

Effects of Group Fitness Classes on Stress and Quality of Life of Medical Students

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Financial Disclosures: Dr Yorks is a Les Mills International-certified group exercise instructor, but she did not receive financial compensation for instructing the classes or for any part of the research. The research was conducted without the knowledge or consent of Les Mills International.

Support: Funded by the Carmen Pettapiece, DO, Student Research Fund, dispensed by the UNECOM Student Government Association Professional Development Committee.

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Submitted
July 28, 2016;
revision received
January 23, 2017;
accepted
January 30, 2017.

Context: Medical school can produce intense psychological distress in its students; however, there is a paucity of research exploring potential means of improving medical students' well-being.

Objective: To investigate the relationship between physical exercise and stress and quality of life (QOL) in a medical student population.

Methods: This nonrandomized, controlled, 12-week study used a survey research design. First- and second-year osteopathic medical students at the University of New England College of Osteopathic Medicine were recruited to participate in 1 of 3 groups: (1) students participating in 30-minute CXWORX (Les Mills International LTD) group fitness classes; (2) students exercising alone or with up to 2 additional partners regularly (eg, running, weight lifting), henceforth called the *health-enhancement group*; and (3) students in a control group who did not engage in regular exercise. Participants completed the Perceived Stress Scale survey once every 4 weeks, as well as visual analog scale surveys to assess physical, mental, and emotional QOL weekly during the course of the study. Statistical significance was defined as $P < .05$.

Results: Sixty-nine participants met the inclusion criteria and completed the study protocol, with 25 in the fitness class group, 29 in the health-enhancement group, and 15 in the control group. Compared with baseline values, the fitness class group demonstrated decreased perceived stress ($P = .038$) and increased physical QOL ($P = .007$), mental QOL ($P = .046$), and emotional QOL ($P = .004$) after 12 weeks. Participants in the health-enhancement and control groups showed no statistically significant changes between baseline and week 12 for any of these parameters, with the exception of mental QOL, which improved in the health-enhancement group ($P = .023$).

Conclusion: Participation in regular group fitness classes led to a statistically significant decrease in perceived stress and an increase in physical, mental, and emotional QOL compared with exercising regularly on one's own or not engaging in regular exercise. Attending weekly group fitness classes could be a solution to improving the emotional well-being and stress level of medical students.

J Am Osteopath Assoc. 2017;117(11):e17-e25

doi:10.7556/jaoa.2017.140

Keywords: exercise, fitness, quality of life, stress, well-being

Medical school often produces intense psychological distress for medical students. This distress is manifested as depression, anxiety, burnout, increased alcohol use, fatigue, and low quality of life (QOL).¹⁻⁵ Incidences of major

depressive disorder and generalized anxiety disorder are 5-fold higher in medical trainees than in their age-matched, nonmedical counterparts.⁶ These findings have important implications for both personal well-being as well as empathy, interpersonal relationships, and attitude toward the medical profession.⁷⁻⁹ While there is ample research highlighting medical student distress,¹⁻⁹ there is limited research exploring potential countermeasures.

A positive correlation has been found between physical exercise and mental and emotional health.¹⁰⁻¹³ Physical exercise has been shown to have a positive influence on depression, anxiety, improved capacity for dealing with stress, and elevation of mood.^{10,14} Conversely, most medical school–related activities are sedentary (eg, attending classes and studying). Furthermore, medical education typically contains little, if any, instruction on the importance of physical activity or how to counsel patients regarding physical fitness.¹⁵⁻¹⁷ Of note, medical students who engage in physical activity are more likely to counsel their patients to do so as well.¹⁸

To the authors' knowledge, few studies have examined the potential positive effects of physical exercise on mental health in a medical student population, and no studies have looked specifically at the osteopathic medical student population. Parkerson et al¹⁹ identified a negative correlation between physical activity and both anxiety and depression. Similarly, Sheets et al²⁰ indicated that academic stress levels are lower in medical students engaging in physical activity, and Cecil et al²¹ reported that physical activity is negatively correlated to emotional exhaustion. However, these studies were all multifactorial survey studies that did not quantify the regularity or duration of physical activity, nor did they profile the type or the individual or group nature of the exercise.

The purpose of the current study was to investigate the relationship between exercise and QOL in a medical student population and to compare the effects of group exercise with individual exercise or no exercise on stress and QOL. The authors hypothesized that

(1) participation in regular exercise would yield decreased perceived stress and increased physical, mental, and emotional QOL and (2) participation in a group fitness class would yield greater stress reduction and QOL improvement than exercising individually.

Methods

The institutional review board at the University of New England approved all methods, and participants provided informed consent electronically before entering the study and completing the first surveys.

Participants

Demographic information was collected at baseline. First- and second-year osteopathic medical students at the University of New England College of Osteopathic Medicine (UNECOM) were recruited via classwide e-mails, class announcements, and class-specific Facebook postings to participate in a 12-week controlled study. Students were allowed to self-select into 1 of 3 nonrandomized groups:

- **Fitness class group:** Using CXWORX (Les Mills International LTD), the group fitness class participants engaged in at least 1 class per week, plus additional exercise if desired.
- **Health-enhancement group:** This group included students exercising alone or with up to 2 additional partners regularly (eg, running, weight lifting) at least twice per week.
- **Control group:** Beyond walking or biking as a means of transportation, this group did not engage in regular exercise.

Students were withdrawn from the study if they did not comply with the exercise requirements outlined for their chosen group. Students were not excluded from the study if they were already engaging in group fitness classes. However, as this project was developed partially in an effort to lay the foundation for an enduring group fitness program for UNECOM, there were

few regular group fitness opportunities available for students before this study.

Study Intervention

Fitness classes were led by a UNECOM student (D.M. Y.) certified in the method. The exercise modality used targets and strengthens core musculature to improve functional fitness in a 30-minute session. The exercises use body weight, resistance tubes, or free weights to challenge coordination, balance, and strength, and each exercise has modifications to accommodate varying fitness levels and abilities. Although the routine followed the same general format, it was altered every week or so with different music and choreography. The workout consisted of 6 “tracks.” Each track was 1 song in length and focused on a specific physical objective (eg, oblique strengthening, glute/hip stabilization). In each track, the instructor provided options to either increase or decrease intensity based on fitness level as well as indications to either increase or decrease the intensity.

Survey Instruments

Both surveys were administered before beginning exercise (baseline) and at the end of the study. A completion survey was administered after the study that asked participants in each study group whether he or she would continue to exercise or not exercise.

Stress

To assess the degree to which situations in one’s life were appraised as stressful, participants completed the Perceived Stress Scale (PSS), one of the most widely used psychological instruments for measuring the perception of stress.²²⁻²⁴ The PSS is a 10-item survey in which answers are on a 0-to-4-point scale based on frequency of experiencing a given situation (eg, “In the last month, how often have you felt nervous and stressed?”), with 0 indicating never and 4 indicating very often. The items are scored and summed for a possible maximum total of 40 points; the higher the score, the greater the stress. This survey was administered once every 4 weeks—a timeline consistent with existing PSS literature.

QOL

Participants completed surveys to assess perception of stress once every 4 weeks. The QOL surveys were created based on visual analog scales (VASs) that have been validated for some metrics (eg, pain).²⁵ The VASs were created with clear definitions of physical, mental, and emotional QOL. Participants rated their physical, mental, and emotional QOL on a scale of 0 (as bad as it can be) to 10 (as good as it can be).^{26,27} These surveys were created using SurveyMonkey and distributed weekly to participants via e-mail on the Sunday of the appropriate week. Participants were given a deadline of the following Sunday to complete the surveys but were encouraged to complete them by no later than Wednesday. E-mail reminders were sent 1 to 2 days after the survey was sent.

Exercise Logs

Exercise logs were created via SurveyMonkey and distributed along with the other study surveys to ensure compliance and to monitor type and duration of daily exercise, as well as the number of participants involved.

Statistical Analysis

Based on Cramer von Mises analysis, the data followed a normal distribution; thus, parametric tests were performed. Presurvey vs postsurvey data were analyzed using 2-tailed *t* tests. Between group and multiple time point data were analyzed using a 3 (groups) × 4 (time points) analyses of variance. Where significance was identified, the Fisher least significant difference was used for post-hoc analysis. Statistical significance was determined at $P \leq .05$.

Results

A total of 94 participants were recruited to the study (fitness class group, 33; health-enhancement, 39; control, 22). Over the course of the study, 8 participants each withdrew from the fitness class group and the health-enhancement group, and 6 withdrew from the control group. Additionally, because of noncompliance,

Table 1.
Effects of Group Fitness Classes on Stress and Quality of Life
of Medical Students: Participant Demographics by Study
Group (N=69)^a

	Fitness Class ^c	Health-Enhancement ^c	Control ^c	Total
Sex				
Female	16	11	9	36
Male	9	18	6	33
Year of Medical School				
First	8	11	5	24
Second	17	18	10	45
Age, y				
20-24	7	9	4	20
25-29	18	15	8	41
30-34	0	3	2	5
35-39	0	1	1	2
≥40	0	1	0	1
Baseline Activity Level, d/wk				
0-1	2	0	11	13
2-3	9	11	4	24
4-5	12	14	0	26
6-7	2	4	0	6

^a Data are given as number of participants.

^b Fitness class, at least 1 CXWORX (Les Mills International LTD) class per week, plus additional exercise if desired; health-enhancement, students exercising alone or with up to 2 additional partners regularly (eg, running, weight lifting) at least twice per week. Control, no regular exercise beyond walking or biking as a means of transportation.

2 participants in the health-enhancement group and 1 participant in the control group were excluded from analysis. Therefore, 25 fitness class participants, 29 health-enhancement participants, and 15 control participants met inclusion criteria and completed the study protocol (N=69) (Table 1).

Each group included approximately a 2:1 ratio of second-year medical students to first-year medical students. No significant differences were found in baseline values for PSS ($P=.85$), physical QOL ($P=.62$), mental

QOL ($P=.13$), or emotional QOL ($P=.31$) between first- and second-year students. Because of self-selection, the ratio of men to women was not consistent across groups. However, no significant differences were found in baseline values for PSS ($P=.96$), physical QOL ($P=.95$), mental QOL ($P=.94$), or emotional QOL ($P=.43$) between men and women.

Before beginning the study, a baseline level of activity was estimated from the self-reported days in which participants engaged in 30 or more minutes of intentional exercise (eg, strength training, cardiovascular exercise) during the previous month (Table 2). The main effect revealed a significant difference in baseline activity level between groups ($P<.001$). Post-hoc analyses revealed that the baseline activity levels of the fitness class and health-enhancement groups were significantly higher than baseline activity levels of the control group ($P<.001$), but the baseline activity level did not differ significantly between the fitness class and the health-enhancement groups ($P=.32$). The fitness class group participated in a mean (SD) of 1.55 (0.28) 30-minute group exercise classes per week. Including other forms of exercise they were allowed to engage in, the fitness class group exercised a total of 2.95 (0.34) hours per week. The health-enhancement group exercised 4.11 (0.66) hours per week, and the control group, 0.48 (0.24) hours per week. Participants in the health-enhancement group exercised with 3 or more additional partners 0.53 times per week; participants in the control group did not participate in group exercise.

At baseline, no significant differences existed between any of the experimental groups for PSS, physical QOL, or mental QOL. Emotional QOL was significantly lower in the fitness class group than the health-enhancement or control groups at baseline ($P=.047$; Table 2). Comparing baseline and week 12, the fitness class group showed decreased PSS ($P=.038$) and increased physical QOL ($P=.007$), mental QOL ($P=.046$), and emotional QOL ($P=.004$; Table 3). The health-enhancement and control groups showed no statistically significant changes between

Table 2.
Participant Stress and Quality of Life Survey Scores Before Exercise Implementation (N=69)^a

Survey	Fitness Class ^b	Health Enhancement ^b	Control ^b	P Value ^c
PSS ^d	15.6 (5.94)	15.51 (5.69)	13.64 (4.48)	.52
QOL ^d				
Physical	6.44 (2.02)	7.62 (1.97)	6.5 (2.07)	.07
Mental	7.00 (1.61)	6.76 (1.92)	7.43 (1.28)	.48
Emotional	6.16 (1.93)	7.24 (1.77)	7.38 (1.39)	.047

^a Data are given as mean (SD).

^b Fitness class: at least 1 CXWORX (Les Mills International LTD) class per week, plus additional exercise if desired; health-enhancement: students exercising alone or with up to 2 additional partners regularly (eg, running, weight lifting) at least twice per week. Control: no regular exercise beyond walking or biking as a means of transportation.

^c Statistical significance set at $P \leq .05$.

^d Perceived Stress Scale (PSS) is a 10-item survey, in which answers are on a 0-to-4-point scale (higher scores indicate greater stress). Visual analog scales were used to assess quality of life (QOL) using a scale of 0 (as bad as it can be) to 10 (as good as it can be).

baseline and week 12 for any of the PSS or QOL metrics, with the exception of mental QOL, which showed an improvement in the health-enhancement group (Table 3).

Within-group analyses of variance showed a decreased PSS score in the fitness class group

Table 3.
P Values Comparing Participants' Stress and Quality of Life, Baseline to Week 12 (N=69)^a

Survey	Fitness Class ^b	Health Enhancement ^b	Control ^b
PSS ^c	.038	.058	.64
QOL ^c			
Physical	.007	.24	.35
Mental	.046	.023	.96
Emotional	.004	.64	.65

^a Statistical significance set at $P \leq .05$.

^b Fitness class: at least 1 CXWORX (Les Mills International LTD) class per week, plus additional exercise if desired; health-enhancement: students exercising alone or with up to 2 additional partners regularly (eg, running, weight lifting) at least twice per week. Control: no regular exercise beyond walking or biking as a means of transportation.

^c Perceived Stress Scale (PSS) is a 10-item survey, in which answers are on a 0-to-4-point scale (higher scores indicate greater stress). Visual analog scales were used to assess quality of life (QOL) using a scale of 0 (as bad as it can be) to 10 (as good as it can be).

($P=.064$) (Figure 1). No significant changes were found in the PSS score for the control ($P=.52$) or health-enhancement ($P=.35$) groups. Because QOL may vary weekly, a 12-week mean value was calculated for each group. Between-groups differences were statistically significant in the physical ($P=.001$), mental ($P=.009$), and emotional ($P=.007$) QOL domains (Figure 2). Post-hoc analyses indicated that the fitness class group scored significantly higher in mental QOL than the health-enhancement ($P=.04$) or control ($P=.003$) groups. The fitness class group also scored significantly higher in physical QOL than the health-enhancement ($P=.036$) or control ($P=.002$) groups, and it scored significantly higher in emotional QOL than the health-enhancement ($P=.002$) or control ($P=.002$) groups.

Discussion

Medical school is stressful and can negatively affect students' QOL.¹⁻⁹ The findings of the present study demonstrate a significant decrease in perceived stress and an increase in physical, mental, and emotional QOL for students who regularly participated in a 12-week group fitness program compared with students

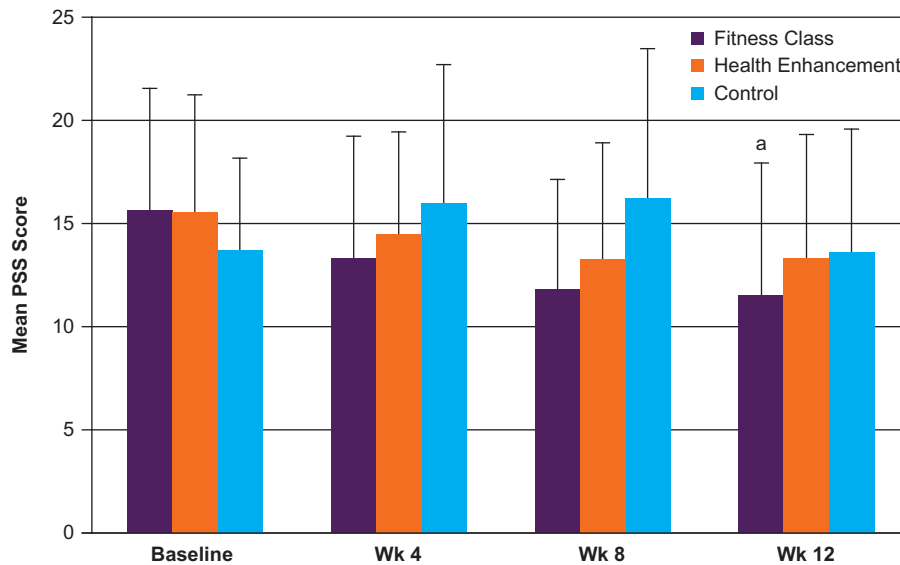


Figure 1.

Comparison of Perceived Stress Scale (PSS) scores across groups (N=69). Values are means of each group at 4-week intervals from baseline through week 12. The PSS is a 10-item survey, with each item receiving a score of 0 to 4 (0=no stress) for a possible maximum score of 40. The higher the score, the greater the stress. Fitness class group, at least 1 CXWORX (Les Mills International LTD) class per week plus additional exercise if desired; health-enhancement group, students exercising alone or with up to 2 additional partners regularly (eg, running, weight lifting) at least twice per week. Control group, no regular exercise beyond walking or biking as a means of transportation; ^aWithin-group trend from week 0 at $P=.064$.

who participated in exercise regimens on their own or who did not engage in formal physical activity.

No significant difference was noted in the baseline amounts of physical activity or group exercise between fitness class and health-enhancement groups. This finding suggests that the significant increase in the 3 QOL measures in the fitness class group were specific to the novel group exercise regime. The possibility that the social aspects of group exercise improved QOL and decreased stress also cannot be discounted. The social component of group exercise is therapeutic.^{28,29} Furthermore, group exercise classes often use up-tempo music and choreography to make the class more fun and engaging. Bringing together medical students who are all going through similar stresses to work out and have fun may transcend the experience of working out on their own.

The interconnectedness of body, mind, and spirit is inherent in osteopathic philosophy.³⁰ Furthermore,

physical activity has been positively correlated with QOL in college-aged and older adult populations.³¹⁻³³ In child and adolescent populations, fitness levels and moderate-to-vigorous physical activity have been positively correlated with academic performance.³⁴⁻³⁶ To the authors' knowledge, no such data have been collected from a medical student population. Medical education is an endeavor that requires long hours of sedentary behavior, and these findings²⁸⁻³⁶ all point to the importance of incorporating a physical fitness component into osteopathic medical school, either as a curricular offering or as part of a student health benefit, such as a fitness class or club membership discount.

This research is not only relevant to students during their medical education, but also to their lives as future physicians. According to the Centers for Disease Control and Prevention, more than 35.1% of adults in the United States are obese, and 69.0% of adults in the

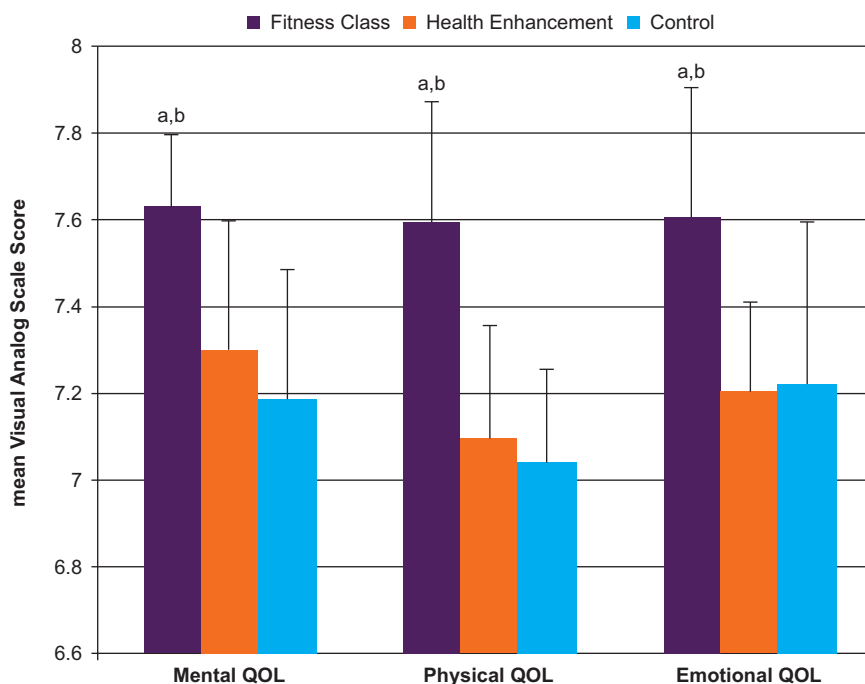


Figure 2.

Comparison of quality of life (QOL) across groups (N=69). Values are the mean of weeks 1 through 12 for each QOL parameter. Visual analog scale (VAS) surveys with a 0-to-10 (0=poor QOL) scale were used. ^aPost-hoc analyses revealed significant difference between control (no regular exercise beyond walking or biking as a means of transportation) and fitness class (at least 1 CXWORX [Les Mills International LTD] class per week plus additional exercise if desired) groups. ^bPost-hoc analyses revealed significant difference between the health enhancement (students exercising alone or with up to 2 additional partners regularly [eg, running, weight lifting] at least twice per week) and fitness class groups.

United States are overweight or obese.³⁷ Not only is obesity a risk factor for diseases, including heart disease, stroke, diabetes, and cancer, but it also increases annual medical costs by \$1429 over that incurred by patients of normal weight.³⁸ Many medical education curricula do not include formal instruction on how to develop exercise programs with patients or counsel them regarding exercise habits.^{15-17,39} Regardless of formal instruction, medical students who engage in physical activity throughout their training are more likely to provide fitness counseling to their patients.¹⁸ The current study speaks to these very issues: By encouraging student doctors to be physically active and researching how their activity level can positively influence other areas of their lives, we hope to inspire a generation of future

physicians that will lead healthy lifestyles. We believe that if physicians lead by example and address their wellness, then they can more effectively inspire and educate their patients to do the same.

The psychological distress experienced by many students during their medical education can have severe consequences, such as burnout, higher rates of depression, stress, low QOL, and fatigue.¹⁻⁹ Osteopathic philosophy teaches that “The body is a unit; the person is a unit of body, mind, and spirit” and “Structure and function are reciprocally interrelated.”³⁰ Therefore, this distress can have negative effects on a personal level—including substance abuse, relationship difficulties, suicide, and attrition from the profession, as well as on a professional level, including cynicism, which may subsequently affect patient care, relationships with faculty,

and the culture of the medical profession.⁹ It is critical that medical education address this issue. Given the positive impact that group exercise had on medical student stress and QOL, we recommend that other osteopathic medical schools consider offering formal group fitness programs and promoting other social fitness activities as ways to encourage behavior that is both beneficial to student well-being as well as in line with osteopathic philosophy.

The present study is not without limitations. The sample size was small. Rather than being randomly assigned, the participants self-selected into the study groups. It was feared that students would withdraw from the study or fail to comply if assigned to the control group. This randomization would have further narrowed our sample size and diminished generalizability of the study results. The fitness class, health-enhancement, and control groups all started at the same level of perceived stress and physical and mental QOL, but the fitness class group had lower baseline emotional QOL compared with the other 2 groups. It is possible that those who self-selected into the fitness class group were looking for a means of improving their emotional QOL. An additional limitation is that one of the authors (D.M.Y.) led the group fitness classes. It is possible that this author inadvertently introduced bias into the class.

Future research should include involvement of other medical schools (osteopathic and allopathic) and should be expanded to include third- and fourth-year medical students and residents. Future research should also use additional validated measures of QOL, well-being, stress, and depression. Because the habits of physical activity and nutrition are commonly linked, future research should also attempt to distinguish the individual and combined benefits of these habits on QOL.

Conclusion

Participation in group fitness classes led to a decrease in perceived stress and an increase in physical, mental, and emotional QOL compared with participation in

exercise individually or not participating in regular exercise. These findings should not be interpreted as a condemnation of individual exercise. We believe much benefit can be derived from physical exercise of any kind, but the addition of group fitness classes in a medical student population may have additional benefits. Engaging in social fitness activities could be a solution to improving the well-being of medical students and physicians.

Acknowledgments

We thank Marilyn R. Gugliucci, PhD, for her support and guidance.

Author Contributions

All authors provided substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; Drs Yorks and Schuenke drafted the article or revised it critically for important intellectual content; Dr Yorks gave final approval of the version of the article to be published; and all authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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