

A multi-theoretical investigation of the relative importance of training volume and coach autonomy support for preventing youth swimming attrition

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ABSTRACT

There are hypothesized associations between high training volume in youth sport and negative psychological and behavioral outcomes such as decreased enjoyment, and increased burnout and dropout. Autonomy support, however, is associated with positive motivational and behavioral outcomes. The purpose of this study was to concurrently explore the relationships of training volume and perceived coach autonomy support with enjoyment, commitment, burnout symptoms, and dropout from swimming. Survey data were collected from 265 swimmers (Mage = 13.78 ± 1.60) representing more than 50 clubs across Canada. Their parents provided training volume data. Several months later, at the start of the next swimming season, a follow-up survey identified which swimmers dropped out. Structural equation modeling did not show a significant relationship between training volume and enjoyment, but there was a significant pathway from autonomy support to enjoyment, which predominantly predicted functional commitment. Obligatory and functional commitment differentially predicted burnout and intentions to continue swimming. Swimmers who dropped out had significantly lower training volume, enjoyment, functional commitment, and intentions to continue swimming, and higher sport devaluation, compared to those who continued swimming in the following season. Perceptions of an enjoyable, autonomy-supportive training context in adolescent swimming seem to have greater associations than training volume with several psychological and behavioral outcomes, including burnout symptoms and dropout. Coaches should support young athletes' autonomy and help them recognize links between their training efforts and personal sport achievements.

Keywords:

Autonomy support – burnout – developmental model of sport participation – dropout – enjoyment – self-determination theory – sport commitment model – training volume

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Introduction

The amount of training required to become successful in sport has been vigorously debated. Much literature pertaining to elite development in sport shows support for significant volumes of structured training or the accrual of increasing “deliberate practice” (Ericsson, Krampe, & Tesch-Römer, 1993) over

time, as being important for skill-based growth in youth sport (Baker & Young, 2014). Recommendations related to competitive youth sport programming based on this perspective suggest that early investment in a predominant sport is a precondition for eventually acquiring elite status, a notion embodied in the early engagement hypothesis (Ford, Ward, Hodges, & Williams, 2009). In contrast, a body of literature associated with

the developmental model of sport participation (DMSP; Côté, Baker, & Abernethy, 2003; Côté & Fraser-Thomas, 2007) posits that elite sport development is not hindered, and may in fact be enhanced, by lower levels of structured sport-specific practice at an earlier age, as long as it is accompanied by unstructured sport play and sampling of various sports. Proponents of this view hold that high training volumes prior to adolescence are associated with greater likelihood of burnout and sport attrition, and that lack of enjoyment associated with deliberate practice and overly-focused sport training is a primary reason for young athletes dropping out of sport (Butcher, Lindner, & Johns, 2002; Crane & Temple, 2015). To date, there is little empirical support for positive associations between training volume and dropout (e.g., Fraser-Thomas, Côté, & Deakin, 2008; Wall & Côté, 2007) or burnout (Gustafsson, Kenttä, Hassmén, & Lundqvist, 2007; Larson, Young, McHugh, & Rodgers, 2019), although some qualitative work has identified heavy training demands as a precursor to burnout (e.g., Creswell & Eklund, 2007). Furthermore, it is unclear whether the proposed negative effects of increased training volumes are independent of other characteristics of the training environment, such as autonomy support. More robust empirical evidence is needed to test these arguments and provide a stronger basis to guide practice in youth sport development.

Autonomy support from coaches has been instrumentally positioned as a key factor for maintaining enjoyment and sport commitment, and attenuating negative consequences, especially when young athletes are experiencing intensive activity in youth sport (Horn, 2015). According to self-determination theory (SDT; Deci & Ryan, 1985), intrinsic motivation is associated with behavioral persistence and psychological well-being, and is fostered by the satisfaction of three psychological needs for autonomy, competence, and relatedness. These needs can be met in an autonomy-supportive context. Autonomy support is demonstrated by authority figures, such as coaches, when they account for the perspectives of the individuals under their supervision and provide them with choice and opportunities for input into decision-making (Gillet, Berjot, Vallerand, & Amoura, 2012). A qualitative study by Larson, McHugh, Young and Rodgers (2018) suggested that an autonomy supportive social environment may be more important than training volume when it comes to burnout and dropout from adolescent swimming. They conducted interviews with masters (adult) swimmers, asking adults to reflect on their adolescent sport experiences and reasons for continued or disrupted patterns. Although some participants identified high training volume as a reason for their departure from youth swimming, this was typically described in conjunction with reduced perceptions of competence in swimming and/or fraught relationships with coaches/teammates. Others reported maintaining long adolescent swimming careers despite high training volumes because of their strong positive relationships within the sport. Thus, the current study sought to examine associations between young swimmers' perceived autonomy support and negative outcomes—specifically, burnout and dropout—in a sample that

was engaging in varying amounts of intensive, sport-specific swim training within the coached practice context.

Sport motivation and its effects on participation is complex. Numerous theories propose factors that are likely to influence positive and negative outcomes of participating in structured sport. For instance, the sport commitment model (SCM; Scanlan, Carpenter, Simons, Schmidt, & Keeler, 1993) has been proposed as another way of understanding aspects of personal motivation, as well as burnout and dropout. Scanlan, Chow, Sousa, Scanlan, and Knifsend (2016) suggested that combining the SCM with other motivational theories, such as SDT, may allow for a deeper understanding of the sport experience. Within the SCM, enjoyment is the most prominent predictor of commitment, having a strong positive relationship with enthusiastic, or functional commitment (FC), and a negative relationship with constrained, or obligatory commitment (OC; Scanlan et al., 2016; Young & Weir, 2015). These two central commitment constructs in contemporary versions of the SCM allow for broader, cross-model discussions of self-determined motivation (e.g., Wilson et al., 2004). It is important to distinguish between these two types of commitment as they are thought to promote different motivational and behavioral outcomes. FC reflects a voluntary, personally-initiated, and self-accepted commitment type that has been positively associated with self-determined motives and participation in physical activity, exercise, and sport (Santi, Bruton, Pietrantonio, & Mellalieu, 2014; Wilson et al., 2004; Zahariadis, Tsoarbatzoudis, & Alexandris, 2006). In contrast, OC reflects a more controlling and less self-accepted form of commitment that has been associated with burnout, an undesirable sport outcome marked by emotional and physical exhaustion, reduced sense of accomplishment, and sport devaluation (Raedeke, 1997).

Schmidt and Stein (1991) hypothesized that sport outcomes could be predicted based on three distinct commitment profiles: 1) attraction-based (functional) commitment, 2) entrapment-based (obligatory) commitment, and 3) low commitment. Athletes displaying OC would theoretically be more prone to burnout, whereas those with FC would likely continue enjoying sport, and athletes exhibiting low commitment might drop out of sport, but not due to burnout. Raedeke (1997) expanded on this investigation into commitment and burnout and found that adolescent swimmers displaying characteristics of OC had higher burnout scores than those in the high FC or "indifferent" categories. Weiss and Weiss (2003) found that different commitment profiles were associated with distinctive motivational profiles in adolescent gymnasts. Gymnasts in an "entrapped" category had significantly lower self-determined motivation and higher amotivation compared to gymnasts in "attracted" and "vulnerable" categories, with the former category showing a profile associated with higher rates of burnout (Li, Wang, & Kee, 2013). When Weiss and Weiss (2006) followed up on their 2003 gymnasts in a longitudinal analysis, they found that gymnasts who had been previously categorized as "entrapped" were more likely to have dropped out a year later. Together, this body of literature related to commitment reinforces

the need to consider enjoyment, FC, and OC, in relation to negative psychological and behavioral sport outcomes. The purpose of this study was to concurrently explore the relationships of training volume and perceived coach autonomy support with enjoyment, commitment, burnout, and dropout from swimming. Larson, McHugh, et al. (2019; also see Fraser-Thomas et al., 2008) advocated for greater scrutiny of intensive sport-specific experiences, specifically among early adolescents in competitive swimming, to better understand their association with key criteria representing psychological and behavioral consequences. Competitive swimming is an ideal context for this inquiry as it affords the examination of tenets centred on structured, intensive, sport-specific training volumes; there are limited indications of sport play, or “deliberate play” (Côté et al., 2003), in the recount of sport activities among early adolescents in age-group swimming (Light, Harvey, & Memmert, 2013). It is unclear whether training volume, per se, is independent of other aspects of the training environment, yet current practice recommendations posit strong cautions regarding negative effects of training volumes (e.g., DiFiori et al., 2014). This study extends the current literature with an empirical approach to this topic, taking multiple and robust theoretical approaches to investigating specific hypotheses. Based on the DMSP, we hypothesized that 1) training volume would be negatively associated with sport enjoyment. Based on SDT, we posited that 2) autonomy support would be positively associated with enjoyment. Based on SCM literature, we hypothesized that 3) enjoyment would be positively associated with FC and negatively associated with OC, 4) FC would be positively associated with intentions to continue swimming, and negatively related to dropout and symptoms of burnout, and 5) OC would be positively associated with symptoms of burnout. To examine the unique variance associated with multiple possible outcomes of sport participation, and consider variables related to training volume and autonomy support in parallel, we used structural equation modelling (SEM) as it affords a more sophisticated simultaneous consideration of numerous factors that might be important. We also included a longitudinal component to our study in the interests of predicting dropout.

Methods

Procedure

The study involved 265 competitive youth swimmers and their parents, together representing more than 50 competitive swim clubs across Canada. Participants were strategically recruited from two different swimming contexts—summer club and year-round club—to obtain sufficient variance in levels of investment and training volumes. Most competitive swimmers in Canada participate in clubs that train al-

most year-round, from September until June or July, and often require high levels of investment and training volume. Four Canadian provinces also offer alternative programming in the form of “summer” clubs, which typically run from May until August, giving their swimmers more opportunities to participate in other sports and activities throughout the rest of the year. Although swimmers in these provinces may switch from summer swimming to year-round swimming (or vice versa) over the course of their swimming careers, they would not participate in both in the same year, as the seasons overlap and the level of competition can be quite different. To be eligible to participate in this study, swimmers had to be between the ages of 12 and 17 at the start of data collection, with the ability to read, write, and understand English well enough to complete a questionnaire independently. All procedures were approved by an institutional research ethics board.

Data for summer clubs were collected in person from mid-July to early August in Alberta, a province with a strong summer swimming program. To obtain a more nationally representative sample, data for year-round clubs were collected and managed online, using REDCap electronic data capture tools (Harris et al., 2009) hosted and supported by the Women and Children’s Health Research Institute at the University of Alberta. The majority of these questionnaires were completed between October and April. Both data collection time frames represent periods of training when swimmers have had some time to settle into the season and establish their relationships with coaches and teammates.

Swimmers self-reported perceptions of autonomy support, enjoyment, commitment, burnout, and intentions to continue swimming. Parents reported on their own child’s sport participation, including the duration of their swim season in months and weekly hours of practice. Several months after each data collection, at the start of the next swimming season (May for summer and September for year-round swimmers), all parents received a brief follow-up survey online asking if their child was still swimming or if they had dropped out.

Participants

Of the 265 youth swimmers ($M_{age} = 13.78 \pm 1.60$), 40% trained and competed with summer clubs. The remaining swimmers trained and competed with year-round clubs. None of the participants in our sample participated in both summer and year-round swimming over the course of our study—it was one or the other. The sample included more girls (60%) than boys (40%). The majority of the sample self-identified as White/Caucasian/European/Canadian (73%). Fourteen percent did not indicate their ethnicity. The remainder of the sample indicated that they were Asian (4%), Indigenous (2%), Hispanic/Latino (1%), or belonged to more than one of these categories (5.5%). At the start of data collection, swimmers’ education level ranged from Grade 6 to Grade 12, with 50% of the sample in Grades 7 and 8. The majority of swimmers (67%) came from families with an annual household income of \$100,000 CAD or

more. Their parents were highly educated; 41% had bachelor's degrees, and 28% had graduate or professional degrees.

Measures

The internal validity and reliability of all multi-item measures were assessed with confirmatory factor analysis (CFA). This is a critical first step in SEM, as it provides the basis for evaluating each construct's measurement properties as well as the overall fit of the measurement model, then the structural model (Little, 2013). Model fit was evaluated with a combination of the χ^2 test, root mean squared error of approximation (RMSEA), Comparative Fit Index (CFI), Tucker Lewis Index (TLI), and standardized root mean squared residual (SRMR). Adequate model fit is achieved when $RMSEA \leq .08$, $CFI \geq .90$, $TLI \geq .90$, and $SRMR \leq .08$ (Little, 2013). Ideally, the chi-square statistic is as small as possible, with a statistically non-significant p -value. However, this statistic is not seen as a critical marker of model fit, because 1) it is a test of exact fit, which is unattainable, and 2) it is greatly influenced by sample size (Little, 2013).

All items were phrased to be specific to swimming, where applicable. For example, if an item contained the phrase "In my sport," this was replaced with "In swimming." Items were also pilot tested with a small group of 11-year-old swimmers. They were given the questionnaire to complete, then were asked to identify any words unfamiliar to them or any items where they were unsure of what was being asked. They were also asked about their understanding of certain words, like "obligated," to ensure that items were being interpreted as intended. No issues were identified with these particular measures.

Yearly training volume. Swimmers' weekly hours of competitive swimming practice and their season duration in months were reported by their parents. To obtain a measure of their total swim training volume for the year, weekly hours were converted into hours per month, then multiplied by the duration of their swim season in months. Parents are often responsible for driving or arranging other transportation to get their children to and from sport practices and other activities; as a result, the protocol by which parents report structured, sport-specific practice amounts for their children has been found reliable in research among adolescent athletes (Wall & Côté, 2007).

Autonomy support. Perceived autonomy support was measured with the short-form Sport Climate Questionnaire (SCQ; Deci, 2001) containing six of the 15 items found on the long form. All items deal with athletes' perceptions of their current coach and are rated on a scale from 1 (strongly disagree) to 7 (strongly agree). An example item is "My coach listens to how I would like to do things." Scores for the six items are averaged, with higher means indicating higher perceptions of autonomy support. Previous studies have supported the validity and reliability of this measure (e.g., Noble, Vermillion, & Foster, 2016) and these items demonstrated excellent internal consistency reliability in the present sample ($\alpha = .90$).

Enjoyment. Sport enjoyment was measured using four items (Scanlan, Carpenter, Simons, Schmidt, & Keeler, 1993), each

rated on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). An example is "I like swimming." Scores on these items were averaged to obtain a single enjoyment score. These items also demonstrated excellent internal consistency reliability ($\alpha = .95$). Although Scanlan and colleagues (2016) updated some measures in the Sport Commitment Questionnaire-2 after our data collection was already underway, their changes to the measurement of enjoyment were minimal.

Commitment. Scanlan et al. did not distinguish between FC and OC in their measures prior to 2016. Therefore, in the present study, FC for competitive swimming was assessed with three items from Wilson et al. (2004), such as "I am dedicated to swimming." The FC items demonstrated excellent internal reliability in the present sample ($\alpha = .89$). OC was measured with the three items used by Wilson et al. (2004) and two additional items that Young, Piamonte, Grove, and Medic (2011) used to improve the internal consistency reliability of this scale. Swimmers rated items on a scale from 1 (strongly disagree) to 5 (strongly agree), with higher scores reflecting stronger FC/OC. The internal consistency of OC items was acceptable ($\alpha = .72$), but the CFA showed poor factor loadings in the measurement model, with only two of the five OC items over .70. Kline (2016) recommends that models explain at least half of the variance in every continuous indicator, thus, we opted for a single item indicator, choosing the item "I feel obligated to continue swimming" as best representing the construct. In such cases, Gogol et al. (2014) contend that the use of a single item can provide an appropriate measure for a unidimensional construct.

Burnout. The Athlete Burnout Questionnaire (ABQ; Raedeke & Smith, 2001) is the most popular measure of burnout in sport, with empirical evidence of reliability and construct validity (Li et al., 2013; Raedeke & Smith, 2001). It measures three dimensions of burnout—emotional/physical exhaustion, reduced sense of accomplishment, and sport devaluation. Gustafsson, DeFreese, and Madigan (2017) have noted that the ABQ is limited by the lack of diagnostic cut-offs for determining the severity of burnout in individual athletes or the prevalence of burnout across athletic populations. However, we were interested in negative trends rather than clinically significant symptoms of burnout; therefore, we considered the ABQ subscales suitable for our purposes, as indicators of negative sport outcomes.

For each subscale, swimmers were presented with five statements about feelings and experiences within the sport of swimming and were asked to indicate how often they felt that way. Rating options were 1 (almost never), 2 (rarely), 3 (sometimes), 4 (frequently), and 5 (almost always). We deleted two items from the reduced accomplishment subscale ("I'm accomplishing many worthwhile things in swimming" and "I am not performing up to my ability in swimming") and one item from the sport devaluation subscale ("I feel less concerned about being successful in swimming than I used to") due to factor loadings $< .70$. Subscales comprising the remaining items had satisfactory internal consistency (all as $> .81$). Mean scores were obtained for each subscale.

Intention. Swimmers completed a single-item measure, rating their intention to swim competitively next season on a scale from 1 (strongly do not intend to) to 7 (strongly intend to). This type of measure has been used successfully in other studies to assess intentions to continue sport participation (e.g., Álvarez, Balaguer, Castillo, & Duda, 2012).

Continued participation. The follow-up questionnaire administered at the beginning of the next swim season asked parents if their child was still swimming with the same club. If their answer was no, they were asked if their child was now swimming with a different club, or, depending on their age, on a high school, university, or adult swim team. Positive answers to any of these questions were coded as continued participation. If the answers were all negative, participants were coded as dropouts and parents were given an opportunity to comment on the reason for their child's discontinued participation.

Data analyses

Data screening and bivariate correlations were performed using IBM SPSS Statistics 25. Next, we conducted two-step SEM using robust maximum likelihood estimation (MLR) in Mplus (Muthén & Muthén, 1998–2011). The first step consisted of confirming the measurement model. Once satisfied with the fit of the measurement model, we proceeded with the second step, structural regression. We specified two hypothesized models. Our first model began with autonomy support and training volume as exogenous variables predicting enjoyment, which were in turn specified to predict FC and OC. This pathway is supported by previous work identifying enjoyment as a mediator between antecedent constructs and commitment (Weiss, Kimmel, & Smith, 2001). The three burnout subscales were included as outcomes of FC and OC and predictors of intentions to continue swimming, with the logic that increased experiences of burnout symptoms precipitate cognition for withdrawing (Isoard-Gautheur, Guillet-Descas, & Gustafsson, 2016). Intention was chosen because previous research supports the use of intention as a predictor of continued sport participation, with low intentions being associated with dropout (Gardner, Magee, & Vella, 2017). We tested a second structural model that maintained the exogenous pathways and the central mediator of enjoyment, but intention was positioned alongside the burnout subscales as an outcome variable. This model recognized Smith's (1986) contention that not all athletes who withdraw from sport do so because of burnout, and not all athletes who

experience symptoms of burnout withdraw from sport. Considering the merits of the longitudinal design, we felt it was important to focus some analyses on our dichotomous outcome variable—swimming status at follow-up. We did so using SPSS, as the small number of dropouts was not conducive to the use of SEM. Multivariate analysis of variance (MANOVA) was used to look for mean differences on training volume and the eight psychological variables, between those who were still swimming and those who had dropped out. Finally, we performed a binary logistic regression to predict swimming status. We selected predictor variables based on their performance in the MANOVA, rather than attempting to analyze all of them, due again to the small number of dropouts in our sample.

Results

Preliminary analyses

Only 3% of the data to be used for SEM were missing, therefore we felt confident that robust maximum likelihood estimation would provide a satisfactory solution (Little, Jorgensen, Lang, & Moore, 2013). The percentage of missing data for the MANOVA was also negligible, at 4%, but as an extra precaution we conducted a Little's missing-completely-at-random (MCAR) test. The results did not indicate systematic bias in missing values, $\chi^2(35) = 47.149$, $DF = 35$, $p = .08$, therefore, list-wise deletion was deemed acceptable for the MANOVA.

Descriptive statistics and correlations

Descriptive statistics on age and training volume are displayed in Table 1 according to summer, year-round and total sample. The total sample showed sufficient variability to ensure that restricted ranges would not constrain any possible associations. Descriptive statistics and bivariate correlations for all continuous variables are displayed in Table 2. Correlations were mostly in the expected directions. However, training volume was only significantly related to three variables, showing small positive relationships with exhaustion, FC, and intentions to continue swimming. Notably, training volume did not have a sizable or significant direct association with reduced accomplishment or devaluation. Autonomy support was positively related to enjoyment, FC, and intentions to continue swimming, and negatively related to OC and all three burnout subscales.

Table 1. Descriptive statistics by swimming context.

Item description	Summer (<i>n</i> = 105)		Year-round (<i>n</i> = 160)		Total Sample (<i>n</i> = 265)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age	13.85	1.61	13.74	1.60	13.78	1.60
Season duration (months per year)	4.32	1.53	10.09	1.06	7.73	3.11
Training volume (hours per week)	7.49	3.00	11.96	4.69	10.13	4.64
Total training volume (hours per year)	142.01	99.05	525.34	231.03	370.06	267.39

Table 2. Descriptive statistics and partial correlations, controlling for age (total sample).

	TV	AS	ENJ	FC	OC	EXH	RA	DEV	INT
TV									
AS	-.01								
ENJ	.05	.29*							
FC	.23*	.30*	.69*						
OC	-.08	-.17*	-.10	.01					
EXH	.24*	-.26*	-.37*	-.29*	.22*				
RA	-.04	-.43*	-.43*	-.41*	.23*	.41*			
DEV	-.05	-.36*	-.73*	-.69*	.19*	.49*	.59*		
INT	.29*	.28*	.55*	.75*	.01	-.24*	-.40*	-.63*	
<i>M</i>	374.67	5.25	4.46	4.23	2.91	2.66	2.08	1.86	5.83
<i>SD</i>	265.66	1.28	0.80	0.91	1.49	0.93	0.91	0.95	1.66

Note. * $p < .01$. All correlations representing **medium to large effect sizes are bolded**. TV = current swim training volume in hours per year; AS = autonomy support; ENJ = enjoyment; FC = functional commitment, OC = obligatory commitment; EXH = exhaustion; RA = reduced accomplishment; DEV = devaluation; INT = intention to continue swimming. The burnout, enjoyment, and commitment subscales were measured on a scale from 1 to 5; all other psychological constructs used a scale from 1 to 7.

Structural equation models

We tested two models, both of which began with autonomy support and training volume as exogenous variables. These were hypothesized to predict enjoyment, which would then predict FC and OC. The first model had FC and OC as predictors of burnout, which then predicted intentions to continue swimming. The second model predicted direct relationships between FC, OC, and intention. Age was included as a covariate in both models. The first model fell short of criteria for good fit, $S-B \chi^2(358) = 804.85, p < .001, CFI = .90, TLI = .88, SRMR = .09, RMSEA = .07$ (90% CI = 0.07–0.08). The second model had better fit, $S-B \chi^2(355) = 734.70, p < .001, CFI = .91, TLI = .90, SRMR = .09, RMSEA = .07$ (90% CI = 0.06–0.07), and is shown in Figure 1, with standardized estimates for indicator variables on their latent factors included in Table 3. The relationships between variables were mostly as expected. Training volume was not significantly related to enjoyment. As hypothesized, autonomy support was positively associated with enjoyment, which had a very strong positive association with FC, and a small negative association with OC (not significant). FC was inversely associated with each of the three burnout scales and was positively associated with intentions to continue swimming, as hypothesized. OC was positively associated with each of the burnout scales, as expected, but was not significantly related to intentions.

Relationships with swimming status at follow-up (continued participation or dropout)

At follow-up, 208 participants were still swimming, and 34 had dropped out. Follow-up data for 23 participants were miss-

ing. For the MANOVA at follow-up, the assumption of equality across within-group covariance matrices was not met (Box's $M = 123.00, p < .001$), so Pillai's Trace, which is more robust to violations of this assumption, was used instead of Wilks' Λ . The multivariate test was significant, indicating a large difference between the continuers and dropouts, $F(9, 205) = 7.85, p < .001$; Pillai's Trace = 0.26, partial $\eta^2 = .26$, observed power = 1.00. Levene's Test was also significant for five variables, so a strict alpha level ($\alpha = .001$) was adopted for examination of the univariate ANOVAs. As expected, those who were still swimming at follow-up had previously reported significantly higher levels of enjoyment, FC, and intentions to continue swimming, and lower levels of sport devaluation in their prior season, compared to those who dropped out. Continuers also had significantly higher levels of training volume than dropouts. However, continuers and drop-outs did not report significant differences in autonomy support in the prior season. The results of these univariate ANOVAs are displayed in Table 4.

Variables that achieved significance in the univariate ANOVAs were put into a simultaneous binary logistic regression to see if they could predict swimming status at follow-up (continued participation versus dropout). Autonomy support was also included due to its status as a contextual variable, despite not achieving significance at $\alpha = .001$. Preliminary tests of necessary assumptions were met. The overall model was significant, $\chi^2(6, N = 216), p < .001$, Nagelkerke $R^2 = .36$. Intention was the only significant predictor. Swimmers who had reported higher intentions to continue months earlier had far greater odds of being in the continuer group (see Table 5).

An open-ended question for parents of dropouts provided further insights into their reasons for discontinued participation. Of the 34 parents who reported that their child dropped out

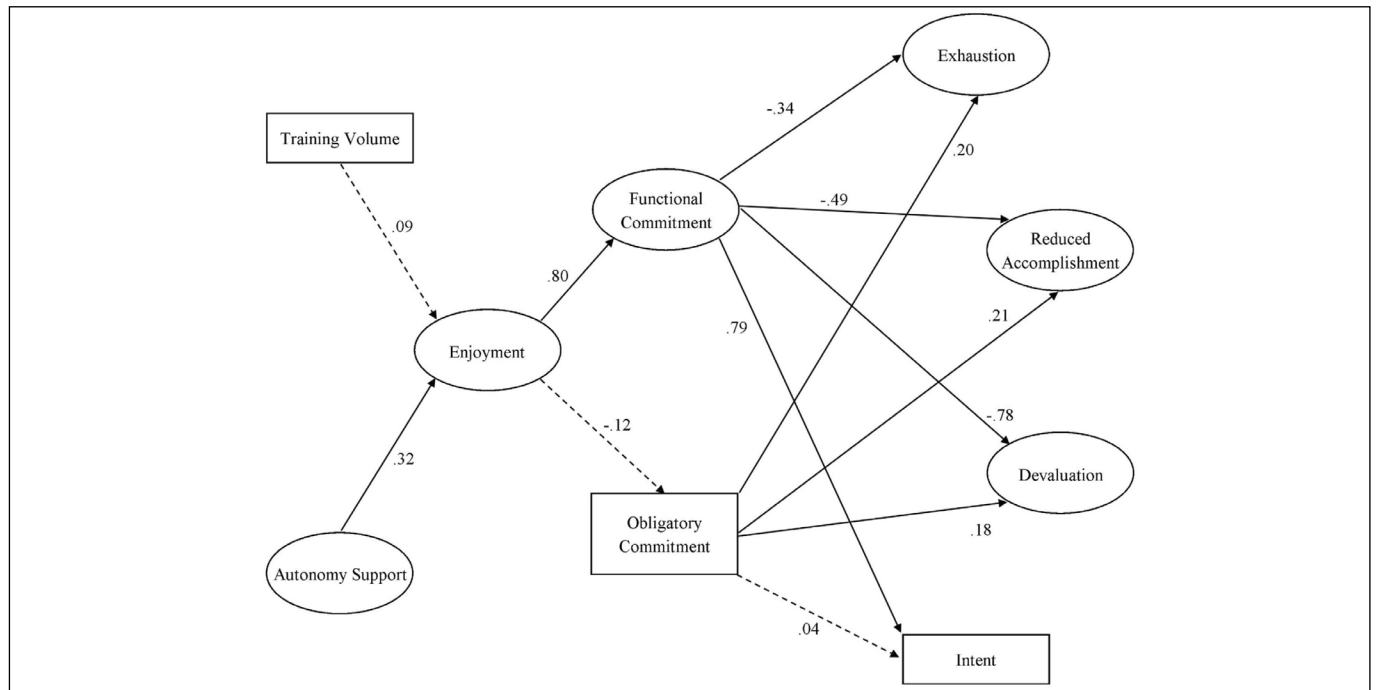


Figure 1. Structural equation model predicting three burnout subscales and intentions to continue swimming. Controlled for age. All coefficients standardized. Solid lines represent pathways significant at $p < .01$.

Table 3. Factor loadings

Variable	Indicator	Estimate	SE	Est./SE	p
AS	I feel that my coach provides me with choices and options.	0.79	0.04	21.22	.000
AS	I feel understood by my coach.	0.80	0.04	21.62	.000
AS	My coach conveys confidence in my ability to do well in swimming.	0.73	0.04	18.12	.000
AS	My coach encourages me to ask questions.	0.75	0.04	19.80	.000
AS	My coach listens to how I would like to do things.	0.83	0.03	25.28	.000
AS	My coach tries to understand how I see things before suggesting a new way to do things.	0.82	0.03	28.08	.000
ENJ	I enjoy swimming.	0.94	0.02	51.84	.000
ENJ	I am happy swimming.	0.92	0.02	49.64	.000
ENJ	I have fun swimming.	0.87	0.03	29.88	.000
ENJ	I like swimming.	0.92	0.03	34.82	.000
FC	I am dedicated to swimming.	0.86	0.04	23.01	.000
FC	I am determined to continue swimming.	0.83	0.04	18.91	.000
FC	I am committed to swimming.	0.83	0.05	17.57	.000
EXH	I feel so tired from my training that I have trouble finding energy to do other things.	0.78	0.03	24.73	.000
EXH	I feel overly tired from my swimming participation.	0.88	0.02	43.77	.000
EXH	I feel “wiped out” from swimming.	0.84	0.03	33.11	.000
EXH	I am exhausted by the mental and physical demands of swimming.	0.80	0.03	25.16	.000
EXH	I feel physically worn out from swimming.	0.87	0.02	38.39	.000
RA	I’m not achieving much in swimming.	0.85	0.04	24.00	.000

Variable	Indicator	Estimate	SE	Est./SE	<i>p</i>
RA	I feel successful at swimming. (Reverse scored)	0.73	0.05	16.03	.000
RA	It seems that no matter what I do, I don't swim as well as I should.	0.84	0.04	23.69	.000
DEV	I don't care as much about my swimming performance as I used to.	0.82	0.04	19.42	.000
DEV	I have negative feelings toward swimming.	0.80	0.04	22.93	.000
DEV	I'm not into swimming like I used to be.	0.83	0.04	20.93	.000
DEV	The effort I spend in swimming would be better spent doing other things.	0.81	0.03	25.23	.000

Table 4. Mean differences by swimming status at follow-up.

Item description	Still swimming (<i>n</i> = 187)		Not swimming (<i>n</i> = 28)		<i>F</i>	<i>p</i>	Partial η^2
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Training volume (hours per year)	401.80	277.13	244.36	186.01	8.45	.004	0.04
Autonomy support	5.29	1.28	4.99	1.58	1.25	.264	0.01
Enjoyment	4.53	0.70	4.04	1.14	9.69	.002	0.04
FC	4.35	0.81	3.36	1.09	32.96	.000	0.13
OC	2.84	1.49	3.07	1.49	0.59	.443	0.00
Emotional/physical exhaustion	2.60	0.91	2.90	1.03	2.51	.115	0.01
Reduced sense of accomplishment	2.02	0.91	2.38	1.03	3.73	.055	0.02
Sport devaluation	1.77	0.85	2.54	1.32	17.12	.000	0.07
Intention to continue swimming	6.13	1.31	3.79	2.25	62.48	.000	0.23

Table 5. Simultaneous binary logistic regression to predict continued participation versus dropout (*N* = 221).

	<i>B</i>	S.E.	Wald	<i>p</i>	Exp (<i>B</i>)
Training hours per year	0.002	0.001	2.598	0.107	1.002
Autonomy support	-0.198	0.201	0.975	0.323	0.820
Enjoyment	-0.605	0.429	1.993	0.158	0.546
FC	0.511	0.409	1.564	0.211	1.667
Sport devaluation	-0.116	0.409	0.080	0.778	0.891
Intention to continue swimming	0.622	0.175	12.649	<0.001	1.862
Constant	0.028	2.766	0.000	0.992	1.029

of swimming, 25 took the opportunity to comment further. Collapsed across these responses, seven referenced a lack of enjoyment (especially when competing) or loss of interest. Six mentioned a lack of time or difficulties with scheduling. Five said their child had switched to a new sport or decided to specialize in a sport other than swimming. Three mentioned physical or mental health issues, including injuries and depression. One each referenced the need to focus on studies and the financial cost of swimming. Six did not give an explicit reason for

dropping out, but of these, two mentioned that their child was participating in a different sport, and four said that their child was participating in or working towards lifeguarding, swim instructing, or coaching.

Summer and year-round correlations

Participants were recruited from both summer and year-round clubs in order to sample a wider range of training volumes.

While this resulted in wide variability, our inspection showed bimodal trends in the distribution of training volume. As a result, we decided to run the correlations again separately for each group to inspect whether the subsamples could be causing a spurious relationship. We did not use SEM due to the limited number of summer swimmers. Although there were slight differences between summer and year-round swimmers in the strength and direction of some correlations, neither group demonstrated a positive relationship between training volume and burnout variables, or a negative relationship between training volume and intentions to continue swimming (see Table 6).

Discussion

The purpose of this study was to concurrently explore the relationships of training volume and perceived coach autonomy support with enjoyment, commitment, burnout, and dropout

from swimming. Notably, we did not see the negative relationship between sport-specific training volume and enjoyment hypothesized in the DMSP. However, our hypotheses regarding the associations between autonomy support, enjoyment, commitment, burnout, and intentions to continue swimming were largely supported. The longitudinal component to our study revealed differences on several variables between those who continued swimming and those who dropped out.

The lack of a relationship between yearly training volume and enjoyment demands scrutiny from conceptual, motivational, and measurement perspectives. Conceptually, the current results should give readers pause as to whether the DMSP postulate (i.e., accruing intensive, structured, sport-specific practice in early adolescence results in negative psycho-social sport outcomes) is over-simplified. The null finding in this study is important and suggests greater complexity in the relationship of training volume to other aspects of sport participation.

Motivationally, the non-significant association with training volume may mean that intensive, structured swimming prac-

Table 6. Descriptive statistics and partial correlations by swimming context, controlling for age.

		TV	AS	ENJ	FC	OC	EXH	RA	DEV	INT
Summer (<i>n</i> = 105)	TV									
	AS	.04								
	ENJ	.01	.23*							
	FC	.09	.24*	.77**						
	OC	.01	.04	.12	.25*					
	EXH	.15	-.04	-.44*	-.39**	-.07				
	RA	.14	-.32**	-.44*	-.41**	-.05	.28**			
	DEV	.05	-.25**	-.73*	-.69**	.00	.48**	.58**		
	INT	-.01	.27**	.64*	.72**	.15	-.29**	-.39**	-.67**	
	<i>M</i>	142.01	5.30	4.39	4.10	3.02	2.46	2.08	1.90	5.45
<i>SD</i>	99.05	1.22	0.93	0.98	1.49	0.80	0.86	0.96	1.81	
Year-round (<i>n</i> = 160)	TV									
	AS	.08								
	ENJ	.07	.33**							
	FC	.29**	.35**	.62**						
	OC	-.09	-.27**	-.26**	-.14					
	EXH	.15	-.35**	-.37**	-.27**	.39**				
	RA	-.15	-.48*	-.42**	-.42**	.40*	.47**			
	DEV	-.11	-.42*	-.72**	-.71**	.30*	.52**	.59**		
	INT	.33**	.28*	.50**	.78**	-.08	-.30**	-.43**	-.63**	
	<i>M</i>	525.74	5.22	4.51	4.30	2.83	2.79	2.09	1.83	6.07
<i>SD</i>	228.03	1.32	0.70	0.86	1.49	0.99	0.94	0.95	1.52	

Note. **p* < .05, ***p* < .01. All correlations representing medium to large effect sizes are bolded. TV = current swim training volume in hours per year; AS = autonomy support; ENJ = enjoyment; FC = functional commitment, OC = obligatory commitment; EXH = exhaustion; RA = reduced accomplishment; DEV = devaluation; INT = intention to continue swimming. The burnout, enjoyment, and commitment subscales were measured on a scale from 1 to 5; all other psychological constructs used a scale from 1 to 7.

tice does not necessarily decrease enjoyment. In support of this, a review article by Baker and Young (2014) documented evidence that some elite athletes report deliberate practice to be at least somewhat enjoyable. Young and Salmela (2002) found this to be the case in their study of distance runners, and offered an explanation grounded in SDT. They suggested that the intensive, effortful practice may be perceived as enjoyable because competitive athletes are conditioned to recognize improvements that are a consequence of their training efforts; thus, they link outcomes of intensive practice to themselves in favorable, motivating, competency-enhancing ways. Interpreted through an SDT lens, if young athletes realize gains and see them as a consequence of their structured practice efforts, and hold these gains as valued and aligned with their ego structures, then they may internalize tough training as enjoyable (or in the current study, at least not discouraging enjoyment). Should young athletes internalize structured training in this fashion, this might explain the absence of the negative relationship between training volume and enjoyment. Indeed, the sense of accomplishment following a difficult training set has been identified as a source of enjoyment by adolescent swimmers (Larson, Young, & Reade, 2018). Additionally, reports of enjoyment may depend on motivational conditions within the training context. For example, adults who previously competed as youth swimmers recalled perceiving high-volume training as somewhat enjoyable when accompanied by a sense of relatedness emanating from close relationships with coaches and teammates (Larson, McHugh, et al., 2019). Likewise, Horn (2015) suggested that when autonomy support is considered in parallel with higher intensive training volumes, as in the current study, the impact of training volumes cannot necessarily be assumed to result in negative psycho-emotional outcomes at a young age.

In terms of measurement, the distinction between structured, sport-specific training volumes and volumes of deliberate practice may be important. It may be that the training volume assessed via parents in our study did not capture the true nature of deliberate practice. Parents' reports of their children's volumes of structured sport activity has proven reliable, especially because parents typically shuttle their children to and from swimming, and these activities are tied to a routine, allowing for better recall (Deakin, Côté, & Harvey, 2006). However, there is a difference between recalling amounts of structured sport practice and deliberate practice, a methodological challenge that has been identified by sport expertise researchers (see Tedesqui, McCardle, Bartulovic & Young, 2019). Parents may be reliably recalling overall sport-specific practice, parts of which may be demanding and non-enjoyable (two defining criteria of deliberate practice; see Ericsson et al., 1993), but they might be confounding this recall to include activity that is not deliberate practice. Deliberate practice is a select subset of activities (Baker & Young, 2014), yet an average youth swim practice contains a wide variety of activities, only some of which are likely to meet the accepted definition of deliberate practice. As there remain challenges in assessing deliberate practice, read-

ers should take caution in extending our conclusions beyond "volumes of structured sport training." The early formulations of the DMSP, and its postulates, were based on directives associated with deliberate practice and deliberate play (Côté et al., 2003). Although dialogue around the DMSP has more recently used terms related to sport-specific practice (e.g., DiFiori et al., 2018), it may be important to consider the terminology, and what exactly is being assessed, in determining continued support for its postulates. Moreover, swim training prescriptions often center upon "training zones" as an indicator of intensity, which were not accounted for in the current methods (Olbrecht, 2015). Our results, which are predicated on structured, sport-specific practice volumes (rather than deliberate practice per se, or a nuanced account of training zones) do not support a negative association with sport enjoyment.

Autonomy support was positively related to enjoyment, as hypothesized. Although we did not include psychological need satisfaction or self-determined motivation as variables in our model, previous research suggests that these would both be mediators in the relationship between autonomy support and enjoyment. Álvarez and colleagues (2009) found that the relationship between autonomy support and self-determined motivation was fully mediated by psychological need satisfaction, and self-determined motivation partially mediated the relationship between psychological need satisfaction and enjoyment. To date, only a few studies have combined aspects of SDT with commitment, and these have largely focused on the relationships between these behavioral regulations and FC. Zahariadis and colleagues (2006) conducted a path analysis that showed positive direct and indirect (through enjoyment) effects of intrinsic motivation on FC. Krinanthi, Konstantinos, and Andreas (2010) also found a positive relationship between intrinsic motivation and FC, and a negative relationship between amotivation and FC. The current study is unique in that the structural pathways demonstrate that the influence of autonomy support on enjoyment may act only to influence FC, but not OC, in a bi-dimensional model of SCM. Although there is substantial support for the bi-dimensional SCM (e.g., Scanlan et al., 2016), quantitative work such as the current study is needed to better elucidate antecedent pathways to the different types of commitment.

The relationships identified in the present study between enjoyment, commitment, aspects of burnout, and intentions to continue swimming were mostly as expected. Enjoyment was positively associated with FC, as predicted by the SCM (Scanlan et al., 2016). FC was positively related to intentions to continue swimming, and negatively related to all three burnout dimensions. The strength of the inverse relationship between FC and sport devaluation is especially noteworthy, suggesting that they could almost represent opposite ends of a spectrum. This makes sense, considering that if one no longer feels that participation in sport is worthwhile, it is unlikely that they would voluntarily "desire and resolve to persist in a sport over time" (Scanlan et al., 2016, p. 235). With respect to the hypothesis of a significant negative association between enjoyment and

OC, our results only revealed trends in this direction; thus, the hypothesis was not supported. This is not completely surprising, as some prior studies involving OC have also revealed non-significant rather than significant inverse associations, (e.g., Wigglesworth, Young, Medic, & Grove, 2012). Finally, in contrast to FC, OC had small significant positive associations with all three burnout dimensions, in line with the findings by Raedeke (1997) and Weiss and Weiss (2003), and offering further validation of the bi-dimensional SCM.

A strength of this study was the longitudinal follow-up to see who was still swimming and who had dropped out. There are a limited number of studies using the SCM framework that have examined the relationship between commitment and behavioral outcomes, and these have tended to examine frequency of participation or effort and intensity of training (e.g., Casper, Gray, & Stellino, 2007; Santi et al., 2014; Weiss, Weiss, & Amorose, 2010). To our knowledge, this is the first study that has examined the relationships between FC, OC, intentions to continue, and actual continued participation. The biggest difference between continuers and dropouts was on intentions to continue, which was positively associated with FC in our SEM analysis. Medium MANOVA effect sizes were present for FC (higher in continuers) and sport devaluation (higher in dropouts), with small effect sizes for training volume and enjoyment (both higher in continuers). The higher training volume seen in the continuers is in contrast to research that found no significant differences between dropouts and engaged athletes by training volume (e.g., Fraser-Thomas et al., 2008; Wall & Côté, 2007). It may be that continuers' higher training volume is a result of enjoyment and high FC. That is, swimmers choose to continue moving up in training groups, with commensurate increases to their training volume, because of their enjoyment and their voluntary desire and resolve to continue participation. Alternatively, swimmers' competence, which was not assessed in the present study, may be a confounding variable that simultaneously increases enjoyment and FC, and prompts coaches to promote swimmers to higher training groups. Future investigations should use longitudinal approaches to untangle the temporal relationships between personal investments, commitment types, and key outcomes. The difference between continuers and dropouts on autonomy support did not manifest as statistically significant, which was unexpected. Obviously, numerous factors can influence dropout and further work is needed on this specific issue.

Limitations

Although the sample size for the current study is suitable for many analyses, a larger sample size that included more dropouts would have afforded the use of more complex SEM techniques (e.g., adding continuance versus dropout as a dichotomous outcome predicted by burnout and intentions, and/or testing measurement invariance by gender, age, and swimming context). Self-report also allows for social desirability bias. Although parents were asked to give the swimmers privacy while completing their online questionnaires, it is possible

that their presence still affected some swimmers' answers. Care was taken to ensure the wording of questionnaire items was age-appropriate, but there may have still been some participants whose responses were impacted by their level of reading comprehension. Future investigations of bi-dimensional sport commitment would likely benefit from use of the new items developed by Scanlan et al. (2016). One final limitation is that we did not explicitly assess sport sampling, which in the DMSP, is associated with positive sport outcomes. Concurrent yearly investment in other sports and in playful activities in swimming may have buffered participants against potentially negative influences of yearly training volume.

Conclusion

Training volume is an important component of sport participation, regardless of one's competitive aspirations. To progress as an athlete, it takes conditioning and intensive, sport-specific practice of skills. Coaches may wonder about the relative importance of monitoring training volume and providing autonomy support when it comes to preventing negative psychological outcomes and promoting continued participation as well as supporting sport progression. Although there are good reasons to monitor training volume (e.g., injury prevention; Jayanthi, LaBella, Fischer, Pasulka, & Dugas, 2015), our findings suggest that the context in which training takes place has a far greater influence on psychological and behavioral outcomes such as burnout and dropout. Coaches should support athletes' autonomy by providing their athletes with an appropriate level of involvement in decisions during practice, explaining the rationale behind decisions, giving athletes opportunities to take initiative and work independently, listening to their athletes, and trying to understand athletes' perspectives on issues (Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2009). They should also facilitate discussions to help young athletes recognize links between their investiture in training and notable/personally meaningful sport achievements (Horn, 2015), as the internalization of motivation for training can facilitate enjoyment and FC. Coaches may also help swimmers recognize those elements that serve to enhance FC, which Larson et al., (2018) noted as social support, team tradition, valuable opportunities in swimming, and a desire to excel.

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Data Availability Statement

The datasets for this manuscript are not publicly available because they are still in use. Requests to access the datasets should be directed to the corresponding author.

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