict student demographics that influence burnout. Students who were out-of-phase in the curriculum were more likely to report burnout in the two- and three-dimensional model, and EE and CY MBI-SS subscales. Lower scores in the AE MBI-SS subscale were not predictive of burnout. This was likely due to a student’s decision to continue their medical education regardless of how many years additional years they need to graduate. Students who scored higher on the SMMS reported less burnout in all categories and this is likely due to a burnout student being less willing to continue their medical education. Although not shown, the level of SMMS persistence subscale was similar between both burnout and non-burnout students. This observation may be due to a student’s determination to continue their education regardless of their level of burnout.

Gender, especially being female, was noted to be a predictor in the two-dimensional model and EE MBI-SS subscale. Higher rates of EE in females have been previously shown and with the two-dimensional model only accounting for EE and CY, it is not surprising that the model be used as a predictor of burnout between genders (29). Students that reported that the wellness initiatives were effective had lower levels of burnout in all categories. This finding provides strong evidence that implementing effective wellness initiatives may be sufficient for reducing burnout. Across UICOM the services students participated the most in across all campuses were health services (17.1%), meditation (16.6%), and others (8.3%), such as dog therapy, aromatherapy, and art therapy. Other wellness initiatives that students reported as beneficial were access to mental health resources on campus. Studies have shown participation in various interventions can reduce stress and depressive (30). Some students expressed the classes were counterintuitive since it took time away from studying which added more stress. This mirrored the response of our students when they expressed frustration for the mandatory wellness sessions offered by our school.

**Limitations**

The study was cross-sectional by design and the relationships described are only associations and merely suggest a potential causal relationship between burnout and student demographics. The survey period may have influenced perceived level of burnout due to the high stress board examinations and upcoming away rotation applications experienced by M2 and M3 students, respectively. A response rate of 21.6% may suggest that the study was selectively completed by students who possessed a strong opinion about burnout and are not reflective of the entire UICOM medical student population (31,32). Lastly, co-morbidities such as mental and physical health, substance abuse, and uncontrollable life events were not assessed in the survey, which have been shown to influence burnout in the medical profession (28,33–35).

**Conclusion**

The 15-item MBI-SS is a validated tool that can assess burnout in medical students. Burnout among UICOM medical students was slightly less than reported national averages. Student demographics, such as gender and being out-of-phase in the curriculum, may be used to identify at-risk groups susceptible to burnout. The implementation of effective wellness initiatives may be sufficient for ameliorating burnout among medical students. We recommend burnout be longitudinally assessed once a year in all medical students.
to determine the effectiveness of wellness initiatives and make modifications as appropriate. Burnout is a deleterious issue that can negatively impact the healthcare community. Early identification and resolution of the phenomenon can help improve the health outcomes of patients receiving care from medical students and resident progressing through their education.

List of Abbreviations

UICOM: University of Illinois College of Medicine; UI-Rockford: University of Illinois College of Medicine at Rockford; MS#: Medical Student Year 1–4; MBI-SS: Maslach Burnout Inventory-Student Survey; EE: Emotional Exhaustion; CY: Cynicism; AE: Academic Efficacy; SMMS: Strength of Motivation for Medical School; IRB: Internal Review Board; SD: Standard Deviation; B: Unstandardized Beta Coefficient;

Declarations

Ethics approval and consent to participate

This study was approved by the IRB at UI-Rockford. All respondents provided written agreement to participate in the study and were given the option to withdrawal at any time.

Consent for publication

Our findings have been reviewed by our research committee and we have obtained consent for publication.

Availability of data and material

Data is freely available on reasonable request.

Competing interests:

The authors declare that they have no competing interests.

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References

1. Reith TP. Burnout in United States Healthcare Professionals: A Narrative Review. Cureus. 2018;10(12).
2. Yang Y, Li J, Wu X, Wang J, Li W, Zhu Y, et al. Factors influencing subspecialty choice among medical students: A systematic review and meta-analysis. BMJ Open. 2019;9(3):1–12.
3. 10.1016/S0140-6736(16)31279-X
West CP, Dyrbye LN, Erwin PJ, Shanafelt TD. Interventions to prevent and reduce physician burnout: a systematic review and meta-
analysis. Lancet [Internet]. 2016;388(10057):2272–81. Available from: http://dx.doi.org/10.1016/S0140-6736(16)31279-X.

4. Han S, Shanafelt TD, Sinsky CA, Awad KM, Dyrbye LN, Fiscus LC, et al. Estimating the Attributable Cost of Physician Burnout in the United States. Ann Intern Med [Internet]. 2019;170(11):784. Available from: http://annals.org/article.aspx?doi=10.7326/M18-1422.

5. Corish B. Medical knowledge doubles every few months; how can clinicians keep up? Elsevier [Internet]. 2018;11. Available from: American Nephrology Nurses Association.

6. Gauer JL, Jackson JB. The association of USMLE Step 1 and Step 2 CK scores with residency match specialty and location. Med Educ Online. 2017.

7. Cook AF, Arora VM, Rasinski KA, Curlin FA, Yoon JD. The prevalence of medical student mistreatment and its association with burnout. Acad Med. 2014.

8. Enoch L, Chibnall JT, Schindler DL, Slavin SJ. Association of medical student burnout with residency specialty choice. Med Educ. 2013.

9. Silva V, Costa P, Pereira I, Faria R, Salgueira AP, Costa MJ, et al. Depression in medical students: Insights from a longitudinal study. BMC Med Educ. 2017.

10. Maslach C, Jackson SE. The measurement of experienced burnout. J Organ Behav. 1981;2(2):99–113.

11. Schaufeli W, Martínez I, Pinto A, Salanova MBA. Burnout and engagement in university students a cross-national study. Journal of cross-cultural psychology. J Cross Cult Psychol. 2002;33(5):464–81.

12. Galán F, Sanmartín A, Polo J, Giner L. Burnout risk in medical students in Spain using the Maslach Burnout Inventory-Student Survey. Int Arch Occup Environ Health. 2011;84(4):453–9.

13. Wickramasinghe ND, Dissanayake DS, Abeywardena GS. Clinical validity and diagnostic accuracy of the Maslach Burnout Inventory-Student Survey in Sri Lanka. Health Qual Life Outcomes. 2018;16(1):1–10.

14. Nieuwhof MGH, ThJ ten Cate O, Oosterveld P, Soethout MB. Measuring Strength of Motivation for Medical School. Med Educ Online. 2004;9(1):4355.

15. Maslach C, Jackson SE, Leiter M. The Maslach Burnout Inventory Manual 3rd Edition. In: Maslach Burnout Inventory,. 1997.

16. Taber KS. The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. Res Sci Educ. 2018.

17. Leibach G, Stern M. Critical Synthesis Package: Strength of Motivation for Medical School—Revised (SMMS-R) Questionnaire. MedEdPORTAL Publ. 2014.

18. 10.1080/08964289.2016.1170662
Illic M, Todorovic Z, Jovanovic M, Illic I. Burnout Syndrome Among Medical Students at One University in Serbia: Validity and Reliability of the Maslach Burnout Inventory—Student Survey. Behav Med [Internet]. 2017;43(4):323–8. Available from: https://doi.org/10.1080/08964289.2016.1170662.

19. Rostami Z, Abedi MR, Schaufeli WB, Ahmadi SA, Sadeghi AH. The Psychometric Characteristics of Maslach Burnout Inventory Student Survey: A Study Students of Isfahan University. Zahedan J Res Med Sci J. 2013.

20. Freudenberg HJ. Staff Burn-Out. J Soc Issues. 2010;30(1):159–65.

21. Erschens R, Keifenheim KE, Hermann-Werner A, Loda T, Schwille-Kientke J, Bugaj TJ, et al. Professional burnout among medical students: Systematic literature review and meta-analysis. Med Teach. 2019.

22. Portoghese I, Leiter MP, Maslach C, Galletta M, Porru F, D'Aloja E, et al. Measuring burnout among university students: Factorial validity, invariance, and latent profiles of the Italian Version of the Maslach Burnout Inventory Student Survey (MBI-SS). Front Psychol. 2018;9(NOV):1–9.

23. 10.1080/10401334.2018.1523010
Shi Y, Gugiu PC, Crowe RP, Way DP. A Rasch Analysis Validation of the Maslach Burnout Inventory—Student Survey with Preclinical Medical Students. Teach Learn Med [Internet]. 2019;31(2):154–69. Available from: https://doi.org/10.1080/10401334.2018.1523010.

24. Dos Santos Boni RA, Paiva CE, De Oliveira MA, Lucchetti G, Fregnani JHTG, Paiva BSR. Burnout among medical students during the first years of undergraduate school: Prevalence and associated factors. PLoS One. 2018.

25. Dyrbye LN, West CP, Satele D, Boone S, Tan L, Sloan J, et al. Burnout among u.s. medical students, residents, and early career physicians relative to the general u.s. population. Acad Med. 2014;89(3):443–51.
26. Monrouxe LV, Bullock A, Tseng HM, Wells SE. Association of professional identity, gender, team understanding, anxiety and workplace learning alignment with burnout in junior doctors: A longitudinal cohort study. BMJ Open. 2017;7(12):1–12.

27. Santen SA, Holt DB, Kemp JD, Hemphill RR. Burnout in medical students: Examining the prevalence and associated factors. South Med J. 2010;103(8):758–63.

28. Dyrbye LN, Thomas MR, Huntington JL, Lawson KL, Novotny PJ, Sloan JA, et al. Personal life events and medical student burnout: A multicenter study. Acad Med. 2006;81(4):374–84.

29. Purvanova RK, Muros JP. Gender differences in burnout: A meta-analysis. J Vocat Behav [Internet]. 2010;77(2):168–85. Available from: http://dx.doi.org/10.1016/j.jvb.2010.04.006.

30. Frajerman A, Morvan Y, Krebs MO, Gorwood P, Chaumette B. Burnout in medical students before residency: A systematic review and meta-analysis. Eur Psychiatry [Internet]. 2019;55:36–42. Available from: https://doi.org/10.1016/j.eurpsy.2018.08.006.

31. Fincham JE. Response rates and responsiveness for surveys, standards, and the Journal. Am J Pharm Educ. 2008.

32. Safdar N, Abbo LM, Knobloch MJ, Seo SK. Research Methods in Healthcare Epidemiology: Survey and Qualitative Research. Infect Control Hosp Epidemiol. 2016.

33. Jackson ER, Shanafelt TD, Hasan O, Satele DV, Dyrbye LN. Burnout and alcohol abuse/dependence among U.S. Medical Students. Acad Med. 2016;91(9):1251–6.

34. Cecil J, McHale C, Hart J, Laidlaw A. Behaviour and burnout in medical students. Med Educ Online [Internet]. 2014;19:25209. Available from: http://www.ncbi.nlm.nih.gov/pubmed/25160716%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC4145104.

35. Rotenstein LS, Ramos MA, Torre M, Bradley Segal J, Peluso MJ, Guille C, et al. Prevalence of depression, depressive symptoms, and suicidal ideation among medical students a systematic review and meta-analysis. JAMA - J Am Med Assoc. 2016;316(21):2214–36.

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