Improve Management of Stress-related Mental Disorders in Chinese Medical Students: A Randomized Controlled Study

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Abstract

Background

Depression, burnout and reduced clinical empathy are the most prevalent mental disorders in medical students. Effective strategies to improving the situations are lacking. This study aimed to investigate the efficacy of teaching an interventional course tailored to the needs of senior Chinese medical students.

Methods

Our study enrolled a total of 146 senior medical students from Zhongshan School of Medicine, Sun Yat-sen University between March 2016 and June 2016 for analysis. The study designed an interventional course based on the preliminary data revealed by a pilot study group (5 pre-clinical students and 5 interns), and the control group got the traditional courses. Before and after the courses, our study required all students to complete five self-assessment questionnaires to evaluate the score of depression, burnout, empathy, self-efficacy (SE), and quality of life (QoL).

Results

After the courses, the interventional group had significantly higher empathy and QoL scores, compared to the control group (111.0 vs 106.0, $P = .012$, and 32 vs 29.5, $P = .04$, respectively). While depression scores in the interventional group were significantly lower than those in control group ($P = .02$). However, there were no significant differences in burnout and self-efficacy scores between both groups.

Conclusions

Our interventional course had a positive impact on the stress-related mental disorders of Chinese medical students, which may help provide novel information for incorporation into the “wellness curricula” of medical schools.

Background

Many stress factors including long-hour study, frequent examinations and reduced clinical empathy make medical students vulnerable to mental health problems [1–4]. Ampler literature has shown that a significant proportion of medical students have different degrees of mental disorders [5, 6]. In addition, the percentage of morbidity from depression was significantly higher among medical students (22–36%) than pre-college students and general population (2–16%) [7–10]. It is well documented that medical students are more susceptible to burnout associated with a noticeable lack of self-efficacy, which affects their academic performance, clinical empathy and overall quality of life [11]. In China, this issue is further exacerbated by the clinically-compromised patient-doctor relationship from medico-legal and patient care

point of view [12]. Frequent medico-legal disputes have negatively impacted both the medical students' passion and confidence in pursuing their future medical careers [13, 14]. Inevitably, the reduced clinical empathy compromised the students' ability of communication and clinical performance [15, 16].

Although the mental health of medical students many literatures have raised extensive concerns regarding the mental health of medical students, effective interventional strategies are lacking [17]. Interventions including mindfulness-based stress reduction (MBSR), Yoga and psychological counseling have been proposed to reduce the mental stress and improve their coping ability [2, 18]. However, these interventions are usually applied for the general population rather than being specially designed for medical students. Additionally, in the above-mentioned interventions, docents, whom are usually psychologists, are used instead of trained clinician, may find it difficult to understand the clinical sympathy that the medical students need in their daily practice.

In China, medical students usually spend five years in their undergraduate course with initiation of full clinical contact in their third year. This transition always brings the heaviest study load and most of the associated mental problems [19]. Students in senior grades often feel more depressed than their junior grade students with more burnout as well as lower sense of personal achievement [20]. Therefore, we chose the third-grade medical students as research candidates and performed a prospective randomized controlled study. Experienced clinicians were selected to provide psychologically oriented interventional courses in the form of workshop. Then, we explored the impact of them on the medical students' physical wellbeing, mental health & wellbeing (depression, quality of life [QoL]), motivation to study (burnout, self-efficiency [SE]) and clinical empathy.

Materials And Methods

Participants

This is a single-center, randomized controlled study conducted in Zhongshan School of Medicine, Sun Yat-sen University between March 2016 and June 2016. Enrollment criteria included: (1) Third and fourth-year medical students whose course major was clinical medicine. (2) Age between 18 to 25 years old; (3) Absence of previous history of mental illness (Fig. 1). Finally, a total of 146 medical students were enrolled. All enrolled participants will read and sign a written informed consent before commencing the study.

Study design and randomization

Eligible participants were randomly assigned to an intervention (n = 74) and a control group (n = 72) according to the results of a sealed opaque envelope given by a co-investigator. The randomization coding list was generated by a simple randomization allocation method PLAN procedure (SAS, version 9.4, USA). Neither the students nor their teachers were blind to the allocated group due to the interactive schedules between both groups. Each group received one session per month for three months.

Development of the Intervention course

To render the interventional course more effective for Chinese medical students, we randomly selected five pre-clinical medical students and five interns to serve as a pilot study group for creation of preliminary data. In the next phase of the study, we interviewed each member of the pilot group for three months before the interventional course. The pilot group members were asked questions in relation to their mental state in their daily life and attitude towards clinical work; their answers were reviewed and analyzed by all investigators. Based on their answers regarding their daily tasks, the content of the interventional course and moderation scales were formulated.

Course administration

The intervention course focused on three main subjects: (1) Establishing the sense of Achievement, (2) Means for Efficient Patient-Doctor Communication, (3) Strategies to Manage Medical Errors. Before the intervention, we (authors) selected three experienced clinicians with at least 10 years of clinical service in our affiliated hospital to serve as docents. The docents were trained by a member of our team to ensure their familiarity with the protocol. Additionally, we (authors) selected several relevant stories for each clinician to share with the medical students and each docent was able to narrate these stories fluently. The shared stories were based on concerns raised by the pilot group, for example: (1) Positive aspects of medical practice such as letters of gratitude, awards or newly acquired experience; (2) Strategies for efficient patient communication and ways to break bad news; (3) Dealing with medical errors.

The interventional courses took the casual form of data collection like a tea party with candies and cookies served in the same classrooms after the regular medical class sessions. The students were divided into three small groups (25students/group) according to the order of their code number and each group was assigned a corresponding docent. During the course, each docent narrated a story about one of the three participants for 30 minutes, then students were allowed another 30 min for group discussion and sharing their own feelings. Each group of students took the interventional course with one of the docents simultaneously every month. At the beginning of the course, all students were required to answer a self-assessment questionnaire for five scales and wrote down their contact information. The same scales were administered to all students again a month after the end of the interventional courses (3 months). Students in the control group were divided into three groups in the same classrooms following the regular sessions with candies and cookies served. The control group students were assigned to an experienced teacher for random conversation without selected topics in a tea party style with candies and cookies served. Control group students were required to finish the same questionnaire scales before and a month after the random conversation courses.

Follow up

In order to evaluate the long-term impact of the intervention course, we contacted all the interventional group students two years after the course completion (June, 2018) by e-mail. They were requested to reflect on their interventional course by responding to the following three questions: (1) Please write down

the most impressive story you remember from the interventional course? (2) Which aspect of the interventional course influence you the most? (3) How did you apply strategies from the interventional course in your daily clinical practice?

Data collection

In this trial, we used five validated questionnaires to reflect the emotional stress, physical health, mental health, burnout and professionalism. All participants were asked to fill questionnaires anonymously before and after intervention. Itemized questions in each survey were initially translated into Chinese for data collection, then translated back into English by bilingual researchers at the First Affiliated Hospital of Sun Yat-sen University to ensure the accuracy of translation. In both groups, we applied SE, QoL [21], Depression, Burnout and Empathy scale to measure the above-mentioned outcomes (see Additional file 1).

Sample size

We estimated that with a sample size of 64 patients assigned to each group, the study would have 80% power to detect 5 points differences with standard deviation of 10 in the primary end point of Empathy between two groups. The power and sample size were calculated with two-sided Chi-square test at a 5% significance level. In the current study, the sample size was 146 participants, rendering 85% power to detect a 2.5 points difference with a standard deviation of 5 in the quality of life scale and 64% power to detect a 15.7% difference between both groups in median or severe depression.

Statistical Analysis

Questionnaires with missing information in three or more items were excluded from subsequent analysis. On the other hand, missing data within relevant items were replaced with the median values of the remaining relevant items. The baseline characteristics of medical students were presented as mean (standard deviation) or median with interquartile range for continuous variables and frequencies (and percentages) for categorical variables. Independent sample t test or Wilcoxon rank sum test was used to compare differences for continuous variables between the two groups while Chi-square test or Fisher exact test was used for categorical variables. All statistical analysis was performed using SAS (version 9.4, USA). A P value < 0.05 was considered to be statistically significant.

Results

Cohort and baseline characters

In this study, we initially recruited 160 third and fourth-year medical students. After applying the inclusion criteria and obtaining the students' consents, a total of 146 medical students were enrolled. Participants were randomized into two arms (74 students in interventional group and 72 students in control group) as described above (Fig. 1). Among all collected surveys, none of the scales were excluded from the analysis but 15 missing minor items were found and they were classified as median. There was no significant

difference in gender and age between the intervention and control group. Additionally, there were no significant differences in the baseline scale scores between both groups (Table 1).

Table 1
Baseline Characteristics of 146 senior medical students between intervention and control group

Variables	Total	Control group (n = 72)	Intervention group (n = 74)	P value ^a
Age, median (IQR)	21.0 (20.0, 21.0)	20.5 (20.0, 21.0)	21.0 (20.0, 21.0)	0.42
Gender				0.87
Boys	76 (52.1%)	37 (51.4%)	39(52.7%)	
Girls	70 (47.9%)	35 (48.6%)	35(47.3%)	
SE, mean (SD)	26.0 (5.0)	26.1(4.4)	25.8(5.6)	0.76
QOL, median (IQR)	31.0 (29.0, 34.0)	31.0 (28.5, 34.0)	31.0 (29.0, 34.0)	0.62
Depression				0.17
No	117 (80.1%)	61(84.7%)	56 (75.7%)	
Yes	29 (19.9%)	11(15.3%)	18 (24.3%)	
Burnout				0.82
No	96 (65.8%)	48 (66.7%)	48 (64.9%)	
Yes	50 (34.2%)	24 (33.3%)	26 (35.1%)	
Empathy, median (IQR)	110 (102, 118)	110.5 (101.5, 119)	110 (103, 116)	0.98
Notes: Continuous variables are presented as mean (SD) and median (IQR). Categorical variables are presented as n (%) according to different levels.				
^a t-test results for continuous variables with normal distribution, Wilcoxon test results for continuous variables with abnormal distribution, and Chi-square test results for categorical variables.				
Abbreviations: SE, self-efficacy; QOL, quality of life; SD, standard deviation; IQR, inter-quartile range.				

Outcomes of Randomized arms

Interventional group students attended 3 educational sessions discussing various challenges facing their daily clinical duty and different coping strategies and potential solutions. Control group students attended 3 random conversation sessions over the course of three months. In the next phase of the study, all students were asked to retake the self-assessment questionnaires for the same five scales and the outcomes of both groups were compared (Table 2). In comparison to the control group, students in the interventional group have significantly higher score of empathy (111.0 (IQR: 102.0, 118.0) vs 106.0 (IQR: 93.0, 111.5), $P = .01$; Table 2 and Fig. 2a). Following the interventional course, the difference in depression

scores between the control and interventional group was statistically significant ($P = .02$, Fig. 2b and Table 2). Following the interventional course, the QoL score was significantly higher in the interventional group than the control group (32 vs 29.5, $P = .04$, Table 2 and Fig. 2c). For the burnout scale, a decreased trend was observed in the intervention group compared to the control group ($n = 20$, 27% vs $n = 25$, 34.7%, Table 2). However, there was no significant difference between both groups in the burnout scale ($P = .31$). Similarly, there was no statistically different in the self-efficacy between the interventional and the control group (25.6 vs 24.3, $P = .16$, Table 2).

Table 2
Outcomes of 146 senior medical students between intervention and control group

Variables	Total	Control group (n = 72)	Intervention group (n = 74)	P value ^a
SE, mean (SD)	25.0 (5.6)	24.3 (6.3)	25.6 (4.8)	0.16
QOL, median (IQR)	31.0 (26.0,35.0)	29.5 (26.0, 34.0)	32.0 (28.0, 35.0)	0.04
Depression				0.02
No	115 (78.8%)	51 (70.8%)	64 (86.5%)	
Yes	31 (21.2%)	21 (29.2%)	10 (13.5%)	
Burnout				0.31
No	101 (69.2%)	47 (65.3%)	54 (73.0%)	
Yes	45 (30.8%)	25 (34.7%)	20 (27.0%)	
Empathy, median (IQR)	108.5 (99.0, 115.0)	106.0 (93.0, 111.5)	111.0 (102.0, 118.0)	0.01

Note: Continuous variables are presented as mean (standard deviation, SD), median (inter-quartile range, IQR) and N (min, max). Categorical variables are presented as n (%) according to different levels.

^a t-test results for continuous variables with normal distribution, Wilcoxon test results for continuous variables with abnormal distribution, and Chi-square test results for categorical variables.

Abbreviations: SE, self-efficacy; QOL, quality of life; SD, standard deviation; IQR, inter-quartile range.

Follow up

Two years after the interventional course, we sent follow-up emails to all participants in the interventional group. Two weeks later, we got twenty-one replies with a response rate of 25.6%. All replied participants reflected on the positive aspects of the interventional course and its positive and constructive influence on their daily practice and long-term careers. Participants found that interventional courses on the sessions of the doctor-patient communication and clinical mistakes were the most helpful and rewarding for their clinical performance. There are some quotes from the participants' replies as follows:

I still remember one story: when the patients' wife asked whether she should keep trying to treat her chronically-ill husband with a huge cost, the teacher answered "If I were you, I would try to save him as long as there is hope and comfort for him without going bankrupt and hurting yourself." I felt this story very touching and I am now using this way of discussion in my clinical practice when facing similar situation.

I remembered sharing my fears of making clinical mistakes and my course teacher told us not to be fear of making mistakes because a clinical decision was always made in the consensus view of the clinical team. We are always supported by our senior colleagues when facing new and complex clinical situations. The courses have provided me courage, clinical empathy and confidence to learn new techniques and explore novel surgical operations for the best interests of patients' care.

Discussion

In this study, we investigated the impact of educational intervention on the mental health of senior medical students. In brief, we designed educational courses based on the positive experiences shared by clinicians and courses were subsequently carried out on the third and fourth-year medical students. Additionally, we required all enrolled participants to complete several self-assessment questionnaires regarding their physical wellbeing, mental health (depression, QoL), self-motivation (burn-out, SE) and doctor-patients communication (empathy) before and after the interventional courses. Our results demonstrated that the students who received the intervention course had significantly improved scores of depression and empathy after the course, compared with students who underwent random conversational sessions in similar settings.

Intense medical school schedule, unbalanced work-life load and heavy stress from doctor-patient communication can negatively impact the mental well-being of medical students. These mental health problems are more prevalent in the senior students because they have more specialized courses and more complex clinical work. Perera et al showed that the score of empathy was negatively correlated with the increasing load of clinical work in medical students at Boston University (R. Perera 2016). In China, the 3rd and 4th year of the medical course is an important transitional stage in the student's academic calendar which is characterized by the heaviest study load and the full-time clinical exposure. The incidence of depression was proven to be higher in senior medical students by a national survey that has screened 33 universities in China [19]. Hence, we selected the 3rd/4th grade medical students as the participants in this study.

In the pre-trial interview, we analyzed and extracted the main challenges facing students including anxiety about clinical practice, fear of uncertainties and medical errors as well as dealing with doctor-patient conflicts. These challenges have been served as associated risk factors accounting for the above-mentioned mental health problems. Based on the results from the interview in the pilot group study, we designed our interventional courses accordingly. We chose experienced clinicians to share real life experiences in participants with stress risk factors in a form of workshop. Interestingly, we found that the depression score was significantly reduced by 10.8%, and the QoL score increased significantly after the

interventional courses. In Malaysia, the impact of a well-being workshop was examined in medical students [22]. Medical students were taught specific strategies to deal with stress and the outcome was favorable [5]. Similarly, Lee and Graham designed an elective course in improving medical students' mental wellness. During this course, students learned about emotional relief and time management to help them cope with clinical workload pressure [23]. Nevertheless, the above-mentioned studies were not randomized controlled studies and they examined junior medical students (1st /2nd) grade. Therefore, their interventional courses might not be suitable for senior Chinese medical students. In addition, the above-mentioned studies using psychologists as the docents, who lacked clinical experience, potentially hindering the clinically effective communication with medical students. In our study, we selected senior medical students who are most reliable candidates. We designed a randomized controlled study to strengthen the validity of our intervention. Furthermore, we selected senior and experienced clinicians to share their own clinical experiences, empathy education and communication skills during the study. We have indeed observed that the well-designed interventional courses for Chinese medical students were effective when combining clinical and technical skills teaching with doctor-patient communication skills teaching. Students who received our interventional courses could comfortably handle their clinical workload pressure and work-related anxiety and stress with improvement in their QoL.

Our results demonstrated that empathy in the interventional group improved significantly. Empathy can be of great help in the better doctor-patient communication to achieve the best mutual understanding [24]. Empathy is also important to patient care by enhancing patients' satisfaction, comfort, self-efficacy and trust leading to accurate diagnosis, shared decision making and therapy adherence. (Quince et al. 2016) Hence, improving empathy of medical students is a primary focus of medical educators. Hospital-related violent incidents have been shown to be closely related to poor doctor-patient communication [25]. Poor doctor-patient relationship may lower the students' clinical empathy which could further exacerbate the doctor-patient communication ultimately affecting the patients' prognosis [26, 27]. In this study, we used experienced clinicians as role models to teach students about the value of empathy. Our clinicians shared real life cases for efficient doctor-patient communications and requested students to reflect on their own experiences. As described in the follow up emails, students stated that they were impressed by the stories shared by the experienced clinicians. The students have been using those stories in guiding their real-life doctor-patient communications and clinical practice.

In this study, 50 (34.2%) of our senior medical students had the symptoms of burnout. In another study, Chunming et al previously reported that the burnout rate in Chinese medical students was 40% which was thought to be related with gender, grade and previous history of psychological diseases [28]. In contrast, our study did not observe a correlation between gender and burnout. Additionally, the interventional course did not show a significantly improvement of burnout or self-efficacy. This could be attributed to either the heavy workload of the 3rd and 4th medical years or the relatively short duration of the interventional course. Future studies with longer interventional courses and longer follow-up periods will be required to validate our hypothesis.

This study has several limitations with firstly being a single-center study. Secondly, we could not prevent the student participants' communication regarding the research contents after classes which might lead to bias on follow-up data collection. In summary, our results need to be confirmed in a large multicenter double-blind randomized study to prove its applicability.

Conclusions

The interventional courses conducted by clinicians as docents sharing real-life experiences can significantly reduce depression, improve QoL score and promote clinical empathy among senior Chinese medical students. Our study demonstrates the instrumental use of therapeutic sessions to improve the mental health among medical students. Our results could pave the way towards a novel strategy for medical education intervention including course reform by adding the wellness curriculum to prevent stress-related mental disorders among medical students.

Abbreviations

SE, self-efficacy; QoL, quality of life; MBSR, mindfulness-based stress reduction; IQR, inter-quartile range.

Declarations

Ethics approval and consent to participate

The study was approved by the institutional ethic review board of Zhongshan School of Medicine and all enrolled participants read and signed a written informed consent before commencing the study.

Consent for publication

Not applicable.

Availability of data and materials

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

RR and JLG conceived the design. MK and HPX supervised the study. WC, WYC, ZHD and YBZ performed all the clinical biology experiments. RR, JLG and YBZ analyzed the data. RR and ZHD wrote the manuscript. MK and HPX reviewed the manuscript. All authors reviewed and approved the manuscript.

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Figures

Figure 1

Flowchart of the inclusion of study participants according to CONSORT diagram.

Figure 2

The scatter plot of (a) median of empathy, (b) proportion of depression, and (c) median of QoL before and after intervention for each group. Red represents data from control group and blue from intervention group. Bars mean 95% confidence interval.

Supplementary Files

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