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Using the concepts of intrinsic and extrinsic motivation from self-determination theory, this study investigates the relationship between stress and motivation in collegiate swimmers. This longitudinal study examined the intersection of stress and motivation athletically and academically over the course of a collegiate swim season. Participants were asked to complete five surveys over time measuring their stress and types of motivation. We used a generalized estimating equation analysis with types of motivation as the independent variable and stress as the dependent variable. Results indicate that intrinsic motivation does not predict stress over time, but external regulation does. Intrinsic motivation significantly changed over the course of a season, with the lowest point happening at the peak of the season. A hierarchical regression revealed that coaching characteristics explained 11.7% of the variance in amotivation, with coach likeability being a significant and negative predictor of amotivation.

Keywords: stress, intrinsic motivation, athletics, coaching

Although to many young children, it is a dream to become a college athlete, that dream becomes a reality for very few. In fact, in 2019, just over 7% of all men and women high school swimmers went on to compete in the National Collegiate Athletic Association (NCAA; NCAA, 2020). Becoming a college athlete not only requires physical talent, but also requires strong motivation. This motivation can come from many aspects, including scholarships (Cremades, et al., 2012), talent, facing challenging environments, and internal love of sport (Mallett & Hanrahan, 2004), and can change relating to pressure to perform (Almodovar, 2017; Mallett & Hanrahan), social support (DeFreese & Smith, 2013), coach athlete relationship (McGee & DeFreese, 2019), or academic stressors (Isoard-Gautheur et al., 2012). Despite years of research on stress in students and student athletes, there is limited information on the interaction of the academic and athletic performance stressors over time (Gustafsson et al., 2008; Isoard-Gautheur et al., 2012), as well as how changes in motivation can predict stress (McGee & DeFreese, 2019). Using Self Determination Theory (SDT; Deci & Ryan, 1985), this study examines changes in stress associated with changes in motivation over the course of a competitive season in collegiate swimmers.

Stress in Student Athletes

Stress as a college student can come from many different factors including academic, financial, time management, social, and family. Although student athletes experience similar levels of academic stress as non-athletes (Martin, 2018), student athletes report more sources of stress, including time management, missing class due to travel, burnout, fear of failure, dealing with team dynamics, anxiety, depression, and self-esteem issues (Wilson & Pritchard, 2005). Gender may also play a role in stress, making it an additional important variable to consider. Previous research has found significant differences in stress levels between male and female students, with females reporting higher levels of life stress (Bureau, 2016; Martin, 2018). This could be because women perceive their participation in collegiate sports as an additional stressor (Kimball & Freysinger, 2003).

Adding academic responsibilities on top of athletic responsibilities can have detrimental effects on student athletes' grades and wellbeing (Nagle et al., 2015; Scott et al., 2008). Many factors can affect stress level and motivation, including ability to manage stress (Park et al., 2012), social contagion of classmate stress levels (Raufelder et al., 2018), subjective perception of exam stress and cortisol levels (Haleem et al., 2015), and self-efficacy (Burger & Samuel, 2016). Likely due to the time demands of sport participation, collegiate student athletes tend to report lower GPA in-season than out of season, despite often taking less course hours (Scott et al., 2008). In a longitudinal study on NCAA Division I female swimmers, perceived stress was found to be related to an increase in training volume (Nagle et al., 2015), suggesting an inverse relationship between perceived stress and training volume (O'Connor et al., 1989). Reducing training volume was associated with lower levels of fatigue and higher levels of energy. The results of this study suggested that monitoring a student athlete's perceived stress throughout the season is important to prevent burnout, overuse injuries, and underperformance (Nagle et al., 2015). However, Nagle et al. (2015) focused primarily on stress and physical outcomes, rather than motivation, the focus of the current study.

Wellbeing among Student Athletes

Stress is present among all college students and it is a particularly important variable to study among student athletes because their heavy workload and pressure to perform increase their stress levels to the point of making it a risk factor for their wellbeing (Kroshus, 2014). This high level of stress is related, for example, to an increased risk of depression (Hammen, 2005). In addition to pressures to perform sports and be successful in academics, student athletes experience unique risk factors, such as injury and overtraining, which may also increase their chances of experiencing symptoms of depression (Wolanin et al., 2015). These risk factors may also be related to anxiety, which can affect performance in sports and academics (Davorean & Hwang, 2014). This scenario is even more worrisome when considering that student athletes feel less comfortable seeking mental health services than their non-athlete peers (Moore, 2017).

Even though some researchers suggest that student athletes may be at an advantage to cope with these stressors due to the breadth of resources offered to them at their schools (Delahaij et al., 2011; Martin, 2018), student athletes may not always use the available resources when they need (Hatteberg, 2020). Hatteberg found that when asking for help of support staff members, some student athletes may be concerned about confidentiality, the staff's ability to help, and whose interest will be prioritized - the student athlete's or the institution's. Additionally, Berg and Warner (2019) have found that institutions that provide better social support to their student athletes tend to be open and honest with the student athletes, besides treating them fairly.

Another issue for student athletes' wellbeing that is rooted in stress is burnout (Smith, 1986). Experiencing even one symptom of athlete burnout can have detrimental effects to physical and psychological health and further puts the student athlete at risk for developing burnout syndrome (Taris et al., 2005). Ultimately, despite the resources provided to student athletes to manage their stress and increase their wellbeing, they still experience high stress that can culminate in issues such as anxiety, depression, and burnout, which makes stress an important topic of study (Ryan et al., 2018; Taris et al., 2005).

The Relationship Between the Coach and Student Athlete Wellbeing

Coaches, especially at the collegiate level, are influential members of a student athlete's autonomy, competence, and relatedness. The relationships that are formed between a coach and a student athlete give the coach a powerful ability to impact the athlete's psychological health (Jowett & Shanmugam, 2016). Higher ratings of coach likeability are related to lower levels of perceived stress (Weathington et al., 2010). Coach likeability can significantly predict higher perceptions of student athlete competence when the student athlete reports low levels of fitness, interest, or social motivation (Weathington et al., 2010). Coaching behaviors may influence the amount of intrinsic motivation and perception of skill and competence in student athletes.

For example, positive perceptions of coaching behaviors, such as social support, positive feedback, and training and instruction, lead to higher levels of perceived competence and enjoyment (Price & Weiss, 2000; Rezania & Gurney, 2014), which are indicators of intrinsic motivation. Relatedness support, supporting social connections, between the coach and athlete is negatively associated with athlete burnout over the season, and positively associated with athlete engagement over time (McGee & DeFreese, 2019). Autonomy supportive coaches, supporting choice or control, have been shown to positively relate to better wellbeing and motivation over time (Stenlin, 2016). In addition, McGee and DeFreese (2019) made preliminary explorations of

relationships between coach-athlete relationship, stress, and motivation, finding that perceived stress and sport motivation were better predictors of student athlete burnout and engagement when coach-athlete relationship was included in the model. Stress and motivation may be underlying predictors, while coach-athlete relationship is a mediator (McGee & DeFreese, 2019).

Self-Determination Theory

While there are many theories of motivation, a commonly used theory in sports is self-determination theory (SDT; Deci & Ryan, 1985). This theory purports that the fulfillment of three components (autonomy, relatedness, and competence) drives self-motivation, development, and personal wellbeing. The satisfaction of these needs may lead to intrinsic motivation, or the desire to participate in a behavior because it is inherently interesting, and not dependent on a reward or punishment (Ryan & Deci, 2000). Intrinsic motivation was repeatedly found to be associated with lower levels of stress in cross-sectional studies (Baker, 2004; Liu, 2015; Park et al., 2012). This may be because of the very nature of intrinsic motivation. The behaviors performed are linked to an internal desire to do so and thus, the perception of the action at hand is seen as enjoyable or a challenge rather than a stress or threat.

In contrast, extrinsic motivation is defined as being dependent on a separate outcome. Organismic integration theory (OIT; Deci & Ryan, 1985) further distinguishes the types of extrinsic motivation. On this spectrum, extrinsic motivation is broken down into external regulation, or dependent on a reward; introjected regulation, meaning performance to avoid guilt or anxiety or to gain ego enhancements; identified regulation, meaning accepting the action as personally important; and integrated regulation, meaning to completely assimilate actions into one's perception of themselves. Finally, to have no motivation at all, one would be described as amotivated (Deci & Ryan, 1985).

SDT is particularly useful in sport psychology because of its ability to explain motivation as a combination of multiple factors, including both social context variables and individual desire to participate in physical activity (Deci & Ryan, 2000; González-Cutre, 2016; 2020). In the lens of SDT, motivation to participate in a sport can be attributed to external motivators, such as scholarships (Cremades et al., 2012) or perceptions from others, (DeFreese & Smith, 2013) as well as intrinsic motivators such as interest, curiosity, or competition (Ryan & Deci, 2000).

The relationship between perceived stress, athlete burnout, and self-determined motivation has been heavily researched in the realm of sports, consistently showing that shifts on the motivation continuum toward more extrinsic sources are related to negative outcomes such as burnout (Cresswell & Eklund, 2005; Gould et al., 1996a; 1996b) and stress (Gagné & Blanchard, 2007; Holden et al., 2019; Pines, 1993), while athletes with higher intrinsic motivation report lower burnout scores and a higher intention to continue their sport (Alvarez et al., 2012; Keshtidar & Behzadnia, 2017). Extrinsic incentives in sports, such as scholarships, result in a perceived loss of autonomy and a decrease in intrinsic motivation, which can lead quickly to the onset of burnout (Deci & Ryan, 1985; Lemyre et al., 2006; 2007). Athletes who have external reasons to participate often report higher levels of perceived stress that lead to poor training adaptation patterns hypothesized to lead to burnout (Gould et al., 1996a; Raedeke, 1997). Some research has explored the impact of gender on motivation with mixed results. Although some research indicate that males are more extrinsically motivated (Cremades et al., 2012; Hepler & Witte, 2016; Medic et al., 2007), other research suggest that males report higher intrinsic

motivation (Amorose & Horn, 2000), while still others find no difference in motivation between males and females (Abrahamsen et al., 2008).

The framework of SDT allows for a comprehensive view of how need support can impact stress and motivation. Fulfilling the three basic needs increases self-determined motivation and improves student athlete wellbeing (Gagné & Blanchard, 2007). However, thwarting these needs may increase stress (Li et al., 2019), and have negative outcomes on student athlete wellbeing (Alvarez et al., 2012; Keshtidar & Behzadnia, 2017). Thus, SDT appears to have a relevant theoretical framework to examine the changes in motivation and stress.

The Current Study

The relationship between stress, motivation, and overall student athlete wellbeing make it an important and compelling line of research. As previous research cross-sectionally demonstrates that higher intrinsic motivation is associated with lower levels of stress, (Raufelder et al., 2018) and less burnout (Cresswell & Eklund, 2005; Gould et al., 1996a; 1996b), this study examines changes in intrinsic motivation and stress longitudinally. By conducting a longitudinal study, we were able to analyze data at different points of the season as stress, both physical and academic, varied, as well as the intersection of stress and motivation peaks. These findings uncover the periods of time when student athletes are most at risk of experiencing decreased wellbeing due to high stress and low motivation.

This study examined the collegiate sport of swimming. The swim season in college athletics includes several periods of hard training and rest (Nagle et al., 2015). Swimming also represents a unique situation where peak training also falls during the most intense part of the academic year. Commonly, collegiate swimming ramps up through December/January and tapers until the championship meet in mid to late February. Often, the most stressful part of the season falls in late November through December, when student athletes have completed their mid-season championship meet and are in the peak of physical training, while academically, finals and final projects are looming (Scott et al., 2008). This makes collegiate swimming a unique sport to study stress and motivation, both academic- and athletic-wise.

In this study, we hypothesized that there will be several findings.

Hypothesis 1: Changes in intrinsic motivation will predict changes in stress over the season.

Hypothesis 2: Stress will change over the course of the season in an inverted U with the peak at Time 3 (just prior to winter break).

Hypothesis 3: The relationship with the coach is a significant predictor of intrinsic motivation and stress at the peak of the season.

Method

Design

This study followed a longitudinal design. Participants were asked to complete five surveys over the course of the collegiate swim season from September through March. All surveys contained the same questions. Time points will be referred to as T1, T2, T3, T4, and T5 in chronological order.

Participants

Participants were recruited through two strategies. First, participants were recruited via swim coaches of a mid-major Division I NCAA conference. Coaches were asked to provide a roster of their team with emails, which was then used to create a contact list. These schools were originally selected because of the authors' relationship with the coaches and knowledge that the mid-season invite would take place in the same week, meaning that those teams likely followed a similar training pattern.

However, because of an extremely high attrition rate in longitudinal studies and difficulty in working with student athletes, we increased our participant pool by reaching out on Twitter to any NCAA swimmer. Popular swimming accounts were tagged and asked to share the invite. After the participant collection was complete, we had a comprehensive list of 163 participants. All participants were over the age of 18 and were a current NCAA Division I, II, or III swimmer.

A total of 163 participants enrolled in the study, although only 132 completed at least one survey. Out of these 132 participants, 108 completed enough surveys to be included in the longitudinal data analysis. Table 1 shows the number of participants, their gender, GPAs, years of swimming, and the division that they competed in for each of the five surveys.

Table 1
Participant Demographics Across Five Data Collection Points

Time	Age M (SD)	GPA M (SD)	Valid % of females	Valid % of 11+ years of competitive swimming	Valid % of DI
T1 (N = 116)	19.50 (1.15)	3.40 (0.38)	65.2%	67.2%	82.2%
T2 (N = 95)	19.63 (1.11)	3.45 (0.33)	61.1%	68.4%	82%
T3 (N = 72)	19.85 (1.12)	3.50 (0.32)	66.6%	70.9%	80.3%
T4 (N = 71)	19.93 (1.16)	3.50 (0.36)	69.0%	71.8%	77.6%
T5 (N = 67)	20.15 (1.18)	3.52 (0.36)	67.2%	75.0%	84.5%

Instruments

Demographic Questions. Participants were asked for demographic information, including their school, grade, age, and gender. We asked participants how many years they had been swimming and what distance they generally practiced with in order to form a basic athletic background. Finally, we asked about their scholarship status (full, partial totaling more than half the total cost of attendance, partial totaling less than half the total cost of attendance, no athletic scholarship). Originally, we considered scholarship status as a confounding variable, but we chose to simplify our analysis and only include Division as a confound because there was reasonable overlap.

The Situational Motivation Scale. The Situational Motivation Scale (SIMS; Guay et al., 2000) is designed to capture the situational (or state) motivation and assesses several facets of motivation: intrinsic motivation, identified regulation, external regulation, and amotivation. We modified the SIMS to fit our participant pool. Participants were given the prompt "why are you currently engaged in swimming?" and a series of 16-items in which to respond, such as (1) "because I think that swimming is interesting," (2) "because I am doing it for my own good," (3) "because I am supposed to do it," and (4) "there may be a good reason to do this activity, but personally I don't see any." Each of these statements represent the four subscales: (1) intrinsic motivation, (2) identified regulation, (3) external regulation, and (4) amotivation. Participants were asked to respond on a 7-point Likert scale from 1 (*corresponds not at all*) to 7 (*corresponds exactly*). Scoring is conducted by adding up the scores on each subscale. Cronbach's alpha for each subscale at each time point is reported in Table 2.

The Perceived Stress Scale. The Perceived Stress Scale (PSS; Cohen et al., 1983) is a 14-item scale designed to measure the degree to which situations in one's life are appraised as stressful. The questions are general in nature and cover a variety of what one could consider "normal" life stressors. Participants were asked to indicate how often they felt or thought a certain way in the last month. Items included statements such as "in the last month, how often have you felt that things were not going your way?" and "in the last month, how often have you felt difficulties were piling up so that you could not overcome them?" Each statement is rated on a 4-point scale ranging from 1 (*never)* to 4 (*very often*). Scores are calculated by reversing the scores of seven positive items and then summing across all items. The highest score an individual can get is 56. Cronbach's alpha for all five times are reported in Table 2.

Table 2
Cronbach's Alpha Reliability Table

	# of Items	T1	T2	T3	T4	T5
Intrinsic Motivation	4	.85	.88	.90	.91	.90
Identified Regulation	4	.69	.74	.81	.84	.79
External Regulation	4	.81	.86	.85	.86	.86
Amotivation	4	.84	.83	.87	.88	.82
PSS	14	.78	.77	.83	.81	.76

Coaching characteristics. While the primary motivation for this study is not to analyze student athlete's perception of the coach, the coach-athlete relationship has been shown to be an important determinant of athlete stress and motivation levels (Ambrose & Horn, 2000; 2001; Weathington et al., 2010). To briefly analyze coaching characteristics, we drew from Weathington et al. (2010) two separate single-item ratings of coach likeability and technical expertise. Participants were asked at each time point to rate their primary coach from 1 (*poor*) to 5 (*high*) on each of these components.

Procedure

After IRB approval, an online survey link was emailed to participants at each of the five designated times. Surveys were distributed at five points throughout the year in alignment with college swimming season (Cowley, 2015; Lemyre et al., 2006). All 163 participants who had given informed consent were assigned a random number to track their responses throughout the study, although only 108 participants had enough data to be included in the longitudinal data analysis. The following numbers are those who completed the survey at each time point. The distributions took place September 16th (pre-meet season; T1) (n = 116), October 14th (mid-meet season; T2) (n = 95), November 18th (pre-mid season championship invite; T3) (n = 72), February 10th (pre-championship meet; T4) (n = 71), and March 2nd (post-season; T5) (n = 67).

At each time point, participants completed the SIMS, PSS, and were asked if an injury or illness has stopped them from practicing for two or more days in the past two weeks, as well as how many days they had missed. These questions were included to look for participants who were not practicing that year (either injury redshirt or long-term illness), in which case, their data was not used in the final analysis. Finally, we asked the two coaching questions and ended with an open-ended question asking if there was anything else about their life to add. Since this question was phrased as "optional" this question recorded a low response rate. We initially asked this question to check for confounding variables but found that this data named many of the stressors experienced by student athletes. We found that this data added valuable depth to the findings and included frequency analyses and illustrative quotes in our results.

Data Analysis

The Statistical Package for the Social Sciences (SPSS) was used for all analyses. Demographic data was analyzed using frequencies for division, gender, and years swam, and descriptives for GPA and age. Following analysis of demographic data and mean scores of the main variables, two Repeated Measures ANOVA were used to assess if there was a significant trend in stress and intrinsic motivation changes in the sample during the season (hypothesis 2).

Generalized estimated equation (GEE) was used to test our first hypothesis that variations in motivation could predict variations in stress level. A GEE is an extension of a generalized linear model that has a flexible approach to handling correlated data structures (Liang & Zeger, 1993). GEE models can handle correlated data arising from repeated measures of the same individual over time as well as time varying and time invariant predictors and are flexible for missing data (Zeger et al., 1988). This flexibility allowed us to include participants who did not complete all five questionnaires. Gender and NCAA division were also added as a predictor in the GEE analysis.

We ran three hierarchical linear regression analyses to test the contribution of coaching characteristics in explaining motivation (intrinsic and amotivation) and stress (hypothesis 3), to attempt to build on the findings of Weathington et al. (2010). In step 1, gender was the independent variable while in step 2, the two coaching questions (likeability and technical expertise) were the independent variables. These variables were evaluated at time three because of the dip in intrinsic motivation and peak of stress at that time, which provided the best scenario to find an influence of coaching on stress and motivation, if there was one (Lemyre et al., 2006; Nagle et al., 2015; Scott et al., 2008).

Finally, descriptive coding (Saldaña, 2013) was used to identify the main sources of stress that student athletes chose to report when asked about something else that they would like to add about their lives. Qualitative data was collected and analyzed at each time point, reflecting the different stressors of that time. Two coders individually coded the data using inductive coding and identified three themes: positive affect (e.g., positive relationship with team/coaches, excited to race), negative affect (e.g., feel burned out, high anxiety, injury/illness stress), and season not in session (e.g., redshirt, season has not begun). Following, the same two researchers coded the responses into these three themes. From there, the frequency that each theme was coded was measured at each time point.

Results

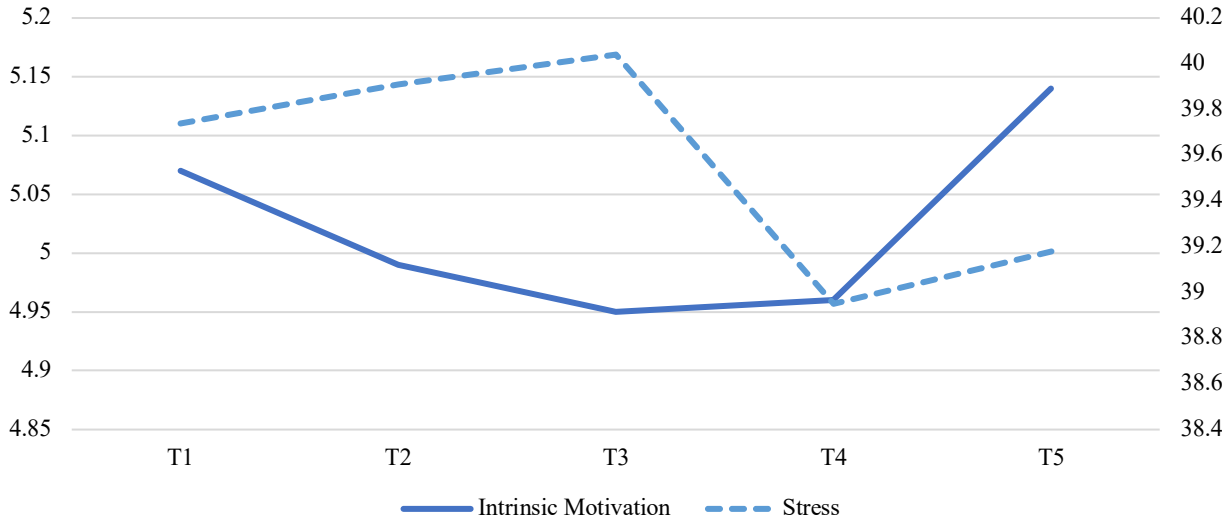
To test our first hypothesis, we ran a GEE with stress as the dependent variable and the four motivation scales (intrinsic, amotivation, external regulation, and identified regulation) as the predictors and gender and division as a covariate. 108 cases were included in this analysis. Means and standard deviations of each motivation can be found in Table 3. External regulation was a significant predictor of stress across time (B = 1.20, $p = .01$), but intrinsic motivation (B = -.487, $p = .476$), amotivation (B = .467, $p = .408$), and identified regulation (B = -.805, $p = .309$) did not predict stress. No differences were found between genders nor NCAA divisions.

Table 3
Variable Means Across Five Data Collection Points

	T1	T2	T3	T4	T5
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Intrinsic Motivation	5.07 (1.16)	4.99 (1.20)	4.95 (1.15)	4.96 (1.23)	5.14 (1.14)
Identified Regulation	5.75 (.86)	5.66 (.80)	5.64 (.91)	5.74 (.94)	5.71 (.87)
External Regulation	2.90 (1.31)	2.89 (1.32)	2.78 (1.39)	2.74 (1.29)	2.74 (1.31)
Amotivation	2.02 (1.01)	2.12 (1.07)	1.99 (.97)	2.04 (1.05)	2.03 (1.05)
Stress	39.74 (6.39)	39.91 (6.37)	40.04 (7.12)	38.95 (6.90)	39.18 (6.15)

Further, we assessed the trends of stress and intrinsic motivation (Hypothesis 2) by running two repeated measures ANOVA to identify any significant trends. These analyses had fewer participants because they only accounted for participants who completed all five surveys. Within subjects analyses showed that stress did not significantly change over the course of the season ($F(4, 34) = 1.216$, $p = .277$); however, intrinsic motivation had a significant quadratic trend ($F(4, 38) = 8.369$, $p = .006$). When plotted, both of these variables trended in the expected directions. Stress was at its peak at T3 ($N = 69$, $M = 40.0$, $SD = 7.11$), where intrinsic motivation was lowest ($N = 71$, $M = 4.48$, $SD = .94$) (see Figure 1).

Figure 1.
Intrinsic Motivation and Stress Trends.



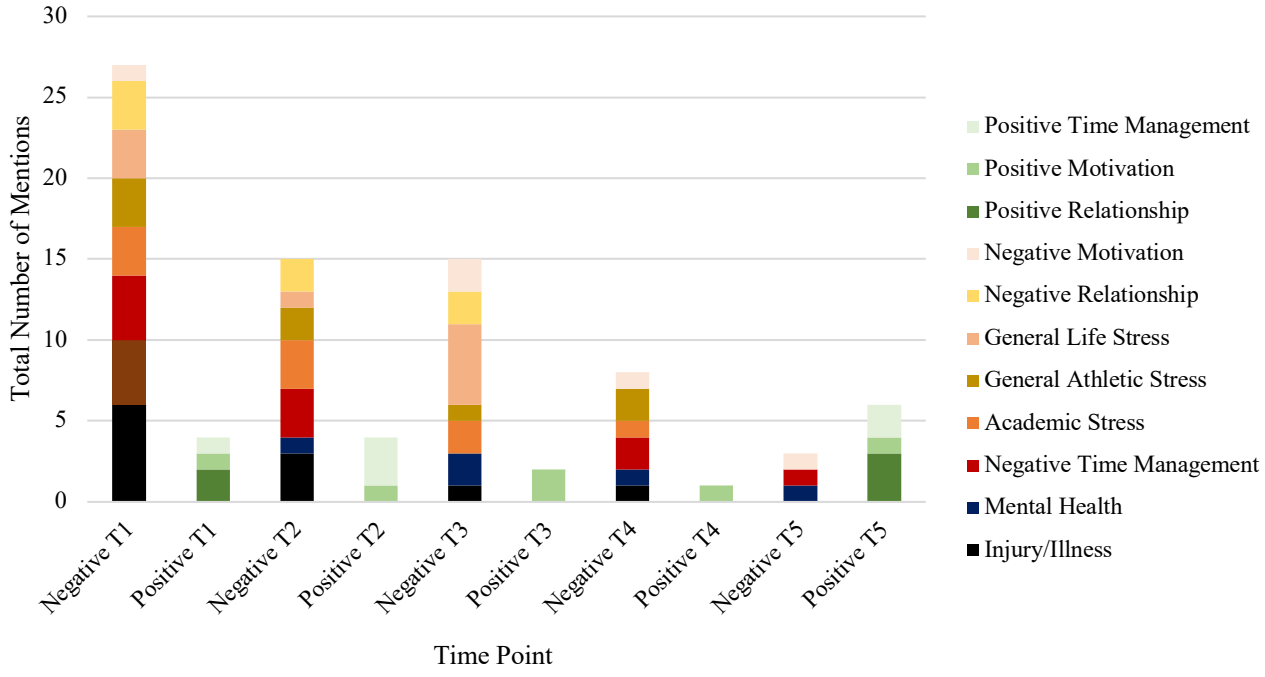
Our third hypothesis was tested with three hierarchical regressions to understand the influence of coaching characteristics on intrinsic motivation, amotivation, and stress. In the first, gender significantly explained 12% of the variance in stress, although coaching characteristics did not increase this variance significantly (1.1%). Both the first model ($F(1, 66) = 9.01$, $p = .004$) and the second model were significant ($F(3, 64) = 3.207$, $p = .029$) in this regression.

Neither gender nor coaching characteristics significantly explained the variance in intrinsic motivation. However, a hierarchical regression with amotivation as the dependent variable showed coaching characteristics significantly explaining 11.7% of the variance in amotivation ($F(2, 65) = 4.42$, $p = .016$) with coach likeability ($\beta = -.323$, $p = .028$) being a significant negative predictor of amotivation. Gender explained none of the variance and was not a significant predictor of amotivation.

The open-ended question revealed several unaccounted sources of stress and motivation from participants. A total of 69 responses were collected over the five time points, for a total of 103 codes, as some responses were analyzed with several codes. Several themes emerged, broadly including negative affect (subcoded as injury/illness stress, general life stress, negative time management, mental health, academic stress, negative relationship, and negative motivation), positive affect (subcoded as positive relationship, positive time management, and positive motivation) and season not in session. For T1 through T4, components relating to

negative affect were mentioned most often (T1 = 77.1%; T2 = 75.0%; T3 = 88.2%; T4 = 72.7%). However, at T5, components relating to positive affect become most frequently mentioned (T5 = 66.7%). See Figure 2 for complete breakdown of coding.

Figure 2.
Qualitative Data Positive and Negative Influences.



Many of the qualitative responses reflected our quantitative findings. For example, at T1, a participant hinted at the relationship between external regulation and stress, saying,

> I have found that I have been burned out since starting college swimming. I have struggled with mental health and wanted to quit since my freshman year. Due to the full tuition scholarship I cannot afford to and I realize the great privilege I hold. I often find times of joy in the sport and enjoy the exercise, but feel as though if I had a choice, I would be living my life very differently. I am not sure if my peers feel the same way as me, but I am now a senior and have a sense of cognitive dissonance. Every day I struggle with turning over my college years to being on a team that I don't relate to and in a sport I've been doing since I was 6 years old.

This participant found that the external rewards of the sport were overpowering their motivation to perform in their sport.

At T3, when stress peaked while intrinsic motivation hit its trough, this change was also reflected in qualitative responses, which included the most mentions of negative affect (88.2%) exemplified in the following quotes: "exams are piling up and I have fallen behind in a class that stresses me out," "…fell into a panic pertaining to some of my academics…I still get worried if I choke a test or get a bad grade or something," "had some outside stressors lately," and "life is

pretty nonstop with training, work, and university." This was not unique to T3, as many similar answers pertaining to balancing academics and athletics were also given at all time points. Many T5 write-ins reflected on decreased stress, both academically and athletically mentioning "[feeling] less stressed about life in general without having to worry about going to swim every day," and "nice academically to not be in practice right now," suggesting that stress is related to the occurrence of practices.

Discussion

Our first hypothesis was not supported as intrinsic motivation did not predict stress across time. This was not supported by previous literature, as much found that intrinsically motivated behaviors are associated with lower levels of stress (Baker, 2004; Liu, 2015). This could be because of the difference in samples. Much of previous research focuses on the relationship between academic stress and academic intrinsic motivation in non-athletes, which could manifest itself differently in student athletes. We examined general life stress and motivation for sport, which may explain why our findings did not align with previous research.

However, the current study observed external regulation to predict stress over time. This is supported by previous literature (Gould et al., 1996b): student athletes who feel pressure to participate in their sport for external reasons report higher levels of stress. The current study, however, adds to the literature by assessing this relationship longitudinally whilst considering variations in general life stress and not just sport-related stress. External regulation, or the cause of motivation being dependent on a reward, is likely to be associated with stress because of the pressure to perform, seen as a stressor. As external pressures increase, stress increases as well. For example, winning a race may be an extrinsic motivator, but the pressure to perform is an additional stressor. This type of motivation is potentially harmful, as stress is one of many predictors of burnout (Raedeke, 1997).

Taken together, these results indicate that external regulation may be a more relevant predictor of general stress among student athletes than intrinsic motivation. Although previous studies (e.g., Baker, 2004; Raufelder et al., 2018) have found that intrinsic motivation and stress are related when analyzed cross-sectionally, the same was not found longitudinally. This information is important to guide interventions to reduce stress, which are relevant for both performance and wellbeing (Davorean & Hwang, 2014). These interventions might consider decreasing focus on external pressure to perform to improve motivation and stress. Nevertheless, further investigation of this longitudinal relationship should be carried out to further explore these longitudinal relationships.

The second hypothesis was partially supported. In the collegiate swim season, intrinsic motivation changed over the season in a quadratic manner, hitting its lowest point where stress was also at its highest. Although stress did not significantly change, intrinsic motivation did. Interesting to point out is the increase of stress at T5, post season. Physically, student athletes are not in season and physical stress should have decreased, decreasing overall stress; however, it is possible that stress toward academics ramped up when stress toward their sport decreased (Nagle et al., 2015; Scott et al., 2008). An increase in stress may be a response to decreased time pressure, or what is known to economists as "Parkinson's Law," the theory that work expands to fill the time available for its completion (Peters et al., 1984). This was reflected in some of our qualitative responses, noting "free time now to focus on school and other things," and "no

motivation to do school work and really had to push [myself] to do it." Eliminating practices from their schedules poses a lack of structure to their day which may increase stress.

Student athletes face many stressors above and beyond those of the average student. While coursework and general life stress may be the same, our qualitative data supported the findings of Wilson and Pritchard (2005) – student athletes face more sources of stress, including mental health issues related to sport, school-sport balance, injury stress, external motivators, and team dynamics. Sport can easily be seen as an additional stressor, especially if there are concurrent demands on the student athlete (e.g., academics, life stress, injury, etc.) (Santomier, 1983).

Contrary to the findings of Weathington et al. (2010), coaching characteristics did not play a large role in predicting stress or intrinsic motivation, with neither being significant. Although we did not find intrinsic motivation to be affected by coaching characteristics, that does not mean that coaches have no influence on motivation. Our results indicated that coach likeability is important, implying that student athletes are motivated in some way through a positive relationship with their coach, similar to what McGee and DeFreese (2019) observed. This is key for preventing burnout, especially during such a long season. Increasing autonomy, competence, and relatedness through coaching during the particularly high stress parts of the season (i.e., mid-season meet through fall finals) could increase intrinsic motivation, and may help decrease amotivation. Coaches should be aware of external motivators and avoid using them in periods of high stress, instead trying to focus on reminders of why the athlete enjoys the sport. This could be exemplified through increased social interaction through teammates, variety in practices, or reexamining internal goals.

Knowing these stress and motivation trends and how coaches may affect these variables can be helpful for several reasons. First, at peak stress, student athletes are at their lowest intrinsic motivation and at higher risk for developing burnout (Taris et al., 2005). Coaches should be aware of their athletes' mental state by continually monitoring for signs of overtraining, burnout, or stress. Monitoring for these signs can be a quick and valuable way to improve physical performance and psychological state (Gonzalez-Boto et al., 2008; Saw et al., 2017). Monitoring stress levels among student athletes is also important to prevent mental health issues, as stress that is not well managed is related to depression and anxiety (Davorean & Hwang, 2014). Future studies should further investigate the trend of stress throughout the swimming season and if it relates to deterioration in the student athletes' wellbeing, as a confirmation of this issue could warrant changes in the NCAA swimming season.

Second, sport psychology consultants should work with coaches and student athletes to plan interventions that help manage stress or increase enjoyment in the sport during the peak of stress in the season. For example, Vidic et al. (2017) found that a mindfulness intervention with 13 women's basketball student athletes helped decrease their stress and increase their perception of presence and relaxation. Additionally, reducing pressure to perform for external reasons may also decrease stress. Even though coaches cannot release athletes from the pressure to perform, they can emphasize other aspects of competition and provide opportunities for relatedness (McGee & DeFreese, 2019) and autonomy (Stenlin, 2016) to reduce stress and increase self-determined motivation. Scanlan (1982) made two recommendations to reduce stress in youth sports: (1) emphasize skill development and improvement over winning, (2) set realistic performance goals. Putting an emphasis on skill development and improvement could break down large goals for student athletes. Additionally, it may be helpful to revisit personal goals and remind student athletes of their intrinsic interest in the sport. Collegiate athletes and youth

sports participants may have different levels of competition, but the love of sport should be retained.

Limitations

Contacting student athletes and preventing attrition were two of the largest limitations to this study. We attempted to get participants who would be attending the same midseason meet but were unable to collect a large enough sample size. These findings are limited by program competition schedule, as it is probable that some mid-season meets and championship meets occurred before or after our survey was sent out.

Self-selection bias may potentially be a limitation to this study. It is arguable that only those who have a certain amount of motivation will complete all five surveys compared to those who does not complete the entire study.

Most of our participants were Division I swimmers, which could have played a role in initial T1 motivation. It is possible that there is a motivational difference between student athletes of different divisions, but our study had very small samples from Division II and III. Future research may investigate differences in motivation over time between divisions with a larger sample.

Conclusion

Although we did not find intrinsic motivation to predict stress over the season, extrinsic motivations may predict stress over time. This study also contributes to literature on changes in intrinsic motivation over the season and possible trends of stress. By understanding what stressors a student athlete faces, as well as the season trends of stress and motivation, sport psychology consultants and coaches can apply techniques to prevent burnout and increase motivation when needed.

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