Journal of Health Communication: International Perspectives

Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/uhcm20

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Version of record first published: 26 Aug 2008

To cite this article: Emil Chiauzzi, Julie Brevard, Christina Thurn, Stacey Decembrele & Sarah Lord (2008): MyStudentBody-Stress: An Online Stress Management Intervention for College Students, Journal of Health Communication: International Perspectives, 13:6, 555-572

To link to this article: http://dx.doi.org/10.1080/10810730802281668

Journal of Health Communication, 13:555–572, 2008

ISSN: 1081-0730 print/1087-0415 online
DOI: 10.1080/10810730802281668

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Taylor & Francis Group

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College students who have high stress levels tend to experience an increased risk of academic difficulties, substance abuse, and emotional problems. To enhance student stress management and health promoting behaviors, an online stress management intervention called MyStudentBody–Stress *(*MyStudentBody–Stress*) was developed and tested. College students at six U.S. colleges were randomized to one of three conditions:* MyStudentBody–Stress*, a control health information website, or no intervention. The differences between groups on stress control and health behavior measures were compared at baseline, and at 1, 3, and 6 months after baseline. Although there were no between-group differences on primary outcome variables, secondary analyses indicated that* MyStudentBody–Stress *participants were more likely to increase weekly physical activity, use specific stress management methods, and exhibit decreased anxiety and family problems. These findings indicate some potentially beneficial effects of online stress management programming for college students. Implications for college health practitioners are discussed.*

The authors thank the administrators and research assistants who made our research possible at the following undergraduate academic institutions: Duke University, Durham, NC; Florida Atlantic University, Boca Raton, FL; Massachusetts Institute of Technology, Boston, MA; New York University, New York, NY; University of Southern California, Los Angeles, CA; and University of Vermont, Burlington, VT.

This research was supported by a Small Business Innovation Research (SBIR) grant from the National Institute of Mental Health (SBIR #2R44MH063609-02).

MyStudentBody–Stress is owned by Inflexxion, Inc. Dr. Chiauzzi is an employee at Inflexxion.

There are more than 4,000 colleges and universities in the United States, enrolling more than 17.3 million students (National Center for Education Statistics [NCES], 2005). College students are particularly prone to stress (Johnson & Arbona, 2006; Larson, 2006; Robotham & Julian, 2006). Surveys indicate that the level of student distress has been increasing in recent years and that student medication use has increased fivefold (Schwartz, 2006). Not only do students appear to be arriving at college feeling frequently overwhelmed, but for a number of students such distress does not dissipate during later college years (Kitzrow, 2003).

The effects of stress on college students are significant. An American College Health Association (ACHA, 2007) survey of more than 16,000 college students found that 33.7% reported that stress interfered with their academic performance, as evidenced by missing classes, receiving lower grades, or dropping courses. Stress and maladaptive coping strategies consistently are associated with both physical and mental illnesses. Stress is related to sleep difficulties, psychiatric disorders, substance abuse, and high-risk behaviors (Broman, 2005; Dusselier et al., 2005). Stress plays an important role in students' decisions regarding whether to remain in school, as stress has been linked to increased attrition and problems with academic performance (Pritchard & Wilson, 2003). For those who do stay in school, stress remains an important factor. For instance, stress levels and maladaptive coping are among the emotional problems shown to be related to dramatic increases in the use of college counseling services (Kitzrow, 2003).

The literature on stress management is replete with calls for programs to help college students manage stress, but there is a paucity of programmatic studies examining the effectiveness of stress management programs with healthy populations of college students. Available studies have focused on clinical approaches, such as individual therapy or counseling, or packages including stress management techniques that help prevent problematic psychological and physiological responses. The most commonly tested stress interventions are based on the seminal work of Lazarus and Folkman (1984), who developed a cognitive-behavioral theory that emphasizes the importance of cognitive appraisals and coping responses, Virtually any cognitive therapy technique (e.g., modeling, role-playing, imaginal processing) can be integrated into a stress management program. Studies have examined the effect of brief interventions (e.g., six to eight sessions) offered in group or individual formats and found reductions in perceived stress and distress, reduced medical symptoms, and increased use of coping skills (Deckro et al., 2002; Seligman, Schulman, DeRubeis, & Hollon, 1999; Williams, Kolar, Reger, & Pearson, 2001). Unfortunately, the availability of counseling staff is limited (Gallagher, Gill, & Sysko, 2000), and college counseling budgets have been falling despite the increasing severity of student emotional issues (Kitzrow, 2003; Terneus, 2006). In addition, students tend not to take the time to attend stress management classes or workshops (Coyne & Racioppo, 2000).

In an effort to reach out to college students, health professionals have begun using computer programs to educate students about health behavior. Computer-based programs offer a confidential and nonjudgmental experience that may increase the potential for students to divulge personal information. This greater openness may facilitate positive changes in knowledge, attitudes, behaviors, or all of these. Studies comparing questionnaires delivered through interviews, self-administration, and computer-assisted administration have found that respondents are more likely to self-disclose sensitive information regarding risk behaviors, for example interpersonal violence, drug use, sexual behavior, and HIV risk behaviors with computer-assisted administration (Hamby, Sugarman, & Boney-McCoy, 2006; Newman et al., 2002).

The value of computer-based programs increases exponentially when offered through the Internet. Currently, 70% of the population in the United States uses the Internet (Pew Internet & American Life Project, 2007). Indeed, college students and other young adults are the most "wired" of all demographic groups, with approximately 80% reporting Internet usage and many using the Internet to seek health information (Hanauer, Dibble, Fortin, & Col, 2004; Pew Internet & American Life Project, 2002). A Kaiser Family Foundation survey (2001) of 15 to 24 year-olds found that two-thirds of respondents reported that they had received health information online and one quarter sought information about drug or alcohol problems. Recent studies of college students using health online programs for prevention of binge drinking have found reductions in the rate of drinking and high-risk behaviors (Chiauzzi, Green, Lord, Thum, & Goldstein, 2005; Walters & Bennett, 2000). The key element of these programs is the provision of tailored, motivational feedback to alcohol questionnaires, which has been shown to reduce drinking (Dimeff, Baer, Kivlahan, & Marlatt, 1999). Such motivational feedback now has been applied to a variety of other health problems, including drug use, diet, exercise, smoking, and HIV risk behaviors (Burke, Arkowitz, & Menchola, 2003).

This report describes a randomized controlled trial of an interactive, online, multimedia program called *MyStudentBody–Stress* (*MyStudentBody–Stress*). The purpose of this study was to evaluate the efficacy of *MyStudentBody–Stress*, which specifically was developed to provide students with tailored individual motivational feedback about stress management, online stress management tools, peer stories, and stress management strategies. This study tested the hypotheses that exposure to the stress reduction website, *MyStudentBody–Stress*, would accomplish the following: (1) reduce college students' level of perceived stress, (2) increase college students' health promoting behaviors, and (3) increase college students' adjustment to college life stressors.

Methods

Participants

Six 4-year colleges in the United States participated in this research. The study procedures were approved by both the Inflexxion Institutional Review Board (IRB) and the IRB at each participating university. Recruitment was accomplished by research coordinators (RCs), who set up tables in public areas such as student centers or cafeterias at each university. These tables advertised a "college health study," and RCs used the Perceived Stress Scale (PSS); to screen those interested in participating (Cohen, Kamarck, & Mermelstein, 1983). To participate in the study, participants had to be college students between the ages of 18 and 24, scoring above 14 on the PSS, the mean score for 18-to-29-year-olds from a national sample so as to target students who were experiencing higher levels of stress (Cohen et al., 1983). We calculated that given the design of three conditions and four assessment points, 213 participants would provide 80% power to detect the main effect and 100% power to detect the interaction effect, assuming a medium effect size ($d = .50$) for the condition-by-time interaction (alpha = .05, two-sided test), with a small main effect for condition ($d = .20$) and a medium effect for time ($d = .50$). To account for possible attrition, approximately 10% more participants than needed were recruited so that the study would not be underpowered, for a total N of 240 (40 at each school).

Study Design

Once a person consented to participate, she or he was randomized to one of three possible conditions: (1) *MyStudentBody–Stress* website (*MyStudentBody–Stress*), (2) a control website (CW), (3) no treatment control (NTX). *MyStudentBody–Stress* offers motivational feedback upon completion of five online questionnaires (tailoring variables based on questionnaires are in parentheses): (1) rate my stress signs (physical stress indicators); (2) rate my life events (life events appropriate for college students); (3) rate my hassles (daily hassles); (4) rate my coping style (task-focused, emotion-focused, and avoidant coping), and (5) rate my mood (depression). All students completed the same questions for each questionnaire. They then received individual, tailored text and graphical feedback that is based on the scores of these questionnaires. This report could be printed. Further tailoring is achieved by tailoring articles, strategies, and interactive tools to students' questionnaire scores and responses. This was accomplished by highlighting these resources with a yellow icon. For example, if a student rated himself or herself as having a high degree of physical stress indicators, an article and interactive tool describing relaxation methods would be highlighted. A student who indicated depressive symptoms would receive an article on the benefits of counseling and contact information for the student health center.

The site also includes weekly updates of peer stories (*Student Voices*), *Ask the Expert* (frequently asked stress questions answered by a college stress management expert), and college health news. Students can use interactive relaxation tools, review the effectiveness of different stress management methods, learn about physical effects of stress on various parts of the body, and understand the potential negative effects of various substances on stress management. Strategies include tips on time management, developing good sleep habits, practicing relaxation skills, handling depression and anxiety, developing social support, and communicating with family members. An emergency area is featured prominently to help students recognize effective ways to deal with depression and locate local college resources in the event of immediate risks.

The CW was created at Inflexxion and contained standard text-based college health information such as brochures, pamphlets, and other public domain information that typically might be offered in a school health center. Unlike *MyStudentBody–Stress*, there were no tailored, interactive, motivational, skill-building elements, or even images. For the purposes of this study, this information was placed online so that this control condition would be able to help examine the effect of tailored, interactive information. Students in both the *MyStudentBody–Stress* and the CW group were instructed to visit the website at least four times for a minimum of 20 minutes per visit, but they were free to log on for longer or more frequently if desired. After screening was completed and informed consent signed, students randomly were assigned to an experimental condition. Random assignment was stratified by school, gender (male vs. female), race (Caucasian vs. other race), and year in school (freshman or sophomore vs. junior or senior). All participants were told that they were participating in a study of college student's health, and they were blinded to condition. Investigators were not blinded to participants' condition, however, since the participants completed the intervention and assessments on their own at home, there was little potential for the single-blinded nature of the study to introduce bias.

Procedures

After being assigned to an experimental condition, participants were sent a URL to complete the baseline assessment online. After the baseline assessment was completed, participants who were assigned to *MyStudentBody–Stress* or CW were given the URL for their respective websites and instructed to create a username and password for the site. These participants were instructed to visit the website four times over a 2-week period and to spend at least 20 minutes using the site each time. An RC monitored participants' usage of the website on a weekly basis, and if students were not visiting the website, or if they were logging on for less than the required amount of time, they were sent emails reminding them of the instructions for participation. Participants assigned to NTX were sent an email after they completed the baseline assessment saying that they would be sent a follow-up survey in one month.

Outcome Assessments

The primary outcome measure was the PSS (Cohen et al., 1983; Cohen & Williamson, 1988). This scale is a widely used 10-item instrument for measuring the perception of stress within the past month. Respondents rate how stressful (unpredictable, uncontrollable, and overloaded) they perceive their lives to be. Each item is rated on a 5-point Likert scale (0 = never, 4 = very often). The PSS was designed for use in community samples for individuals with at least a junior high school education.

Secondary outcome measures were the Health-Promoting Lifestyle Profile II (HPLP-II; Walker, Sechrist, & Pender, 1987) and the College Adjustment Scales (CAS; Anton & Reed, 1991). The HPLP-II is a 52-item scale that uses a four-point response format to measure the frequency of self-reported health-promoting behaviors in the domains of health responsibility, physical activity, nutrition, spiritual growth, interpersonal relations, and stress management. The Cronbach alpha values for the HPLP-II subscales range from .79 to .94 (Walker, personal communication, 2005). The CAS is a 108-item inventory developed to provide a method of screening college counseling clients for common developmental and psychological problems, including psychological distress, relationship conflict, low self-esteem, and academic and career difficulties. There are nine CAS subscales addressing different problem areas. One subscale, Suicidal Ideation, was not included in this study due to IRB concerns. Cronbach's alpha values for the CAS subscales range from .80 to .92. To augment the measures that were chosen for this study, a number of questions from the HPLP-II were adapted to gauge the frequency of performing stress-reduction behaviors that directly were encouraged in the *MyStudentBody–Stress* website, and were analyzed at the item level.

Participants were given these questionnaires at baseline, in addition to demographic questions, administered online after random assignment to an experimental condition. Participants were not sent the URL to their intervention until they had completed the online questionnaire. Follow-up assessments were completed online 1, 3, and 6 months after the baseline questionnaire was completed. This strategy allowed assessment of the immediate effects of *MyStudentBody–Stress*, as well as its long-term effects. The CAS was not administered at the 1-month follow up, in an effort to decrease the participants' response burden and because the CAS constructs were not hypothesized to change within 1 month.

Statistical Analysis

The analysis of the study outcomes used a mixed model analysis (via SAS PROC MIXED, SAS Institute Inc., Cary, NC, USA). Mixed models are similar to regression or general linear models (GLM), but mixed models have more flexible requirements than regression or GLM, allowing for incomplete follow-up data, as well as unbalanced groups, and unequally spaced follow-up time points. For many clinical trial designs, a mixed model analysis is often statistically preferable (Gueorguieva & Krystal, 2004). A four-step procedure for conducting the mixed model analysis was followed, as recommended by Littell and colleagues (2000). Non-normal or skewed data were transformed for analysis. Each mixed model contained the following independent variables: experimental condition, time, school, year in school, gender, race (Caucasian vs. other), and living situation (on-campus vs. off-campus). After finding the best covariance structure for each model, and removing covariates with p values of greater than .20, the final mixed model was run, and group means for each time point were estimated.

Participants

The number of people who were screened for participation was tabulated, as were the reasons for ineligibility, the percent of people screened who were eligible, the percent of eligible participants who consented to participate, and the percent of participants who completed the follow-up measures. Participant demographics were analyzed by calculating the frequencies of categorical variables and the means and standard deviations of continuous variables.

Effect of Website Dosage on Dependent Variables

We hypothesized that longer amounts of time spent on the website would be associated with a greater degree of change in the dependent measures. To test this hypothesis, a mixed model analysis of the *MyStudentBody–Stress* and CW participants was conducted for each outcome measure with condition and total number of minutes spent online as independent variables.

Participant Satisfaction with MyStudentBody–Stress

Study participants who were assigned to the *MyStudentBody–Stress* group were asked questions about their satisfaction with aspects of the website such as website content, layout, ease of use, utility, and other topics. Participants indicated on a 5-point scale whether they agreed or disagreed with statements about the website, and those responding "agree" or "strongly agree" were considered to endorse the statement. The percentage of *MyStudentBody–Stress* users who agreed with each satisfaction statement was calculated.

Results

Participants

Recruitment of participants occurred between January 13, 2005, and February 28, 2005. Four hundred fifty-eight people were screened, and 307 were eligible for

participation in the study. Of the 307 who were eligible, the first 40 students at each school were invited to participate. Figure 1 shows the number of people screened and consenting to participate.

Table 1 illustrates the demographic characteristics of the participants in this study. There was an even balance of gender and grade in school. In addition, the sample was racially and ethnically diverse, with 40% of the participants being minority. About two-thirds of the sample lived on campus, whereas one-third lived off campus in an apartment or at home with their family. Participants had a variety of academic majors. On average, participants spent 9 hours per week on extracurricular activities such as athletics, school clubs or organizations, or volunteer work. Those students who were involved in sororities or fraternities spent 7 hours per week on average participating in Greek activities. Chi-square tests were performed to test whether the three experimental groups were demographically different. There were no significant differences ($P < .05$) found between the groups on gender, race, ethnicity, year in school, or place of residence. These results show that the three study groups were demographically similar.

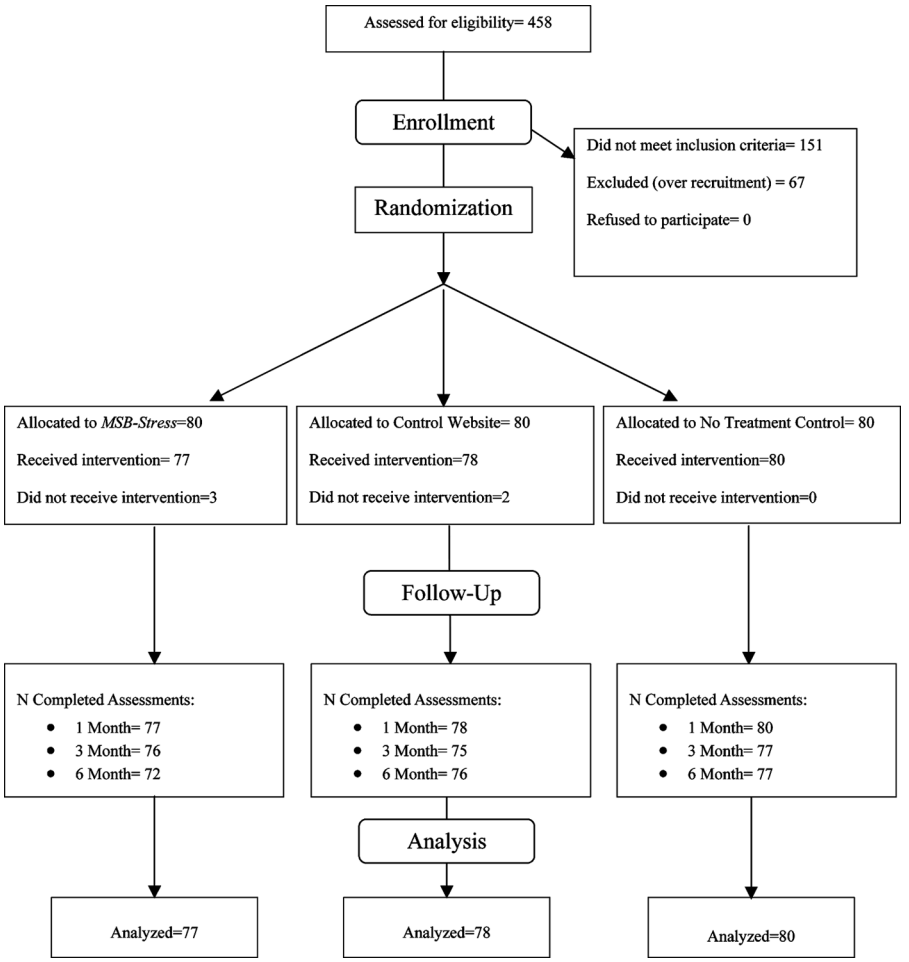


Figure 1. Participant flowchart.

Table 1. Participant characteristics

	MSB	CW	NTX	*P*
Gender				
Male	34	40	42	.44
Female	44	43	36	
Year in School				
First	30	29	23	.53
Second	16	18	19	
Third	19	19	12	
Fourth	13	17	24	
Race/ethnicity				
White/Caucasian	44	48	50	.86
Black/African American	13	12	7	
Asian	14	16	13	
Hispanic/Latino	5	9	8	
Other	7	7	8	
Living situation				
Dormitory	48	50	42	.40
Off-campus apartment	6	8	7	
Home with family	9	8	5	
On-campus apartment	10	11	21	
Other	5	6	3	
Greek member				
Yes	17	18	21	.67
No	61	65	57	
Major in school				
Liberal Arts	15	16	19	.89
Math/Science/Computer/Engineering	24	26	28	
Business	14	12	7	
Premed/Prelaw/Predental	11	13	11	
Other	14	16	13	

Note: The Hispanic/Latino categorization was considered to be an ethnicity, not a race, in accordance with government reporting guidelines. Therefore, someone who identifies as being Hispanic must also choose a race (i.e., White, Black, etc.). Thus, the subject totals for race do not add up to 240/100%.

Outcome Analyses

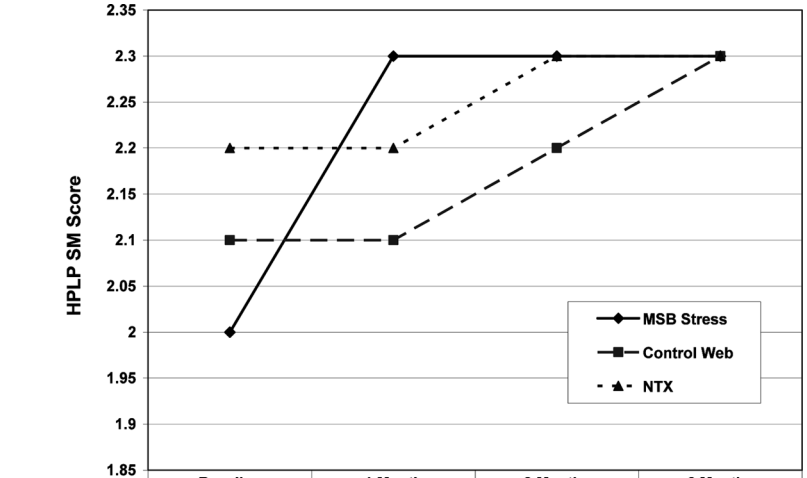
Assessments were administered to students between February 28, 2005, and September 25, 2005. Two hundred and thirty-five of the original 240 participants completed follow-up assessments (a 98% follow-up rate) and thus were included in the outcome analysis (77 in *MyStudentBody–Stress*, 78 in CW, 80 in NTX). As stated in the Methods section, mixed models were used to analyze the effect of the experimental condition on the dependent variables over the course of the study. The effect of interest was the condition-by-time interaction effect, as this assesses whether participants in one experimental group increased or decreased their score on the dependent variable over the course of the study to a greater or lesser extent than the two control conditions. In these analyses, any significant demographic or site factors such as gender, school, year in

school, minority status, or living on or off-campus were controlled for in the analysis. Baseline equivalence of groups was tested by comparing *MyStudentBody–Stress* to the CW and NTX groups at baseline using ANOVA. Any differences between the groups ($p < .10$) are shown in Table 1. The items adapted from the Health-Promoting Lifestyle Profile-II were found to have skewed distributions, so log transformations were performed on the data before analysis commenced.

A summary of the results of the outcome analyses is shown in Table 2. There was not a significant condition-by-time interaction effect for the primary outcome measure, the Perceived Stress Scale, or the total score of the Health Promoting Lifestyle Profile-II. There were significant effects found among several subscales of the outcome measures, however, as well as the HPLP-II items. The Stress Management subscale of the HPLP-II did show a significant difference between groups over time ($P = .03$), where the *MyStudentBody–Stress* group increased from baseline to 1 month follow-up, and the control groups did not. At the 6-month follow-up, however the control students' scores had increased to match the

Table 2. Summary of study outcomes

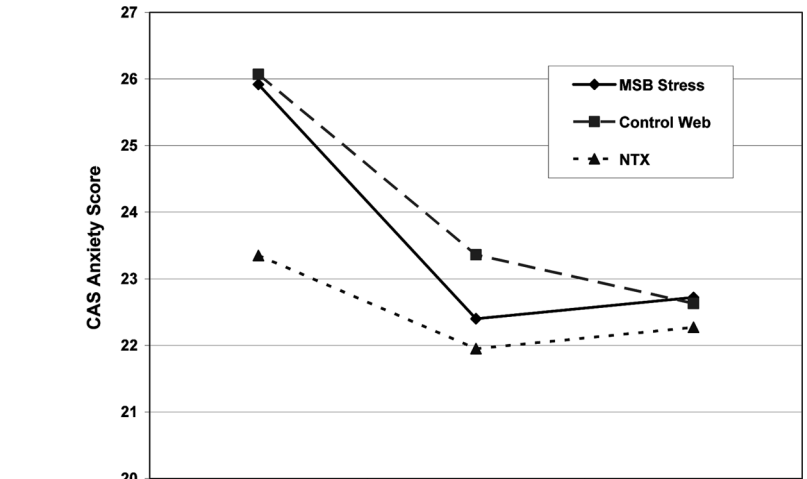
Measure	Subscale	Condition-by-time interaction effect *P*
Perceived Stress Scale (PSS)	N/A	.77
College Adjustment Scales (CAS)	Academic Problems	.15
	Anxiety	.03
	Interpersonal Problems	.45
	Depression	.12
	Career Problems	.79
	Substance Abuse	.46
	Self-Esteem	.13
	Family Problems	.01
Health Promoting Lifestyle Profile (HPLP)	Health Responsibility	.92
	Physical Activity	.54
	Nutrition	.86
	Spiritual Growth	.22
	Interpersonal Relations	.50
	Stress Management	.03
Stress Controlling Behaviors Taken from the HPLP	Use specific methods to control your stress	.11
	Practice relaxation or meditation	.59
	Discuss problems with people close to you	.92
	Exercise vigorously for 20 minutes or more	.61
	Engage in light to moderate physical activity	.02
	Gotten enough sleep	.78
	Taken time for relaxation	.26



	Baseline	1 Month	3 Months	6 Months
MSB Stress	2	2.3	2.3	2.3
Control Web	2.1	2.1	2.2	2.3
NTX	2.2	2.2	2.3	2.3

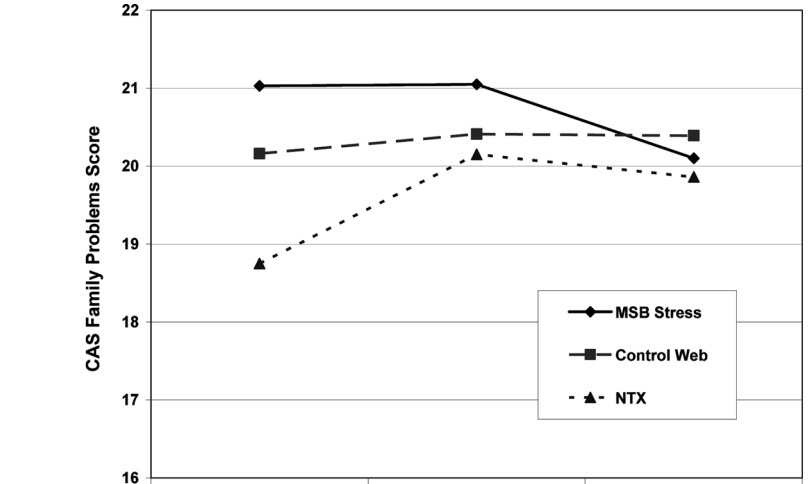
Figure 2. Change on the health promoting lifestyle profile stress management subscale.

MSB students' scores, so *MyStudentBody–Stress* seemed to be associated with an earlier improvement in stress management techniques, but it was not a long-term differential effect (Figure 2). For the College Adjustment Scales, there were significant condition-by-time interaction effects found for the Anxiety ($p = .03$, Figure 3) and Family Problems subscales ($p = .01$, Figure 4), but none of the other subscales. For the CAS Anxiety subscale, the *MyStudentBody–Stress* group showed the greatest score decrease between baseline and follow-up, but at the 6-month



	Baseline	3 Months	6 Months
MSB Stress	25.92	22.4	22.72
Control Web	26.07	23.36	22.63
NTX	23.35	21.95	22.27

Figure 3. Change on the college adjustment scales anxiety subscale.



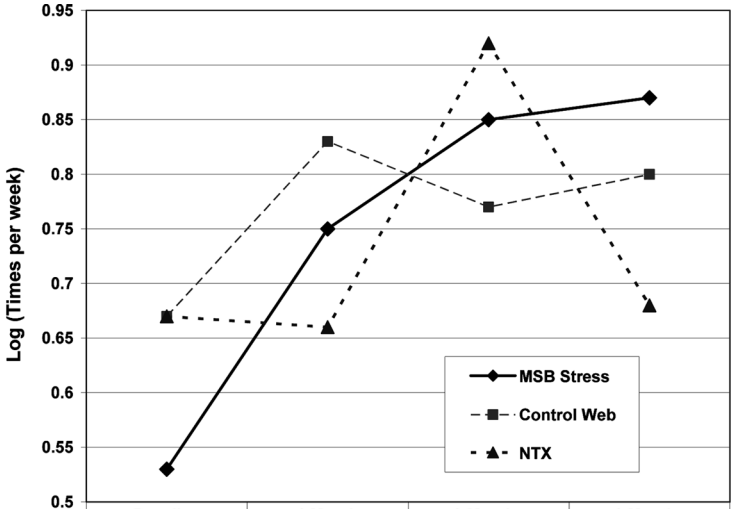
	Baseline	3 Months	6 Months
MSB Stress	21.03	21.05	20.1
Control Web	20.16	20.41	20.39
NTX	18.75	20.15	19.86

Figure 4. Change on the college adjustment scales family problems subscale.

follow-up the groups seemed equivalent. Although the CAS Family Problems subscale showed a significant difference between groups, upon examination of the data, it appears that the groups were somewhat different at baseline, and regression toward the mean occurred during the course of the study. We performed item-level analyses on several HPLP-II items assessing stress prevention behaviors that we were trying to target for behavior change. Several items revealed differences between the study conditions: number of times per week takes part in light to moderate physical activity ($P = .02$; shown in Figure 5), and the number of times per week that participants use specific methods to control their stress ($P = .10$; shown in Figure 6).

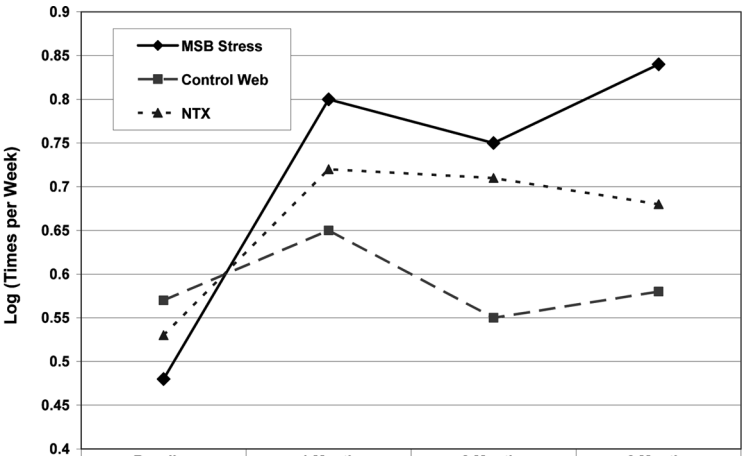
Effect of Website Dosage on Dependent Variables

The time that students in the *MyStudentBody–Stress* and CW groups spent online was tracked. It was not possible to gather complete data for all participants, due to the fact that the log-off time was recorded only if a participant clicked the "log off" button, rather than simply closing down their web program. The time spent online was able to be recorded for 68% of the online visits. Since this problem occurred in both the *MyStudentBody–Stress* and control groups, this is likely to be random error that should be distributed equally between groups. The total time spent online was calculated for each participant by summing the minutes spent online for each visit when data were available. The students in the *MyStudentBody–Stress* group spent an average of 126 minutes online, and students in the control website group spent an average of 51 minutes online, a significant difference between the groups ($f_{(157)} = 88.6$, $P < .001$). We wondered if more highly stressed students would spend more time on the websites, but students' baseline Perceived Stress Score did not significantly correlate with the number of minutes spent online ($r = -.12$, $P = .13$).



	Baseline	1 Month	3 Months	6 Months
MSB Stress	0.53	0.75	0.85	0.87
Control Web	0.67	0.83	0.77	0.8
NTX	0.67	0.66	0.92	0.68

Figure 5. Number of times per week engaging in light to moderate physical activity. *Please note that the Y-axis represents log-transformed data. This transformation was performed to correct for skewness in the data.



	Baseline	1 Month	3 Months	6 Months
MSB Stress	0.48	0.8	0.75	0.84
Control Web	0.57	0.65	0.55	0.58
NTX	0.53	0.72	0.71	0.68

Figure 6. Number of times per week use specific methods to control stress. *Please note that the Y-axis represents log-transformed data. This transformation was performed to correct for skewness in the data.

Participant Satisfaction

Participants in the *MyStudentBody–Stress* and CW groups were asked questions about their satisfaction with the websites. Table 3 presents the results for each group. Participants receiving no intervention did not receive these questions. Ninety-two percent of MSB students agreed with the statement, "This website is effective at addressing college health issues related to stress," as compared with only 73% of CW students, which is a significant difference between the groups ($p = .005$). Eighty-three percent of MSB students agreed with the statement, "The information on this website made me think about my own behaviors and attitudes regarding personal health," compared with 78% of CW students ($p = .057$). Seventy-five percent of MSB students agreed with the statement, "I learned a lot about stress management from this website," compared with 68% of CW students ($p = .046$).

Students also were asked about integrating *MyStudentBody–Stress* into college health curriculum. Seventy-four percent of MSB students agreed with the statement, "This website should be included in college health courses," compared with only 65% of CW students ($p = .28$). Sixty-five percent of MSB students agreed with the statement, "I would visit this website if it were offered by my college or university," compared with 43% of CW students ($p = .042$). There did seem to be a problem with the navigability of the MyStudentBody–Stress website, since only 73% of the MSB students agreed with the statement, "It was easy to find my way around this website," compared with 91% of student exposed to the control website ($p < .0001$).

Table 3. Participant statisfaction with websites

Statement	Group	Mean*	SD	*t*	df	*p*
This website is successful at addressing college health issues related to stress.	MSB	4.25	0.71			
	Control	3.88	0.83	2.876	148	0.005
The information on this website made me think about my own behaviors and attitudes.	MSB	4.21	0.84			
	Control	3.91	1.00	1.915	148	0.057
I am confident that this website could answer questions I may have about stress and mental health.	MSB	3.83	0.88			
	Control	3.54	1.00	1.886	148	0.061
I learned a lot about stress management from this website.	MSB	3.97	0.92			
	Control	3.67	0.90	2.016	148	0.046
I would visit this website if it were offered by my college or university.	MSB	3.65	1.10			
	Control	3.28	0.92	2.056	148	0.042
This website should be included in college health courses.	MSB	4	0.93			
	Control	3.83	0.96	1.076	148	0.283
It was easy to find my way around this website.	MSB	3.83	1.02			
	Control	4.42	0.81	−3.926	148	0.0001
Ratings: 1 = strongly disagree, 5 = strongly agree						

*Ratings: 1 = Strongly disagree, 5 = Strongly agree.

Discussion

This field trial compared *MyStudentBody–Stress*, an interactive, online stress intervention for college students, with a text-based website containing stress information and an assessment-only condition. Two hundred and forty students at six colleges and universities participated in this study and were followed for 6 months. A battery of measures was given to participants at baseline, and at 1, 3, and 6 months after baseline, thus making it possible to assess the effect of the intervention over time.

The results for this study were mixed. Unfortunately, there were no between-group differences on primary outcome variables, and out of the secondary analyses, only four evidenced differences between the conditions. The fact that the measures used in this study have many subscales increases the chance of a Type I error. We chose not to perform a Bonferroni correction on our analyses as it increases the chance Type II error (Perneger, 1998), and our goal was to explore all possible effects of *MyStudentBody–Stress* for further investigation. While many of the subscales tested did not show a difference between groups in their change over time, however, the subscales that closely were related to stress (the Stress Management subscale of the HPLP and the Anxiety subscale of the CAS) did show a difference between groups.

Three positive outcomes are noteworthy: (1) *MyStudentBody–Stress* students reported changes in several important stress management behaviors and stress-related measure subscales; (2) *MyStudentBody–Stress* students evidenced significant satisfaction with and acceptance of the website; and (3) the methodology and program delivery strategies used in this study offer a replicable, effective means of conducting e-health research. It is encouraging that group differences were found on several important stress-related subscales: the Stress Management subscale of the HPLP-II and Anxiety and Family Problems as measured by the CAS. Additionally, *MyStudentBody–Stress* participants reported greater increases in light-to-moderate physical activity, and studies have shown that exercise is related to lower stress levels and better health in general (Ernst, Olson, Pinel, Lam, & Christie, 2006; Galper, Trivedi, Barlow, Dunn, & Kampert, 2006; Parfitt & Eston, 2005). Considering the brief intervention period (2-week exposure for a minimum of 80 minutes total time spent on the website), We note that such a brief intervention was able to show an early effect. This outcome is consistent with past research findings with brief interventions. *Interestingly, the duration of interventions is often not related to outcome—some of the briefest programs achieve positive results* (Walters & Bennett, 2000). This has been shown in studies of brief intervention programs that provide students with individualized normative feedback regarding their alcohol consumption patterns and perceptions of drinking, as well as drinking moderation strategies. For example, Baer and colleagues (2001) found that a single session of feedback for college freshmen produced significant reductions in negative consequences of drinking over a 4-year follow-up. Unfortunately, even though the effect was strongest immediately after the *MyStudentBody–Stress* intervention, it was not sustained at the 6-month follow up. In future research efforts, strategies such as ''booster'' sessions may help sustain these gains.

Second, there was evidence that the *MyStudentBody–Stress* intervention was received well by users, as students regarded the *MyStudentBody–Stress* website as interesting, useful, and thought-provoking in terms of personal health behaviors.

In addition, *MyStudentBody–Stress* participants spent an average of 75 more minutes on the *MyStudentBody–Stress* website than on the control website. The present study did not assess the reasons for this time difference, but several possibilities should be considered. The control site basically provided a brochure online. Although the suggested time for using the control website was the same as the experimental website, students may have been more responsive to the individual tailoring, interactive tools, diversity of stress topics, and design features (e.g., college-oriented images) available in *MyStudentBody–Stress*.

A third important outcome of this study involves its implications for e-health program development and research methodology. In terms of program development, this study supports the feasibility of providing stress management interventions to college students without requiring face-to-face contact. In this study, the only direct face-to-face contact was for research purposes: informed consent, orientation to procedures, and so on. Once the study began, any personal contacts were made remotely through e-mail, and students accessed the intervention independently. The implications of such programming are significant; college health educators can reach out to the student body at large to provide not only stress management education, but also intervention. In light of college students' lack of enthusiasm for formal interventions, the population-based dissemination available via the Internet overcomes traditional outreach barriers. Interventions such as *MyStudentBody–Stress* can overcome other logistical barriers, as they are available at any time of day, can be accessed anonymously, and can help students take more responsibility for their personal health.

In terms of research methodology, there were a number of procedures implemented that addressed the challenges of e-health studies, such as developing and maintaining a representative sample, monitoring subject compliance with protocols, and achieving an unusually high follow-up rate. The study sites included a variety of colleges, based on geographical location and public/private status. This study utilized a large sample size that generated power to detect effects and to provide confidence that nonsignificant findings represent nonexistent or negligible effects. The participant pool was characterized by an even balance of males and females, with about 40% minority representation. The study targeted students with higher levels of stress so that we could detect intervention effects on students that most needed assistance. Such diversity suggests that positive results may be generalizable to different types of students and academic settings.

Another area of concern among e-health researchers is monitoring compliance with study protocols. We were able to monitor treatment compliance by requiring students to maintain activity logs, but more importantly, by monitoring their use of the site (logging in and length of sessions). Although measuring time spent online can be confounded by students who neglect to log out, we were able to track this measurement about two-thirds of the time. We also were able to contact students who did not spend sufficient time in their sessions or who were behind schedule. The third methodological concern revolves around achieving adequate follow-up rates. With close monitoring and maintenance of e-mail contact, we were able to achieve a 98% follow-up rate.

It is important to consider the application of online stress management within a broader university context, especially regarding future research directions, programming considerations, and counseling practice. The research methods used in this study were intended to test the efficacy of *MyStudentBody–Stress*, in that the website usage was monitored by research personnel. This process was necessary to ensure that

participants assigned to the *MyStudentBody–Stress* or control website condition complied with study procedures and viewed their assigned websites, but it is unknown how the results may differ when students are free to use *MyStudentBody–Stress* where and when they want. Indeed, it is possible that longer exposure to the website may effect greater change. An important next step in this research would be to subject *MyStudentBody–Stress* to an effectiveness test within naturalistic settings.

In terms of programming considerations, interventions for college students work best when integrated within a comprehensive strategy to address health problems. This approach has been pioneered by the National Institute on Alcohol Abuse and Alcoholism (NIAAA, 2002) in their report on college student alcohol use. They suggest that no single intervention cansolve the student binge drinking problem; policy initiatives, the college environment, the key stakeholders' involvement must combine to combat the problem. In a similar manner, it may be insufficient for any single educational approach or intervention to make significant progress on student stress unless it is integrated into broader efforts. Future studies could investigate whether colleges using *MyStudentBody–Stress* in combination with campuswide stress awareness campaigns or other policy initiatives achieve greater effects. On an individual level, future research can determine which individual characteristics might predict a positive response to e-health alone (e.g., self-efficacy) or in combination with live interpersonal interventions (e.g., comorbid psychiatric conditions).

Finally, the use of an Internet-based program to assist students with stress management offers important advantages for health educators and counseling staff at colleges. First, because many students do not seek formal services for stress management, a college stress management websiteallows students who would not normally seek any assistance to get help. Students who cannot effectively address stress-related problems in this format also will be able to find local resources for more formal help. In this way, colleges can leverage available services to educate a broader population of students about stress management. Second, self-assessment and motivational feedback can be used in conjunction with ongoing counseling services. Students can bring the results of their assessments to treatment and can complete follow-up assessments as treatment progresses. Third, counseling can be supplemented with interactive tools and peer stories, offering a form of modeling for desired stress management behaviors. Fourth, the use of the Internet ensures that information can be kept current. Unlike the print material that is typically offered through counseling centers, websites easily can be updated and revised. It is critical, however, to allocate human and financial resources for maintenance of any health websites. In many cases, the focus is on development of the intervention rather than on maintenance. If the latter is not accorded similar importance, the effectiveness of the online intervention will be compromised.

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