

RESEARCH ARTICLES

Students' Health-Related Quality of Life Across the Preclinical Pharmacy Curriculum

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Objectives. To examine health related quality of life (HRQOL), perceived stress, and coping skills in the 3 preclinical years of a doctor of pharmacy (PharmD) curriculum.

Methods. Health-related quality of life, perceived stress, and coping strategies were measured using the Short Form-36, Perceived Stress Scale, and Brief COPE. Average annual scores were compared across curriculum years.

Results. Two hundred thirteen students enrolled in the study. Entering students had physical and mental HRQOL scores that were similar to age-adjusted US norms. Mental HRQOL scores were significantly lower and stress significantly higher during the second year of the PharmD curriculum compared to the first year ($p < 0.05$). Lower mental HRQOL scores were associated with increased stress and use of maladaptive coping skills in all years of the curriculum.

Conclusion. Increased stress and reduced mental HRQOL were observed across the first 3 years of a PharmD curriculum. Methods to reduce stress and/or use of maladaptive coping skills are needed to improve students' HRQOL throughout the pharmacy curriculum.

Keywords: Health-Related Quality of Life (HRQOL), stress, coping strategies

INTRODUCTION

Pharmacy schools teach medication therapy and medication therapy management services as a means to improve patients' clinical outcomes and ultimately their health-related quality of life. However, doctor of pharmacy (PharmD) students' health-related quality of life (HRQOL) has not been well studied. A literature review (Medline, International Pharmaceutical Abstracts) found 3 abstracts and 3 published articles reporting the results of 5 studies that had measured PharmD student HRQOL.¹⁻⁶ All 5 studies detected reduced HRQOL in PharmD students, although each study only measured HRQOL at 1 or 2 time points during a 4-year curriculum. Two of these studies also reported a significant relationship between reduced HRQOL and increased stress.^{4,6}

Although reduced HRQOL among PharmD students has been documented to some extent, it would be useful to broaden the examination to include the possible amelio-

rating effect of students' coping strategies. The types of coping strategies used to respond to stressful situations have been well studied since the initial conceptual model proposed in the late 1960s.⁷ Within medicine, the exploration has been expanded to examine the relationship among 3 variables: coping strategies, stress caused by a disease state, and the ultimate impact on patient HRQOL. Examples include women with breast cancer and patients with human immunodeficiency virus (HIV).^{8,9} Positive (adaptive) coping strategies are associated with improved HRQOL, while negative (maladaptive) coping behaviors such as avoidance are associated with reduced HRQOL. We expect that similar relationships exist within healthy student populations, coping with primarily non-disease stress (ie, stress from the educational program, activities, and environment).

The purpose of this study was to explore the HRQOL of students at a new school of pharmacy as they progressed through the curriculum. While this type of investigation would be useful in any school, the faculty members and administration believed it was particularly important to monitor during the early years of the school's development, since the impact of normal stresses of a curriculum might be compounded by the evolving nature of

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the program itself. The specific objectives were to (1) compare entering PharmD students' HRQOL to the US norm; (2) compare PharmD students' HRQOL, perceived stress, and coping strategies across the 3 preclinical curriculum years; and (3) examine relationships among HRQOL, perceived stress, and coping strategies.

METHODS

This study was approved by the University of California San Diego (UCSD) Human Research Protection Program prior to its implementation, and all subjects completed an informed consent form. The results of the first 5 academic years (2004-2005 through 2008-2009) of this ongoing cohort study are presented in this paper. Pharmacy students in all classes were invited to enroll in the study. Enrolled students were systematically sent survey instruments at the middle (days 33-36) of the fall, winter, and spring quarters of each year to allow their average annual scores (used for analysis) to reflect their experiences across each curriculum year. Additionally, newly enrolled students (starting with the class of 2008) were also surveyed during their orientation session during the week prior to beginning the first year of the 4-year PharmD curriculum. When the study started, the school's first 2 classes (graduating in 2006 and 2007) were in their third and second year, respectively, and thus did not have the opportunity to participate during their earlier years. Subjects were assured their responses were confidential and would only be reported as aggregate data in study results. Participation was voluntary and an incentive was offered via a lottery system.

Three previously validated instruments were used to collect study data. HRQOL was measured with SF-36, version 2 (Quality Metric Incorporated, Lincoln, RI), a widely used, self-administered general health instrument consisting of 36 items measuring 8 domains of physical and mental health.¹⁰ A physical component summary (PCS) score and a mental component summary (MCS) score can also be calculated, with higher scores indicating better health status. Scores can be normalized to the US general population, where the mean score is 50 and the standard deviation is 10, allowing comparison to published US norms and to group scores reported in the literature, including those for PharmD students.^{4,6} Stress was measured using the 10-item version of the Perceived Stress Scale (PSS).¹¹ The PSS is a self-administered questionnaire measuring the degree to which situations are perceived as stressful. The items relate to how unpredictable, uncontrollable, and overloaded respondents find their lives in general and do not focus on a specific event. Questions ask about how often certain feelings or thoughts have occurred in the past 4 weeks (5-point Likert-type re-

sponse scale ranging from "never" to "very often"). The PSS has been used in many mental and physical health studies and was chosen because there are comparative values in the literature, and because it is general and not specific to a particular type of stress. A total perceived stress score is calculated, with higher values indicating a greater level of stress (scores were converted to a 0-to-100 scale in this study to facilitate interpretation). Coping strategies were assessed via the Brief COPE, which consists of 28 items measuring the amount of time or how much an individual has been using adaptive and maladaptive coping strategies.^{12,13} Responses to different coping mechanisms range from "I haven't been doing this at all" to "I've been doing this a lot." Adaptive strategies have been cited as being related to desirable outcomes and maladaptive strategies with less favorable outcomes.¹⁴ An adaptive coping score ranging from 16 to 64 can be obtained by summing responses across the 16 items related to adaptive coping strategies and a maladaptive score ranging from 12 to 48 can be calculated by summing across the 12 items related to maladaptive strategies. Each of these scores was converted to a 0-to-100 scale to facilitate interpretation; higher scores indicated greater use of a particular type of coping strategy. Demographic data collected during the initial survey of each subject included age, gender, and ethnicity. Statistical analyses were performed using Stata Statistical Software: Release 10 (StataCorp, College Station, TX).

Descriptive statistics were calculated for all variables. Kurtosis and scatter plots were examined to determine normality of data distribution, which was confirmed. Average annual scores (average of a student's data for the quarters for which a completed questionnaire was available during each year), were calculated for each measure [HRQOL physical component summary (PCS), HRQOL mental component summary (MCS), perceived stress, and maladaptive and adaptive coping] and used for analyses. Since multiple classes of students experienced each curriculum year, an analysis of variance (ANOVA) was first conducted to compare mean scores (PCS, MCS, perceived stress, maladaptive and adaptive coping) among classes of students for each curriculum year to determine whether there were significant differences in the experience (mean scores) between classes of students. This analysis indicated that no significant differences existed among classes, thus allowing data for all students (regardless of class) to be combined for subsequent analyses by curriculum year. For example, the mean score reported for PCS in the third curriculum year is comprised of students in each class who had participated and progressed through that curriculum year. A 1-sample *t* test was used to compare mean PCS, MCS, and

perceived stress scores to previously published values. ANOVA with repeated measures was used to compare means (PCS, MCS, perceived stress, maladaptive and adaptive coping) across the 3 preclinical curriculum years for the subset of students who participated in the survey in all 3 years. A last observation (data from curriculum year 2) carried forward approach was used to estimate missing scores in curriculum year 3 for 6 subjects. This was a conservative estimate since curriculum year 2 scores were always lower than curriculum year 3 scores. Tukeys procedure for conducting multiple comparisons was used for post hoc testing of means. Fisher's exact test was used to examine differences among subjects participating during all 3 curriculum years vs. those who did not. Significance level was set a priori at 0.05. A 5-point difference (half the standard deviation) in mean norm-based PCS and MCS scores was considered clinically significant.¹⁵ The relationship between SF-36 scores (PCS and MCS) and perceived stress and coping strategies was assessed using Pearson correlation. Correlations less than 0.29 were considered small; between 0.30 and 0.49, moderate; and greater than 0.5, large.¹⁶

RESULTS

Subjects

Of the 320 students (24 from the class of 2006, 26 from the class of 2007, 30 from the class of 2008, and 60 each from the classes of 2009, 2010, 2011, and 2012) available to participate in the study, 213 enrolled (66.6% response). Descriptive characteristics of the study sample are presented in Table 1. The majority of subjects were female (67.1%) and less than 25 years of age (66.2%). At least half of the students in each class participated in the study with the total sample weighted more heavily to the classes of 2009-2012, the years in which school enrollment was expanded to 60. The largest proportion of subjects (42.7%) was Asian/Pacific Islander followed by white/Caucasian (32.9%). No significant difference was detected in gender and ethnicity among the classes ($p = 0.627$ and 0.829 , respectively). A significant ($p = 0.003$) difference in the mean age of students was detected only for the initial class of 2006, which was older (25.4 ± 1.8 years) than the classes of 2010 (22.2 ± 1.7) and 2011 (23.2 ± 1.9). Overall, the study sample was slightly younger, had a greater percentage of female students and a lower percentage of Caucasians compared to the overall population of graduate and professional students at UCSD (mean age 27.8 ± 4.6 years; 42.8% female; 46.5% Caucasian).¹⁷ The demographic profile of participants was similar to that of the pharmacy school student body overall (age 25.3 ± 2.9 years; 64% female; 52.5% Caucasian).

Table 1. Descriptive Characteristics of Pharmacy Students Enrolled in a Study of Health-Related Quality of Life (n=213)

Variable	No. (%)
Gender	
Female	143 (67.1)
Male	43 (20.9)
Missing	27 (12.7)
Age	
<25	141 (66.2)
>25	44 (20.7)
Missing	28 (13.2)
Graduating Class Year	
2006	14 (6.6)
2007	12 (5.6)
2008	24 (11.3)
2009	36 (16.9)
2010	33 (15.5)
2011	39 (18.3)
2012	55 (25.8)
Race/Ethnicity	
White/Caucasian	70 (32.9)
Asian/Pacific Islander	91 (42.7)
Latino/Hispanic	4 (1.9)
Other	19 (8.9)
Not Specified	29 (13.6)

Not all enrolled subjects participated in the study in all 3 curriculum years. This was due to either lack of opportunity (ie, study started after they had completed a curriculum year) or choice not to participate in a given year (Table 2). A higher percentage of subjects who were older than 25 years of age dropped out of the study (73.4%) vs. those less than 25 years of age (45.6%, $p = 0.04$). There were no significant differences between the

Table 2. Student Participation in a Study of Health-Related Quality of Life

Class	Pre CY1	CY1	CY2	CY3	CY4
2006				14	7
2007			12	8	6
2008	24	24	17	12	13
2009	36	21	24	19	12
2010	32	25	18	10	
2011	34	35	24		
2012	37	46			
Total ^a	163	151	95	63	38

Abbreviations: PreCY1 = prepharmacy curriculum year 1; CY1 = curriculum year 1; CY2 = curriculum year 2; CY3 = curriculum year 3; CY4 = curriculum year 4

^a Not all subjects participated in each curriculum year; therefore, total participants does not match n values in other tables.

study dropouts vs. the non-dropouts in gender, ethnicity, or year of graduation.

Health-Related Quality of Life

Students entering pharmacy school who were less than 25 years of age had significantly greater PCS scores than the age-adjusted US norm (56.4 ± 5.1 vs. 53.5 ; $p < 0.001$), while PCS was not significantly different than the norm for students 25 years of age or older (53.9 ± 5.4 vs. 53.6 ; $p = 0.813$). Although significant, the difference in PCS scores for younger subjects did not reach the *a priori* clinical significance level. There was no difference in MCS scores compared to age-adjusted US norms (< 25 years, 46.2 (norm), $p = 0.797$; and ≥ 25 , 49.2 (norm), $p = 0.661$).

A significant difference in mean MCS scores was detected across the 3 preclinical curriculum years, $p = 0.002$ (Table 3). The lowest MCS level was reported for the second year (33.0 ± 11.7), in which the mean score was significantly and clinically lower than that for the first year (39.0 ± 9.5 ; $p < 0.05$). Furthermore, the mean MCS score in each curriculum year was significantly lower than that of the age-adjusted US norm ($p < 0.001$). There was no significant difference in mean PCS score across curriculum years ($p = 0.059$). Comparing our PCS and MCS mean scores to those previously reported in 2 prior studies of pharmacy students revealed little difference.^{4,6}

Perceived Stress and Coping Strategies Across Curriculum Years

A significant difference in mean perceived stress scale score was detected across the 3 preclinical years of the pharmacy curriculum ($p = 0.004$). The level of stress reported in the second year (51.4 ± 17.5) was significantly greater than that reported in the first (44.5 ± 14.2), $p < 0.05$; Table 3). The mean perceived stress scale score for third-year students was significantly higher than that reported by Marshall for third-year pharmacy stu-

dents ($p = 0.01$), and the mean score for students in the first year of the curriculum in our study was significantly higher than that reported by Cohen for a sample of undergraduate students ($p < 0.05$) (published scores were converted to 0-100 point scale to allow comparison).^{6,11} No significant difference in frequency of use of maladaptive or adaptive coping strategies was detected across the 3 preclinical years of the PharmD curriculum ($p = 0.288$ and $p = 0.078$, respectively). Notably, mean adaptive scores were approximately twice that of the mean maladaptive scores for each curriculum year, indicating that students were consistently using appreciably more adaptive (positive) coping strategies than maladaptive (negative) strategies. The MCS score exhibited a large negative correlation with perceived stress ($r = -0.753$ to -0.869) and greater use of maladaptive coping strategies ($r = -0.518$ to -0.642) across all curriculum years (Table 4). There was also a consistent and strong positive correlation between perceived stress and greater use of maladaptive coping strategies ($r = 0.515$ to 0.651). All other correlations were below this magnitude and considered small.

DISCUSSION

Students entering pharmacy school had physical and mental HRQOL scores similar to age-adjusted US norms. Significant differences in perceived stress and mental HRQOL were observed across the 3 preclinical curriculum years, with the second year having a significantly higher level of stress and lower level of mental HRQOL than the first year. The mental HRQOL scores for all 3 preclinical years was significantly lower than US age-adjusted norms and lower than the score that has been used as a cut-off screener for major depression or dysthymia (42.0).¹⁸ Lower mental HRQOL scores were strongly associated with increased stress and use of maladaptive coping strategies. However, encouragingly, students consistently used adaptive coping skills more frequently than maladaptive coping skills during these curriculum years.

Table 3. Health-Related Quality of Life (SF-36), Perceived Stress and Coping Strategies Across Curriculum Years

Curriculum Year (n=52) ^a	SF-36 ¹⁰		PSS ¹¹	Brief Cope ¹³	
	Physical Component Summary (PCS), Mean (SD)	Mental Component Summary (MCS), Mean (SD)	Perceived Stress Scale, Mean (SD)	Maladaptive Strategies, Mean (SD)	Adaptive Strategies, Mean (SD)
CY1	56.1 (5.0)	39.0 (9.5)	44.5 (14.2)	26.1 (12.3)	51.8 (14.6)
CY2	56.5 (5.6)	33.0 ^b (11.7)	51.4 ^b (17.5)	28.4 (11.9)	54.7 (14.9)
CY3	58.0 (5.4)	35.8 (11.8)	49.3 (17.9)	26.3 (12.7)	50.0 (17.6)
P Value	0.059	0.002	0.004	0.288	0.078

Abbreviations: CY1 = curriculum year 1; CY2 = curriculum year 2; CY3 = curriculum year 3; CY4 = curriculum year 4

^a Only subjects with complete data for each CY included.

^b Significantly different than CY1, $p < 0.05$

Table 4. Correlation Among Perceived Stress, Coping Strategies, and Health Related Quality of Life by Curriculum Year

r ^a (n) ^b	PreCY1 (n=154)		CY1 (n=141)		CY2 (n=92)		CY3 (n=60)		CY4 (n=32)	
	PSS ¹¹	MCS	PSS	MCS	PSS	MCS	PSS	MCS	PSS	MCS
PCS ¹⁰	0.017	-0.258	-0.060	-0.266	0.034	-0.188	0.109	-0.221	0.011	-0.042
MCS ¹⁰	-0.753	1.000	-0.744	1.000	-0.847	1.000	-0.802	1.000	-0.869	1.000
Maladaptive Coping Strategies ¹³	0.515	-0.595	0.580	-0.518	0.603	-0.610	0.651	-0.642	0.593	-0.602
Adaptive Coping Strategies ¹³	0.085	-0.155	0.174	-0.075	-0.004	-0.080	-0.045	-0.071	-0.120	0.105

Abbreviations: PreCY1 = prepharmacy curriculum year 1; CY1 = curriculum year 1; CY2 = curriculum year 2; CY3 = curriculum year 3; CY4 = curriculum year 4; PSS = Perceived Stress Scale; PCS = Physical Component Summary; MCS = Mental Component Summary.

^a Pearson correlation; correlations are for descriptive purposes and were not therefore analyzed for significance.

^b Subjects with complete data for all measures.

The reduced mental HRQOL scores and increased stress were similar to findings in cross-sectional studies of pharmacy students reported in the literature.^{4,6} However, the level of stress in this study was greater than that reported in the literature for third-year pharmacy students and undergraduates in other studies.^{4,11} These prior studies were limited to 2 time points and were unable to investigate the changes that may occur over the course of the curriculum. This study indicated a consistent pattern of stress and mental HRQOL change, experienced by all classes as they progressed through preclinical curriculum years. A strong negative correlation between increased stress and lowered mental HRQOL was also observed in this and prior studies.^{4,6}

The findings have several implications. First, measuring stress or HRQOL at a single point in a multi-year curriculum may be misleading. Significant differences occurred in both across the preclinical years. Second, the pattern of increased stress and reduced mental HRQOL provides information to target interventions before or during certain time periods (eg, coping workshops held prior to students beginning their second year, changes in examination scheduling, increased availability of counseling services). Third, the Accreditation Council for Pharmacy Education (ACPE) recommends measuring perceived stress in students (Standard 15.5).¹⁹ Results of this study build on those of others showing that the Perceived Stress Scale is a feasible and easily-completed instrument for self-assessing stress. Utilization across colleges and schools of pharmacy would allow for useful comparisons and benchmarking of results. In addition, the strong correlation of stress with reduced mental HRQOL and greater use of maladaptive coping skills suggests these too would be useful to measure to help guide the creation of interventions as needed. Last, these findings have reinforced the importance of including information about student health support services in annual student orientation sessions. The number of students in this study seeking such support is confidential and thus unknown to the investigators.

Results of this study should be interpreted in light of the study limitations and results are not generalizable to other populations. Responses were from a 4-year PharmD program that fosters interprofessional relationships at an early stage. During the second year of the program, when mental HRQOL was at its lowest and stress at its highest, students participated in a joint medical and pharmacy school basic science curriculum, which can be stressful due to a variety of reasons (eg, large, combined class sizes, change in examination format). The ultimate outcome of this approach will need to be assessed later in the educational and training sequence and as students become practicing pharmacists. Second, there were some changes to the curriculum over the study years; however, the changes were mainly administrative and not expected to affect the students' overall experience. Also, there were no specific interventions for students to reduce stress or improve coping skills. Third, the small sample size of students participating throughout all 3 years of the pre-clinical curriculum was partially due to students dropping out of the study over time. Although dropouts appeared to be similar to other study subjects, except slightly younger, it is not known whether this sample was representative of the student body. Also, because of the small continuing cohort, differences in subgroups of students who may have reacted differently to the curricular demands (eg, age groups, male vs. female) could not be examined. Steps to reduce the dropout rate are being taken to improve continued response in the future, which will also allow the examination of changes that may occur when students begin their advanced pharmacy practice experiences in clinical settings in their fourth year. Finally, students volunteered for this study and their choice to do so, and continue, may have been influenced by their perceived level of HRQOL or stress level at the time. Data collection for students is ongoing with each new pharmacy class (n=60), thus, the power to detect differences will improve. Expansion of data collection to include other comparator groups within the university and other schools of pharmacy is currently being explored.

CONCLUSIONS

Increased stress and reduced mental HRQOL were observed across the first 3 preclinical years of the 4-year pharmacy curriculum. The second curriculum year (consisting of an intense program of basic sciences) had the lowest mental HRQOL and the highest stress levels; however, mental HRQOL scores for all 3 curriculum years were significantly lower than US age-adjusted norms. Lower mental HRQOL was strongly and negatively associated with increased stress and increased use of maladaptive coping skills. Encouragingly, students used more adaptive (positive) than maladaptive (negative) coping skills throughout the curriculum years. Further research is needed across schools of pharmacy to assess the level of HRQOL, especially the mental health component and its relationship to stress that may be caused by varying curriculum, maladaptive coping strategies, or other factors that can be ameliorated through student training or outreach programs.

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