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Exploration of Drive for Leanness in Relation to Drives for Thinness and Muscularity, as well as their Concurrent Associations with Health-Related Outcomes

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Exploration of Drive for Leanness in Relation to Drives for Thinness and Muscularity, as well as their Concurrent Associations with Health-Related Outcomes

by

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ABSTRACT

Drive for leanness, the motivation to build lean muscle, as well as obtain low enough body fat content for this muscle to be seen, is a nascent drive construct compared to the more established drives for thinness and muscularity. What little research has been done on drive for leanness has suggested that drive for leanness is more sex neutral, as well as potentially more adaptive, than the other drive variables. However, there is debate regarding the factor structure of drive for leanness, or more specifically, whether drive for leanness is its own unique construct or if it is better described as an amalgamation of drives for thinness and muscularity. This study aimed to extend the drive for leanness literature in four ways: 1) create a modified Drive for Leanness Scale more semantically similar to the other drive measures; 2) determine if drive for leanness is best described as a unique construct; 3) discern if drive for leanness is best described as an amalgamation of drives for thinness and muscularity; and 4) explore associations between drive for leanness and broad disordered eating- and health-related outcomes. The Modified Drive for Leanness Scale (M-DLS) evidenced good preliminary psychometric properties. Analyses of the factor structure of drive for leanness did not support the uniqueness nor the amalgamated hypothesis. Rather, drive for muscularity overlapped onto drive for leanness, while drive for thinness remained distinct. Finally, the overlapping drive for leanness/muscularity latent variable predicted more negative health-related outcomes than observed drive for leanness has in the past. This study adds to the literature by broadening what is known about the factor structure of drive for leanness in relation to the other drives, providing a base for future drive for leanness model building and outcome associative work.

INTRODUCTION

Body ideals in Western culture have traditionally been defined as thin for females and muscular for males. However, with the emergence of the “fit is the new thin” movement, body ideals are converging across sexes to one that is lean in nature, or simultaneously muscular and slim (Smolak & Murnen, 2008; Webb et al., 2017). When a difference is identified between the body one has and that individual’s ideal body, motivation to engage in behaviors aimed at achieving that ideal can develop. These motivations have been named drive for thinness, drive for muscularity, and drive for leanness (Garner et al., 1983; McCreary & Sasse, 2000; Smolak & Murnen, 2008). While drives for thinness and muscularity have been heavily researched as predictors of health-related variables (i.e., Hartmann et al., 2018; Tod & Edwards, 2015), drive for leanness, due to its more nascent nature, has not (Hartmann et al., 2018; Lang & Rancourt, 2019; Tod et al., 2013). In fact, there is still debate over the structure of drive for leanness and whether it is best described as a construct unique from drives for thinness and muscularity or rather an amalgamation of these other drives. With these two hypotheses on the table, this study was designed to add evidence to this body of literature by investigating drive for leanness in relation to drives for thinness and muscularity. Further, the practical use of how different relationships between these drives predict outcomes was explored.

Brief History of Body Ideals

Extant research in body image formation supports that body ideals traditionally have been sex-specific, with females more frequently endorsing wanting to achieve a thin ideal, and males more frequently endorsing wanting to achieve a muscular ideal (Gray & Ginsberg, 2007).

Theories of body image formation hypothesize that body ideals are defined at least in part by society, which subsequently propagates them to the public (Thompson et al., 1999). For example, magazines for females have typically glorified obtaining and maintaining slimness, while magazines targeting males have focused more on building and maintaining muscle (Pritchard & Cramblitt, 2014).

Recently, society has shifted away from these sex-specific ideals to an ideal that is more unisex and lean in nature (Gruber, 2007; Hargreaves & Tiggemann, 2004; Markula, 1995). The increased emphasis on living a healthy lifestyle and being fit has led to this new lean body ideal that incorporates lean muscle with a low enough body fat content for this muscle to be seen (Smolak & Murnen, 2008). In theory, this new ideal should be attainable by both females and males, as it does not require either extreme thinness or extreme muscularity. Indeed, most studies looking at leanness have found sex invariance in endorsement of wanting to pursue the lean ideal (Lang & Rancourt, 2019; Tod et al., 2012).

While leanness has potential to be achieved by both sexes, all of these ideals – thinness, muscularity, and leanness – are culturally promoted at extremes that are difficult to obtain. Individuals' realization that their actual body does not meet the cultural ideal body can result in discomfort and motivation to decrease this actual-ideal gap. Self-discrepancy theory explains how discrepancies between representations of the self are related to different emotional outcomes (Higgins, 1987). Most relevant to body image literature are the actual/own representation – i.e., attributes individuals believe they possess -- and the ideal/own representation – i.e., attributes individuals would like to possess. In exploring these two representations, the actual/own state is believed to contribute to self-concept, while the ideal/own state is deemed to be a self-guide for what one is striving to achieve. Self-discrepancy theory postulates that when an individuals' self-concept does not match their self-guide (such as identified differences between the actual/own and ideal/own), discomfort exists. Different types of self-discrepancies are related to differences in the kind of discomfort experienced. Discrepancies between actual/own and ideal/own states are associated with dejection-related emotions (e.g., disappointment, dissatisfaction, frustration). These emotions in turn motivate individuals to participate in behaviors aimed at reaching a condition where one's actual/own state matches one's ideal/own state.

Relating this information back to body image work, discomfort can occur when individuals identify a discrepancy between their actual body (actual/own) and what they consider their ideal body (ideal/own), resulting in body dissatisfaction, a dejection-related emotion. This dissatisfaction can prompt the motivation to dispel this discomfort by engaging in behaviors aimed at reaching a state where an individuals' self-concept matches their self-guide – i.e., where the actual body matches the ideal body. Depending on which body type is idealized, extreme body change behaviors targeting weight loss, fat loss, or muscle gain may emerge. It is no surprise that these strategies often are maladaptive (i.e., restrictive eating behaviors, excessive exercise, illegal performance/appearance enhancing supplement use, etc.; i.e., Gulker, 2001; Lang & Rancourt, 2019; Parent & Moradi, 2011). In the body image literature, motivations to achieve body ideals by undertaking (frequently maladaptive) body change behaviors are called drives. Specific to recent body ideals, these are the previously aforementioned drive for thinness, drive for muscularity, and drive for leanness (Garner et al., 1983; McCreary & Sasse, 2000; Smolak & Murnen, 2008).

Drives for Thinness, Muscularity, and Leanness

Drive for thinness was originally proposed by Garner and colleagues (1983) and is defined as an excessive concern with dieting, preoccupation with weight, and desire to become thinner. This drive is most frequently researched in females, pursuant to the idea that the thin ideal is more relevant to and endorsed by females than males (Gray & Ginsberg, 2007). In line with self-discrepancy theory, when one identifies a discrepancy between one's actual body and a thin ideal body, discomfort can occur in the form of body dissatisfaction which may prompt a motivation to shrink this gap in the form of drive for thinness (Cahill & Mussap, 2007). Drive for thinness is associated with behaviors aimed at achieving the thin ideal, most frequently including compulsive exercise, dieting, disordered eating symptomology, and appearance controlling supplement use (i.e., laxatives, diuretics, etc.; Lang & Rancourt, 2019). Drive for thinness is further associated with other negative outcomes, including anxiety and depression (Lang & Rancourt, 2019), which, as described in self-discrepancy theory, also can result from the identification of an actual-ideal discrepancy (Cahill & Mussap, 2007).

Drive for muscularity was proposed in 2000 by McCreary and Sasse as the male alternative to drive for thinness. It is defined as an attitude that one is insufficiently muscular, along with the desire to develop a more muscular physique. Males endorse this drive more frequently than females (Gray & Ginsberg, 2007). Like drive for thinness, drive for muscularity is associated with behaviors aimed at achievement of a specific body ideal. These behaviors differ from those aimed at thin ideal achievement as they are geared purely towards gaining muscle and/or gaining bulk. Most frequently these behaviors include weight training, binge eating, muscle gaining/performance enhancing supplement consumption (i.e., protein products, creatine, steroids, etc.), and excessive exercise (Lang & Rancourt, 2019; Tod & Edwards, 2015). Similar to drive for thinness, experiencing an actual-ideal body discrepancy and subsequent body dissatisfaction related to the muscular ideal are associated with the behavioral motivation of drive for muscularity.

More recently, it is believed that the emphasis on holistic fitness has prompted a drive for leanness. Drive for leanness is a motivating interest in having relatively low body fat and toned, physically fit muscles (Smolak & Murnen, 2008). This drive was proposed to reflect an interest in a body that is deemed healthy due to functionality, as opposed to putting the main emphasis on aesthetics. However, self-discrepancy theory is still applicable to drive for leanness in that drive for leanness is associated with body shape concern, even though it is not predicted by body shape concern over time (Lang, 2018). Further, drive for leanness is unique from drives for thinness and muscularity in that although it is still associated with body change behaviors, these behaviors are undertaken with the intent to balance both body fat loss and lean muscle gain. This focus on balancing low body fat and lean muscle may reflect a less maladaptive drive. Drive for leanness is associated with behaviors such as positive exercise motivations, supplement use (including both fat loss- and weight gain-related substances), weight training, dieting, and disordered eating symptoms, as well as improvements in psychological states, such as decreases in anxious symptoms (Hartmann et al., 2018; Lang & Rancourt, 2019; Tod et al., 2013).

Interestingly, there is debate in the field regarding how drive for leanness is related to drives for thinness and muscularity. Most evidence points to drive for leanness being a unique construct, while sharing some variance with the other drives. This is how the drives are currently operationalized and assessed, with three separate drive measures that share some variance. However, a second argument is that drive for leanness is better described as the amalgamation of drives for thinness and muscularity. This is not difficult to fathom, as it makes sense that an ideal addressing both low body fat and lean muscle encompasses the desires to be both thin and muscular. If it is true that drive for leanness is best described as an amalgamation of the other drives, then measuring the drives using the current approach may be inaccurate and might bias prediction of behavioral outcomes.

While most extant evidence points to drive for leanness holding its own as a construct (Hartmann et al., 2018; Lang & Rancourt, 2019; Smolak & Murnen, 2008; Tod et al., 2012), there is a general dearth of research on drive for leanness, with only a small margin of this work addressing its relationships with the other drives. Therefore, this project aimed to investigate the two aforementioned competing structural hypotheses; drive for leanness is best described as unique from drives for thinness and muscularity or drive for leanness is best described as an amalgamation of these other drive variables.

Evidence for the Uniqueness of Drive for Leanness

At this time, there is only one scale measuring drive for leanness. The Drive for Leanness Scale (DLS) was developed by Smolak and Murnen in 2008. Potential items – 18 in total – were created by the authors and one other colleague known to be an expert in body image and eating disorders. Items were administered to a primarily White, mixed sex (54% female), college-aged sample. The result of scale development efforts, as determined by examining internal consistency via item-total correlations and Cronbach's alpha ($\alpha = .71$), was a final scale consisting of 10 items said to measure attitudes related to the lean ideal. Scale stability was also assessed, finding adequate test-retest reliability in a small sample across two weeks ($n = 18$, $r = .69$, $p = .002$). Smolak and Murnen originally operationalized drive for leanness as distinct from drives for thinness and muscularity.

Most research since the inception of the DLS has supported the idea that drive for leanness is unique. First, while drive for thinness is endorsed mainly by females and drive for muscularity is endorsed at higher levels by males (Gray & Ginsberg, 2007), females and males report comparable levels of drive for leanness. In the original publication, using a sample of 232 college students (59% female), a univariate *F*-test revealed no difference between sexes in mean levels of drive for leanness ($F = .36$, $p = .86$; Smolak & Murnen, 2008). In another study of 651 undergraduate students (47% female), a multiple group confirmatory factor analysis suggested that the DLS was sex invariant at both configural ($X^2 = 72.19$, $p < .001$, $df = 18$; RMSEA = .07, .05–.09; SRMR = .032; CFI = .97; NNFI = .95) and metric levels ($X^2 = 78.41$, $p < .001$, $df = 23$; $\Delta X^2 = 6.22$, $\Delta df = 5$; RMSEA = .06, .05–.08; SRMR = .033; CFI = .97; ΔCFI = .00; NNFI = .96; Tod et al., 2012). However, in this study scalar invariance was not achieved, suggesting that females and males might be interpreting items of the DLS differently, and that mean comparisons of leanness between sexes might be biased. Last, a study with another mixed-sex undergraduate sample ($N = 472$; 53% female) found that both males and females endorsed more drive for leanness than either drive for thinness or muscularity (F (1.83, 859.62) = 251.43, $p <$ .001) and that there were no differences in levels of drive for leanness endorsed by sex (Lang & Rancourt, 2019). In sum, it appears that drive for leanness differentiates itself from the other drives by its similar appeal to both sexes.

In addition to comparing mean levels of drive for leanness, relationships between drives for leanness, thinness, and muscularity have been investigated. In the seminal paper, Smolak and Murnen (2008) assessed the discriminant validity of the DLS by comparing it to the most widely used measures of drive for thinness (Eating Disorder Inventory – Drive for Thinness subscale; EDI-DT; Garner et al., 1983) and drive for muscularity (Drive for Muscularity Scale; DMS; McCreary & Sasse, 2000). The authors determined their sample was too small to support a factor analysis ($N = 85$) and instead described Pearson correlations to ascertain the discriminant validity of the DLS. They found moderate correlations of the DLS with the EDI-DT and DMS within the entire sample, as well as within each sex (*r*s = .38-.53). Scale reliability was only reported for the DLS (α = .77), making discerning whether the relationships between drives were attenuated due to low reliabilities impossible. The authors interpreted their corollary findings as evidence that drive for leanness might be a component of body image that is unique from the other drives for both females and males. While useful as a starting point of discerning relationships between the drives, only considering dyadic relationships between them does not capture the entire picture of drive relationships. More specifically, to ascertain whether drive for leanness is a unique construct or rather a summation of these two other drives, it would be ideal to assess drive for thinness' and muscularity's additive association with drive for leanness.

Since the publication of the seminal paper (Smolak & Murnen, 2008), bivariate correlations between scales have been found to be small to moderate in size (*r*s = .21-.57; Hartmann et al., 2018; Smolak & Murnen, 2011; Tod et al., 2012). While indicative of both some unique and some shared variance, these statistics themselves are similarly not useful to determine if drive for leanness is an amalgamation of drives for thinness and muscularity because these associations only are bivariate. However, this limitation was addressed in a study utilizing a large undergraduate sample (*N* = 589; 51% female; Lang & Rancourt, 2019). In this sample, semi-partial correlations (*r*s = .21-.40) supported 71% unique variance in drive for leanness above and beyond *both* drives for thinness and muscularity. This analysis added useful evidence to the idea of uniqueness as it took all three drives into account simultaneously, showing that there was more variance unique to drive for leanness than variance in drive for leanness shared with drives for thinness and muscularity.

This same study explored the potential that drive for leanness was distinct from drives for thinness and muscularity by conducting an exploratory factor analysis (EFA) including all items from the DLS, EDI-DT, and DMS (Lang & Rancourt, 2019). After dropping one item from the EDI-DT that did not load onto any latent factor, this EFA suggested a four-factor solution representing leanness, thinness, and muscularity behaviors and cognitions (X^2 (249, N = 588) = 637.23, $p < .001$; SRMR = .04; CFI = .92; RMSEA = .07). Correlations between the latent drive for leanness construct and all other latent drive variables ranged from .23-.34. All items loaded uniquely onto their respective latent factors, and no items from any scale cross-loaded.

While these findings supported the independence of the drive constructs, at least as measured by the specific questionnaires utilized, there were several weaknesses to this study. First, it is possible that due to administering the measures in their standard format, there was an ordering effect that impacted the distinctiveness of findings. Physical closeness of items can be seen as a context cue for item similarity, resulting in a phenomenon in which items that are positioned closely within a survey tend to be answered more similarly (Campbell & Mohr, 1950; Mollenkopf, 1950). For example, items within the same questionnaire might be answered more similarly than items in other questionnaires purely due to item position as opposed to content. This item-position effect has particularly strong implications for factor analytic work. If items that are closer together are answered more similarly regardless of content, they might end up being attributed to the same latent factor, whereas if they were positioned farther apart this might not have been the case (Hartig et al., 2007; Schweizer et al, 2009; Schweizer, 2012). It is therefore feasible that, in extant drive work, the item-position effect may have played a role in findings that drives are unique. For example, the presentation of drive scale items within surveys in their standard measure formats gives context cues that each drive scale is measuring something different, potentially prompting individuals to answer items within each scale comparably, regardless of actual content.

Second, it could be the case that the drives appeared distinct in Lang and Rancourt's study because the wording of their measures is noticeably different. All items of the DMS and EDI-DT ask about the participant's body while some items of the DLS ask about the participant's views of others' bodies. More specifically, the DLS contains items that are other-centric in nature (i.e., "People with well-toned muscles look good in clothes") while the EDI-DT and DMS only contain items that are self-centric (i.e., "I am preoccupied with the desire to be thinner" or "I wish that I were more muscular"). Differently worded items can distort factor analyses by fostering formation of artificial factors composed of these unique items (DiStefano & Motl, 2006; Schmitt & Stuits, 1985; Schriesheim & Eisenbach, 1995). It is possible that wording differences between the DLS and other drive scales may have swayed past participants to answer groups of questions similarly due to comparable wording, other- versus I-reference, as opposed to item content. This could have led to leanness emerging as a construct unique from drives for thinness and muscularity due to wording effects as opposed to actual construct uniqueness.

These methodological weaknesses in past work call for 1) a data collection in which all items are randomly presented within one survey, to control for survey-specific, item-positioning effects, and 2) creation of a modified DLS in which items are semantically modified to be more comparable to that of the DMS and EDI-DT, to account for wording effects. Further, while an EFA was a good approach for this first attempt at construct validation, these results need to be replicated using a more theory-driven approach, such as a confirmatory factor analysis (CFA).

All the research cited thus far has been group approaches to exploring drive for leanness. However, person-centered approaches have also been used in the past to test whether drive foe leanness is best described as uniqueness or amalgamated. Lang and colleagues (2017) investigated whether drive for leanness was unique by examining how different patterns of drives for thinness and muscularity endorsement were associated with drive for leanness. Data were collected from 1194 undergraduate students (80.2% female) who had completed the DLS, DMS, and the Drive for Objective Thinness scale (DOT; Chernyak & Lowe, 2010). Latent classes were estimated based on different levels of endorsement of drives for thinness and muscularity, and associations between these latent classes and the DLS were explored. This study specifically tested the amalgamated hypothesis, positing that those high on both drives for thinness and muscularity would report the highest levels of drive for leanness, and that drive for leanness would not be associated with other combinations of these drives. A latent profile analysis (LPA) identified four latent profiles: 1) Both High - high drive for objective thinness/high drive for muscularity), 2) Thinness - high drive for objective thinness/low drive for muscularity, 3) Muscularity - low drive for objective thinness/high drive for muscularity, and 4) Both Low - low drive for objective thinness/low drive for muscularity. In comparison to the Both High group, higher drive for leanness scores were associated with greater likelihood of being in the Muscularity group (β = 1.79, *CI* = 1.35, 2.36). However, when compared to those in the Both High group, those with higher drive for leanness scores had a lower likelihood of being in the Both Low (β = 0.74, *CI* = .61, .90) and Thinness groups (β = 0.79, *CI* = .64, .96). Given that drive for leanness was associated with multiple endorsement patterns of the other drives and not solely associated with the Both High group, amalgamation was not supported.

An LPA was appropriate to explore whether drive for leanness is uniqueness versus amalgamated. However, this work did not unequivocally support uniqueness of drive for leanness from drives for thinness and muscularity given that drive for *objective* thinness, the construct used to quantify the motivation to be thin in this study, is a related but different construct from drive for thinness. Drive for objective thinness is defined as the motivation to achieve an objectively low body weight, or 15% below a medically ideal body weight for height (Chernyak & Lowe, 2010). Alternatively, drive for thinness reflects a more general desire to be thinner, which may reflect motivation to obtain an objectively healthier outcome if, for example, an individual is of overweight status and desires to reach normal weight status. As drive for *objective* thinness is innately unhealthy, while drive for thinness covers a broader range of outcomes, there is potential that the relationship of drive for thinness with muscularity, as well as their subsequent additive association with drive for leanness, might look different. Further, endorsement levels between these drive constructs might look different as a function of what they measure, as the number of individuals who would endorse a drive for objective thinness is much smaller than those who may endorse drive for thinness more generally. Despite these limitations, the aforementioned results support the idea of uniqueness, as drive for leanness was significantly associated with multiple latent drive profiles.

In addition to investigating direct associations among the drives, the uniqueness of drive for leanness from drives for thinness and muscularity has also been examined by exploring each drive's differential pattern of associations with health-related outcomes. Multiple studies have found unique predictive utility of drive for leanness above and beyond the other drives. In a sample of 232 college undergraduates (59% female), drive for leanness cross-sectionally predicted unique variance in body shame above and beyond either drive for thinness or muscularity in both female and male participants (Smolak & Murnen, 2008). In a sample of female weightlifters, drive for leanness cross-sectionally predicted disordered eating; however, when drives for thinness and muscularity were added as additional independent variables, the association between drive for leanness and disordered eating attenuated and was no longer significant (Hartmann et al., 2018). Finally, in a large mixed-sex college sample ($N = 547$; 51% female), Steiger's *Z*s suggested that, in general, drive for leanness was less strongly associated with maladaptive health-related outcomes, and more strongly associated with adaptive health-related outcomes, compared to drive for thinness (Lang & Rancourt, 2019). Findings were less clear when comparing drive for leanness and drive for muscularity; associations with maladaptive variables were generally similar, but inconsistent across more adaptive variables. Taken together, these cross-sectional studies suggest that the three drives have different patterns of associations with health-related outcomes, providing evidence in support of drive for leanness as a unique construct.

Longitudinal investigations of drive for leanness are rare. In a sample of 106 mixed-sex undergraduate students (69% female), drive for leanness longitudinally predicted moderate levels of weight lifting, increases in positive exercise motivations, and decreases in anxious symptoms, above and beyond drives for thinness and muscularity (Lang, 2018). However, in this same sample, drive for leanness was not incrementally predictive of changes in aerobic training frequency, compulsive exercise motivations, frequency of any type of performance enhancing/weight managing supplement use, dieting, symptoms of depression, or global disordered eating symptomology over time. While this study was statistically powered for the analyses, there were high attrition rates and some differences emerged between individuals who did and did not participate in the longitudinal portion of the study. Further, data were collected approximately three months apart, which might not have been long enough for change to occur in the outcome variables. Nonetheless, this study still evidenced the predictive utility of drive for leanness above and beyond the other drives across time, adding evidence to drive for leanness being unique.

Overall, due to its more sex-neutral nature, its low-to-moderate shared variance with drives for thinness and muscularity, and differential associations with health-related variables compared to the other drives, the majority of the extant data in drive for leanness research supports the idea that drive for leanness is unique from drives for thinness and muscularity.

Evidence for the Amalgamation Hypothesis

While drive for leanness was originally posited as a unique construct, there remains some skepticism. An alternate argument states that drive for leanness is not valid as a unique construct, but rather is best explained as an amalgamation of drives for thinness and muscularity. This can be viewed as consistent with the definition of drive for leanness, which describes it as encompassing both low body fat and lean muscularity. More specifically, from this viewpoint it is believed that the low body fat component of drive for leanness requires drive for thinness (even while Smolak and Murnen (2008) noted the contrary), while the lean muscle component requires drive for muscularity.

As previously outlined, research has focused on demonstrating the uniqueness of drive for leanness from drives for thinness and muscularity by parsing out shared variance. However, some have posed the following question: "What is drive for leanness after removing its conceptual overlap between drive for thinness and drive for muscularity?" This argument asserts that drives for thinness and muscularity are integral parts of the drive for leanness construct, and removing their shared variance by controlling for them within analyses does not allow for a full representation of the construct. If this is accurate, it would render extant outcomes based on analyses that parsed out variance incomplete or skewed in some way, and invalidate much of the previously reported drive research, particularly that which tested incremental validity.

Nonetheless, a review of the literature supporting the amalgamation hypothesis suggests a dearth of supporting evidence. One study found that in a sample of college freshman (*N* = 235; 61% female) both females and males endorsed different levels of both drives for thinness and muscularity, and that combinations of levels of endorsement of these drives were related differentially to a range of outcomes including body compulsivity, body anxiety, body esteem, and disordered eating (Kelley et al., 2010). Overall, for both females and males, those low on both drives for thinness and muscularity felt better about their bodies, while those high on either both or just one of the drives endorsed more negative outcomes, such as more disordered eating, body anxiety, and body esteem. The authors interpreted these results to mean that drives for thinness and muscularity are not mutually exclusive, as they frequently occur in the same person, and that different combinations of these drives predict different outcomes.

While a good first step to looking at amalgamation and lack of exclusivity between drives, this study was limited in that it relied on the interaction term of drives for thinness and muscularity to predict outcomes. Drives for thinness and muscularity were deemed to lack mutual exclusivity if the main effect models produced different associations with outcomes than the interaction effect, evidencing differential relationships when they were combined as opposed to when they occurred in isolation. A latent profile analysis may have been a better choice to test the study hypotheses, particularly regarding combinations of drive levels being differentially related to body-related outcomes. More important to the current study, the work by Kelley and colleagues (2010) did not include drive for leanness. In theory, if drive for leanness requires both drives for thinness and muscularity, then it would map onto the same outcome variables as those associated with high levels of both drives. However, that would equate to drive for leanness being related to the highest levels of all negative outcomes. This theory is discrepant with the work described in the previous section that suggested that drive for leanness maps onto *multiple* profiles of drive for thinness and muscularity endorsement (Lang et al., 2017), and that drive for leanness is less maladaptive than drive for thinness, as well as may be less maladaptive than drive for muscularity (Lang & Rancourt, 2019). Nonetheless, the fact that drives for thinness and muscularity can occur in the same individual and have an additive effect on outcomes adds evidence to their lack of mutual exclusivity that may further be applicable to drive for leanness.

In sum, there is not nearly as much evidence for the amalgamated hypothesis as the uniqueness hypothesis. Nonetheless, it is still important to determine the best way to describe relationships among the three drives, as well as get a better idea of how specifically drive for leanness relates to drives for thinness and muscularity. As there is evidence for both drive relationship viewpoints, this study aimed to test these competing hypotheses to attempt to understand drive for leanness' relationship with the other drive variables.

Current Study

Only one measure of drive for leanness currently exists, limiting the ways in which drive for leanness can be explored. In the past, attempts have mainly focused on investigating the internal structure of the DLS and its associations with other variables. While integral to what we currently know about drive for leanness, there are more comprehensive ways to investigate this drive. This study addresses the weaknesses identified in the existing drive for leanness literature by more rigorously testing its associations with drives for thinness and muscularity. Specifically, this project aims to test competing hypotheses regarding the relationships of drive for leanness with drives for thinness and muscularity, as well as explore how different drive structures predict a range of health-related outcomes.

Aim 1 - Hypothesis 1: As noted above, one large limitation to discerning the validity of drive for leanness as a construct is that there is only one scale that claims to measure it. Further, there are issues noted with the scale in its current form. As previously mentioned, there are semantic differences between the DLS and both the EDI-DT and DMS, such that the EDI-DT and DMS ask about oneself while the DLS contains some questions about people in general. Therefore, the first aim of this study was to adapt the DLS to be more semantically similar to the EDI-DT and DMS and test the preliminary psychometric soundness of this Modified DLS (M-DLS). This revised measure captures an individual's own body change motivation related to leanness and was intended to minimize any wording effects that may have impacted past psychometric and factorial work comparing the three drives. Given the consistently strong internal consistency of the DLS across studies, the first study hypothesis was that this M-DLS would demonstrate good preliminary psychometrics as a one factor model.

Aim 2 - Hypothesis 2: Following from Aim 1, it was important to discern if drive for leanness when measured by the M-DLS demonstrated similar patterns of associations with the other drives as when measured by the original DLS. Specifically, does the M-DLS emerge as psychometrically distinct from the EDI-DT and DMS? Further, to test the uniqueness hypothesis, do drives for leanness, thinness, and muscularity emerge as unique latent factors when measured by the M-DLS, EDI-DT, and DMS, similarly to how they did when utilizing the original DLS alongside these same thinness and muscularity measures? If the M-DLS looks similar to the DLS, it might be useful to use this modified version that is more semantically commensurate to the EDI-DT and DMS in the future when looking at all the drives together. Therefore, the second aim of this study was to replicate and extend findings from Lang and Rancourt (2019) to see if the M-DLS behaved in the same way structurally as the original DLS in terms of its relationships with the EDI-DT and DMS, as well as at a factor level in investigating the uniqueness hypothesis. Given that previous EFAs utilizing similar data found that the DLS was distinct from these other drive measures, it was hypothesized that the scales measuring drive for leanness, the DMS, and EDI-DT would be psychometrically distinct and demonstrate good CFA model fit. Further, based on previous findings utilizing the DLS, it was hypothesized that the uniqueness hypothesis would be supported. Drive for leanness as a latent factor, as quantified by either drive for leanness measure, would be unique on a factor level from the other two drives, again as discerned by good model fit.

Aim 3 - Hypothesis 3: Once the psychometric properties of the M-DLS were ascertained and uniqueness of drive for leanness was explored, the third aim of this study was to investigate the competing hypothesis that drive for leanness is not in fact unique, but is better described as an amalgamation of drives for thinness and muscularity. While there is very little evidence supporting this view, there is speculation about these drives' uniqueness, making exploring an amalgamation hypothesis an important step in the investigation of drive for leanness. Nonetheless, based on the dearth of support for the amalgamated model, it was hypothesized that drive for leanness *would not* be best described as an amalgamation of drives for thinness and muscularity. It was therefore anticipated that the model testing amalgamation would not show good fit, or that the model would show good fit, but that the loadings of EDI-DT and DMS items onto the general drive for leanness latent factor would be weak.

Aim 4 - Hypotheses 4 & 5, Exploratory Analysis: Drives for leanness, thinness, and muscularity differentially predict a range of health-related outcomes (Hartmann et al., 2018; Lang & Rancourt, 2019; Smolak & Murnen, 2008; Tod et al., 2013). However, these previous analyses assumed that the best way to describe these drives was as unique factors, not taking into account the possibility of an alternate latent drive factor structure that would change the predictors utilized and perhaps the resultant outcomes. Therefore, the final aim of this project was to replicate and expand upon previous work exploring the relationships between drives and an array of health-related outcomes.

Of note, how these relationships were explored in this study was dependent upon results from this study's previous aims. If drive for leanness was found to be distinct from drives for thinness and muscularity, this would support use of the existing drive measures as predictive tools in their current forms. However, if drive for leanness was better described as a general overarching drive construct that encompasses drives for thinness and muscularity, then using the existing drive measures would not be the most accurate way to predict outcomes. Rather, it would make the most sense to use the amalgamated factor structure as the predictor in these analyses. Hypotheses for outcomes of each predictive scenario are discussed below.

Eating Disturbance. Drives are supported as proponents of disordered eating in etiological and maintenance models (i.e., Garner, 2002; Tylka, 2011) and all drives are correlated with both global and specific disordered eating outcomes (Hartmann et al., 2018; Lang & Rancourt, 2019; Tod et al., 2013). This study aimed to expand upon these extant findings to discern which drives were associated with which outcomes. Specifically, drive for leanness is associated with disordered eating symptom count, compulsive exercise, and supplement use (Hartmann et al., 2018; Lang & Rancourt, 2019). However, muscle building behaviors, purging, restricting, binge eating, body dissatisfaction, cognitive restraint, and excessive exercise are also related to wanting to achieve low body fat and/or muscularity, and their relationships with drive for leanness have not been explored. Therefore, this study sought to examine the associations between the most accurate drive for leanness factor model and all of these disordered eating-related outcomes.

Disordered eating-related outcomes can be divided into those that are solely associated with trying to obtain thinness (i.e., purging, restricting, binge eating), those that are solely associated with trying to obtain muscularity (i.e., muscle building), and those that are implicated simultaneously in both body fat loss and muscle gaining pursuits (i.e., excessive exercise, body dissatisfaction, cognitive restraint). As such, no matter which structure was deemed most appropriate for these drive constructs, it was hypothesized that 1) drive for thinness would be related to all constructs associated with attempting to achieve thinness (i.e., purging, restricting, binge eating, excessive exercise, body dissatisfaction, cognitive restraint); and 2) both drive for muscularity cognitions and behaviors would be related to all outcomes associated with attempting to achieve muscularity (muscle building, excessive exercise, body dissatisfaction, cognitive restraint). However, which factor structure of drive for leanness prevailed influenced the final hypothesis. If previous structural patterns prevailed such that all drives were found to be unique (Hypothesis 2 was supported; Hartmann et al., 2018, Lang & Rancourt, 2019), it was hypothesized that drive for leanness would be related to only those variables deemed important to achieve simultaneous low body fat and muscularity (i.e., body dissatisfaction, cognitive restraint, excessive exercise). However, if drive for leanness was best explained as an amalgamation of drives for thinness and muscularity (Hypothesis 3 was refuted), then it was hypothesized that drive for leanness would be related to all outcomes.

Global Mental Health. Another group of health constructs known to be associated with the drives are mental health outcomes (Hartmann et al., 2018; Lang & Rancourt, 2019); however, a global mental health outcome has never been explored. All drives have been found individually to be correlated with both anxiety and depression (Lang & Rancourt, 2019); however, when all were entered into cross-sectional predictive models, only increases in drive for thinness were significantly associated with increases in negative symptomology (Hartmann et al., 2018; Lang & Rancourt, 2019). Further, drive for leanness had a positive impact on mental health such that increases in drive for leanness predicted decreases in anxiety. As this research did not measure global mental health, this study aimed to discern the relationships between whichever drive for leanness factor model was deemed the most accurate and global mental health. Based on past findings, if the uniqueness model was supported, it was hypothesized that drives for leanness and muscularity would be associated with good global mental health, while drive for thinness would be associated with poor global mental health. However, if the amalgamated model was better supported, it was hypothesized that the amalgamated leanness factor would not be associated with global mental health, as it would balance out the negative impact of drive for thinness and the positive impact of drive for muscularity.

Global Physical Health. Finally, physical health outcomes rarely have been explored in relation to drives for leanness, thinness, and muscularity. Of the three drives, drive for thinness is most strongly associated with extreme eating behaviors that are robust risk factors of extreme weight loss (Johnson et al., 2002; Lang & Rancourt, 2019; Stice, 2002). However, behaviors targeting muscularity also can have negative physical health impacts. For example, body enhancing supplement use can prompt chemical imbalances within the body (this is true for both commonly reported supplements like protein, as well as legal and illegal steroid use for increased muscle and improved performance) and excessive weight lifting can result in injury (Tod & Edwards, 2015). While drive for leanness is posited to encompass good physical health by balancing fat loss and muscle gain, and has generally been found to be more adaptive than the other drives (Lang & Rancourt, 2019), it still is possible to go overboard in attempting to attain this ideal. For example, one might grossly restrict their diet to certain foods or even just consume supplements to minimize fat and highlight muscle. Nonetheless, there is no extant research examining associations between the three drives and explicit physical health. Therefore, the final goal of this study was to discern the relationships between whichever drive for leanness model was deemed the most accurate and global physical health. As very little research exists looking at drive relationships with physical health outcomes, no directional hypotheses were made.

METHOD

Procedures and Participants

Participants were recruited voluntarily via an online system (SONA) from a pool of undergraduate psychology students at the University of South Florida. Interested individuals provided informed consent and completed the survey(s) online.

Two different surveys were utilized for data collection. Survey 1 included demographic questions, as well as all three original drive scales and the modified leanness scale. All items from the modified and original drive scales were presented in random order to avoid item-positioning response bias. Survey 2 included demographic questions, the modified leanness scale in standard format, all three original drive scales in their standard format, and all health outcome measures in standard format. Participants could complete one or both surveys; as they were collected as separate studies over two academic semesters and data are anonymous, there is no way to determine the percentage of participants who completed both surveys. Individuals received partial course credit for participation in each survey they completed. A total of 403 participants completed Survey 1, while 399 participants completed Survey 2.

Survey 1 participants were excluded from the final data set if they missed two or more attention checks (n = 19; Meade & Craig, 2012), if their time to completion fell within the bottom or top 5%-ile (n = 22; Meade & Craig, 2012), or if it was noted that they completed the survey in an inconsistent pattern (e.g., answering 1 for every item; n = 2). This left a final sample of 360 Survey 1 participants available for analysis (See Table 1). This sample was primarily female (n = 220; 61.1%). Participants who identified as Hispanic/Spanish/Latin (n = 83; 23.1%)

were primarily White (*n* = 67; 80.7%), with a minority identifying as African American or Black, Asian, American Indian or Alaskan Native, Native Hawaiian of Pacific Islander, or other. Those who identified as Not Hispanic/Spanish/Latin (*n* = 277; 76.9%) also primarily identified as White (*n* = 190; 68.6%). Participants had a mean age of 20.93 years old (*SD* = 4.79) and were, on average, of healthy weight status (M_{BMI} = 25.02; *SD* = 6.02). The majority of individuals identified their sexual orientation as heterosexual (*n* = 304; 84.4%), while a minority identified as homosexual, bisexual, or other. Relationship status of participants was predominantly single/never married (*n* = 247; 68.6%), with a minority of participants reporting being married, cohabitating/living together, being divorced, not married but in a serious romantic relationship with one person, or casually dating one or more people. Finally, participants were primarily Freshman (*n* = 106; 29.4%), with minorities of upper classmen.

Survey 2 participants were excluded from the final data set for the same reasons as those who were excluded in Sample 1; if they missed two or more attention checks (*n* = 16), if their time to completion fell within the bottom or top 5%-ile (*n* = 24) or if it was noted that they completed the survey in an inconsistent pattern (*n* = 9). This left a final sample of 350 Survey 2 participants available for analysis (See Table 1). This sample was also primarily female (*n* = 219; 62.6%). Participants who identified as Hispanic/Spanish/Latin (*n* = 93; 26.6%) primarily identified as White (*n* = 67; 72%). Those who identified as Not Hispanic/Spanish/Latin (*n* = 257; 73.4%) were also primarily White (*n* = 182; 70.8%). Participants had a mean age of 20.00 years old (*SD* = 4.09) and were, on average, of healthy weight status (M_{BMI}= 23.40; *SD* = 6.10). The majority of individuals identified their sexual orientation as heterosexual (*n* = 283; 80.9%). Relationship status of participants was predominantly single/never married (*n* = 249; 71.1%). Finally, participants were primarily Freshman (*n* = 103; 29.4%).

Independent sample *t*-tests and chi-square tests were used to investigate whether there were significant differences in demographics and variables of interest between Survey 1 and Survey 2 samples (see Table 2). No differences were found between survey sample groups on any demographic variables. While there was a significant mean difference in response to the M-DLS (lower drive for leanness in those who completed Survey 1, $t(697) = -2.85$, $p < .01$), the effect size was small ($d = 0.21$), and there were no significant differences between the groups on the original DLS, $t(698) = -1.15$, $p = .25$. Similarly, there were no significant differences between groups on the EDI-DT, $t(706) = 0.23$, $p = .82$, nor the DMS, $t(708) = 1.48$, $p = .14$.

Measures

While all drive measures and demographics were collected both in Surveys 1 and 2, all eating and health-related measures were only collected in Survey 2.

Drive for Leanness. Drive for leanness was evaluated in two ways. First, the 6-item Drive for Leanness Scale (DLS; Smolak & Murnen, 2008) was utilized. Attitudes related to preference towards a lean, well-toned body (e.g., "Athletic looking people are the most attractive people.") were measured on a 6-point scale ranging from 1 (*Never*) to 6 (*Always*). Higher mean scores indicate greater drive for leanness. The DLS has demonstrated adequate internal consistency in mixed-sex samples ($\alpha = .88$; Lang, 2018) and demonstrated good internal consistency in this study's mixed-sex samples (Survey 1 $\alpha = .87$; Survey 2 $\alpha = .92$).

Modified Drive for Leanness Scale. Second, a modified version of the drive for leanness scale was created from the original DLS as a part of this study (M-DLS; Appendix A). It includes 6 items, one of which is exactly the same as in the original DLS, five of which were modified to reflect attitudes about personal leanness instead of general leanness attitudes. For example, "I think the best-looking bodies are well-toned" was modified to "I think my body looks best when it is well-toned." These items were measured on the same 6-point scale as the DLS ranging from 1 (*Never*) to 6 (*Always*), with higher mean scores indicating greater drive for leanness. The M-DLS demonstrated good internal consistency in the current samples (Survey 1 α = .87; Survey 2 α = .92).

Drive for Thinness**.** Drive for thinness was assessed using the 7-item Eating Disorder Inventory - Drive for Thinness subscale (EDI-DT; Garner et al., 1983). Excessive concern with dieting (e.g., "I think about dieting."), preoccupation with weight (e.g., "I exaggerate or magnify the importance of weight."), and the fear of gaining weight (e.g., "I am terrified of gaining weight.") were assessed on a 6-point scale ranging from 1 (*Never*) to 6 (*Always*). While a scoring transformation is recommended in clinical populations, untransformed scores were used in this study as Schoemaker, van Strien, and van der Staak (1994) recommend using untransformed scores in non-clinical samples. Higher mean scores indicate greater drive for thinness. The EDI-DT has demonstrated good internal consistency for mixed-sex populations (α = .91; Lang, 2018) and demonstrated good internal consistency in this study's mixed-sex samples (Survey 1 α = .90; Survey 2 α = .91).

Drive for Muscularity**.** Drive for muscularity was measured with the 15-item Drive for Muscularity Scale (DMS; McCreary & Sasse, 2000). People's perceptions of how muscular they are or desire to be (e.g., "I think that I would look better if I gained 10 pounds in bulk."), as well as behaviors they use to enhance their muscularity (e.g., "I drink weight gain or protein shakes.") were assessed on a 6-point scale ranging from 1 (*Never*) to 6 (*Always*). Higher mean scores indicate greater drive for muscularity. The DMS has been shown to have good internal consistency in mixed-sex populations (α = .92; Lang, 2018), and it demonstrated good internal consistency in this study's mixed-sex samples (Survey 1 α = .88; Survey 2 α = .91).

Eating Disturbance. Global eating pathology was assessed via the 45-item Eating Pathology Symptom Inventory (EPSI; Forbush et al., 2013). Body Dissatisfaction (e.g., "I did not like how my body looked"), Binge Eating (e.g., "I ate until I was uncomfortably full"), Cognitive Restraint (e.g., "I tried to exclude "unhealthy" foods from my diet"), Purging (e.g., "I made myself vomit in order to lose weight"), Restricting (e.g., "I skipped two meals in a row"), Excessive Exercise (e.g., "I planned my days around exercising"), and Muscle Building (e.g., "I used protein supplements") over the past four weeks were assessed on a 5-point scale ranging from 0 (*Never*) to 4 (*Very often*). The EPSI also includes a Negative Attitudes Towards Obesity subscale, but this subscale was not utilized in this study. Higher subscale scores indicating higher levels of that specific disordered eating-related attribute. In its mixed-sex validation sample, the EPSI demonstrated good internal consistency across subscales (αs = .84 –.89; Forbush et al., 2013). In our Survey 2 sample, all subscales of the EPSI also demonstrated acceptable internal consistency (Body Dissatisfaction α = .88; Binge Eating α = .87; Cognitive Restraint α = .73; Purging α = .66; Restricting α = .82; Excessive Exercise α = .86; Muscle Building α = .75).

Global Health. Global health was assessed in two ways. Overall mental health was assessed via the 4-item Global Mental Health (GMH) subscale of the PROMIS Scale v1.2 - Global Health, while overall physical health was assessed via the 4-item Global Physical Health (GPH) subscale of the same scale. The GMH and GPH assess health via Likert-type scales ranging from 1 (*Poor*) to 5 (*Excellent*), 1 (*Not at all*) to 5 (*Completely*), 1 (*Always*) to 5 (*Never*), 1 (*Very severe*) to 5 (*None*), and 0 (*No pain*) to 10 (*Worst pain imaginable*). Items include things such as "In general, how would you rate your mental health, including your mood and your ability to think?" and "To what extent are you able to carry out your everyday physical activities such as walking, climbing stairs, carrying groceries, or moving a chair?" Negatively worded items are reversed scored such that items within each subscale can be summed with higher scores indicating better health. The full scale was normed using mixed-sex adult samples from the general population (Hays et al., 2009).

Demographic Information. Age, sex, sexual orientation, race, ethnicity, and year in school were collected. Self-reported height and weight were also collected and utilized to calculate body mass index (BMI; pounds/inches^2*703).

Attentional Checks. Meade and Craig (2012) suggest adding up to three "bogus items" to long survey measures in order to detect careless responses. Three "yes" or "no" items (e.g. "I have been to every country in the world.") were dispersed randomly throughout both Survey's 1 and 2.

Data Analysis

There are multiple theories on how many participants are needed for "good" power in factor analyses (VanVoorhis & Morgan, 2007). Rules of thumb include 300 participants in general (Tabachnick & Fidell, 2013), 10 to 20 people per item (suggesting the current study requires 280-560 participants; De Vellis, 2003), or 50 participants per latent factor (suggesting the current study requires 350 for the largest analysis; Pedhazur & Schmelkin, 1991). In sum, a conservative estimate of 350 participants would meet criteria for all rules of thumb and all analyses of this study. This sample size target was met in each survey collection, with a final Survey 1 sample of 360 and Survey 2 sample of 350 available for analysis after data cleaning.

Data were analyzed utilizing SPSS 24 and Mplus 8. Prior to testing hypotheses, descriptive statistics were examined for data abnormalities, including skewed distributions, invalid response patterns, and outliers; no transformations nor other modifications of the data were made.

Hypothesis 1: A modified version of the DLS was created for this project (M-DLS). It was hypothesized that this scale would show good preliminary psychometric properties.

Cronbach's alphas were used as simple measures of scale reliability for the M-DLS in both survey samples. An EFA was used to determine the factor structure of the M-DLS, utilizing the sample from Survey 1. For the EFA, all items (six in total) of the M-DLS were entered with a geomin rotation and up to three factors for extraction. Global fit statistics (X^2, SRMR < .08, RMSEA < .06, CFI > .90), eigen values, and parallel analyses were examined to determine the appropriate number of factors. Factor loadings were explored to determine onto which factor each item loaded; items were dropped if they did not load on any factor (< .40) or evidenced significant cross loading (either a gap between significant loading and non-significant loading < .20 or a gap between significant loading and significant loading < .30; Brown, 2015). These processes occurred until the EFA demonstrated good global fit, and all items loaded onto a single factor.

Hypothesis 2: Two first-order correlated-factor CFAs (see Figure 1) were utilized to test the hypothesis that scales measuring drive for leanness are psychometrically distinct from the EDI-DT and DMS, and further, that drive for leanness is mostly unique from drives for thinness and muscularity at a factor level.

Drive for Leanness Scale. For the first first-order correlated-factor CFA, all DLS, EDI-DT, and DMS items (28 total) from Survey 1 were included. Four factors were specified as has been found in past research utilizing these scales (e.g., Lang & Rancourt, 2019): drive for leanness, drive for thinness, and drive for muscularity split into cognitions and behaviors (see Figure 1). Model fit was determined by evaluating global fit statistics (X^2, SRMR < .08, RMSEA < .06, CFI > .90). Item loadings were evaluated and items were dropped if loadings were < .40.

Modification indices were consulted to assess whether there were changes to the model that could improve model fit and were theoretically defensible. If the modification index for the particular change was ≥ 100 and if the modification made theoretical sense, the change was implemented and the CFA was re-run to verify revised model fit. This selection and evaluation process occurred until model fit was maximized. If the DLS, EDI-DT, and DMS are psychometrically distinct, and if drive for leanness is best described as unique from drives for thinness and muscularity, then this correlated factors CFA should show good fit. On the other hand, if the DLS, EDI-DT, and DMS are not psychometrically distinct, and drive for leanness is *not* best described as unique from drives for thinness and muscularity, there might be high latent factor intercorrelations (*r*s > .30; Hammer & Toland, 2016), and this model would not show good fit.

Modified Drive for Leanness Scale. In the second first-order correlated-factor CFA, all items (28 total) of the M-DLS, EDI-DT, and DMS from Survey 1 were included. Four factors were specified; drive for leanness, drive for muscularity split into cognitions and behaviors, and drive for thinness. The model fitting process was the same as for that described above using the original DLS. If the M-DLS, EDI-DT, and DMS are psychometrically distinct, and if drive for leanness is best described as unique from drives for thinness and muscularity, then this correlated factors CFA should show good fit. On the other hand, if the M-DLS, EDI-DT, and DMS are not psychometrically distinct, and drive for leanness is *not* best described as unique from drives for thinness and muscularity, there might be high latent factor intercorrelations, and this model would not show good fit.

Hypothesis 3: A bifactor *S*-1 CFA (see Figure 2) was used to test the hypothesis that drive for leanness is *not* best described as an amalgamation of drives for thinness and muscularity. This type of model allows factors to differ as far as structure is concerned, as well as statistically contrast *S*-1 group factors against a general factor (Burns et al., 2019). In an *S*-1 model, items that are deemed indicators of the general factor do not cross-load onto group factors, as no group factor for this latent construct is specified. However, indicator items of the group factors can load onto both their specific group and the general factor, as variance in these items is thought to be attributable to both group and general factors. More specifically, the variance attributed to group factors is considered residual from what is deemed attributable to the general factor. For this reason, general and group factors are not allowed to correlate within this model, but the group factors can correlate with each other (Eid et al., 2017). For the purposes of this study, the general factor was specified as drive for leanness (see Figure 2).

All items (28 total) of the M-DLS, EDI-DT, and DMS from Survey 2 were included in the bifactor *S*-1 CFA. Items from the M-DLS were used as indicators of the latent general leanness factor, and no drive for leanness latent group factor was specified. The latent general leanness factor and three group factors – drive for thinness, as well as drive for muscularity split into cognitions and behaviors – were specified. The appropriateness of this *S*-1 bifactor structure was determined via multiple methods: 1) evaluating global fit statistics (X^2, RMSEA < .06, CFI > .90, SRMR < .08), 2) evaluating loadings on both the general and group factors, and 3) evaluating ancillary measures that addressed the dimensionality of all drive constructs within a bifactor model. This multi-step fit interpretation process was undertaken as bifactor models are flexible and tend to over-fit while the actual pattern of loadings may not practically resemble a bifactor structure (Bornovalova et al., 2020).

First, item loadings were evaluated and items were dropped if loadings were < .40 *on both* the general and respective group factor (Brown, 2015). Modification indices were consulted to assess whether there were changes to the model that could improve model fit and were theoretically defensible. If the modification index for the particular change was ≥ 100 and if the modification made theoretical sense, the change was implemented and the CFA was re-run to verify revised model fit. This selection and evaluation process occurred until model fit was maximized.

Second, factor loadings were investigated to determine strength of loading onto the general factor. Loadings < .40 were considered weak and not supportive of a significant amount of variance in that item being accounted for by the general factor. If more than half of each of the EDI-DT and DMS items loaded significantly onto the latent general leanness factor, the model was considered supportive of amalgamation. However, if less than half of the items from both the DMS and EDI-DT loaded significantly onto the latent general leanness factor, then the hypothesis that drive for leanness is *not* best explained as an amalgamation of drives for thinness and muscularity was supported.

Finally, ancillary measures were utilized to assess drive factor dimensionality. Drive scales correlating > .30 (Hammer & Toland, 2016), explained common variance > .85 (proportion of common variance across items explained by the general factor; ECV_{GEN}; Stucky & Edelen, 2015), percent of uncontaminated correlations > .80 (less bias in structural coefficients; PUC; Reise et al., 2013), and individual explained common variances between 1 and .5 (how strongly each item measures the general factor; $IECV_{GEN}$; Stucky & Edelen, 2015) would suggest that these drives overlap sufficiently enough to warrant a general factor within the proposed bifactor model.

Hypothesis 4: Given the outcomes of Hypotheses 2 and 3, Hypotheses 4 and 5 were restructured. Given extant knowledge about the relationships between the latent drive factors and disordered eating outcomes (Hartmann et al., 2018, Lang & Rancourt, 2019), it was hypothesized that the latent general leanness factor would predict constructs typically associated with attempting to achieve muscle gain (i.e., muscle-building), as well as constructs typically associated with simultaneous attempts to achieve low body fat and muscularity (i.e., body dissatisfaction, cognitive restraint, excessive exercise).Three extensions of the *S*-1 bifactor CFA tested all hypotheses.

The latent factors of the final *S*-1 bifactor model were used as the independent variables to ascertain associations of each latent drive factor with each of the dependent disordered eating-related outcomes. All components of the final *S*-1 bifactor model (loadings, correlations, intercepts, variances, and residual variances) were fixed for each regression to correct for potential differences in structural estimates that could emerge in the predictive model. Three regressions were run given each category of disordered eating outcome.

The first analysis looking at thinness-related outcomes included purging, restricting, and binge eating (EPSI – Purging, Restricting, Binge Eating) as the dependent variables. The second examined muscularity-related outcomes and included muscle-building behavior (EPSI – Muscle Building) as the dependent variable. The third analysis investigated outcomes related to simultaneous pursuit of both lean muscle and low body fat, including body dissatisfaction, cognitive restraint, and excessive exercise (EPSI – Body Dissatisfaction, Cognitive Restraint, Excessive Exercise) as the dependent variables.

Dependent variables were regressed onto the latent general leanness factor, the drive for thinness latent group factor, and both drive for muscularity latent group factors. The standardized estimates for each independent latent factor were examined to determine which of these variables were significantly associated with each outcome. Larger standardized estimates indicated stronger associations between factors. The Holm-Bonferroni method (Holm, 1979) was used to adjust *p*-values across all behavior groupings to control for familywise error rates, as well as the false discovery rate, given the large number of dependent variables (Gaetano, 2013).

Hypothesis 5: Hypothesis 5 analyses were comparable to those conducted for Hypothesis 4. Given extant knowledge about the relationships between all three drives and specific mental health variables (Hartmann et al., 2018, Lang & Rancourt, 2019), it was hypothesized that the latent general leanness factor, as well as both drive for muscularity latent group factors, would positively predict good global mental health, while the drive for thinness latent group factor would predict poor global mental health. An extension of the previously completed *S*-1 bifactor CFA tested this hypothesis.

The latent factors of the final *S*-1 bifactor model were used as the independent variables to ascertain the associations between the latent drive factors and global mental health. As described above, all components of the final *S*-1 bifactor model were fixed. Global mental health (as assessed by the PROMIS – GMH) was entered as the dependent latent variable and regressed on the latent general leanness factor, the drive for thinness latent group factor, and both drive for muscularity latent group factors. The standardized estimate for each independent latent factor was examined to determine which of these variables were significantly associated with global mental health. Larger standardized estimates indicated a stronger relationship between factors. Across both global health associative models, the Holm-Bonferroni method was used to modify which *p*-values indicated significant relationships.

Exploratory Analysis: An extension of the previously completed *S*-1 bifactor CFA, as described above, was undertaken to explore if any drive factors were associated with global physical health. Global physical health (as assessed by the PROMIS – GPH) was entered as the latent dependent variable and regressed on the latent general leanness factor, the drive for thinness latent group factor, and both drive for muscularity latent group factors. The standardized estimate for each independent latent factor was examined to determine which of these variables were significantly associated with global physical health. Larger standardized estimates indicated a stronger associative relationship between factors. Across both global health predictive models, the Holm-Bonferroni method was used to modify which *p*-values indicated significant relationships.

Table 1

Ns and Percentages of Demographic Breakdown by Survey

			Survey 1		Survey 2	
			n	%	*n*	%
Sex						
	Women		220	61.1	219	62.6
	Men		140	38.9	131	37.4
Ethnicity and Race						
	Not Hispanic/Spanish/Latin		277	76.9	257	73.4
		White	190	68.6	182	70.8
		African American	36	13	37	14.4
		Asian	34	12.2	20	7.7
		American Indian	3	1.1	4	1.6
		Pacific Islander	4	1.4	3	1.2
		Other	10	3.6	11	4.3
	Hispanic/Spanish/Latin		83	23.1	93	26.6
		White	64	77.1	67	72
		African American	7	8.5	11	11.8
		Asian	1	1.2	6	6.5
		American Indian	1	1.2	1	1.1
		Pacific Islander	1	1.2	1	1.1
		Other	9	10.8	7	7.5
Sexual Orientation						
	Heterosexual		304	84.4	283	80.9
	Homosexual		10	2.8	12	3.4
	Bisexual		36	10	47	13.4
	Other		10	2.8	8	2.3
Relationship Status						
	Single/Never Married		247	68.6	249	71.1
	Married		17	4.7	12	3.4
	Cohabitating		14	3.9	17	14.9
	Divorced		1	0.3	1	0.3
	Serious Romantic Relationship		65	18.1	57	16.3
	Casually Dating		16	4.4	14	4
Year in College						
	1st/Freshman		106	29.4	103	29.4
	2nd/Sophomore		61	16.9	68	19.4
	3rd/Junior		100	27.8	88	25.1
	4th/Senior		83	23.1	82	23.4
	5th+		10	2.8	9	2.6

Note. Survey 1 *N* = 360; Survey 2 *N* = 350. *n* = sample size; % = percent of sample.

Table 2

Distribution Data for Each Item from the M-DLS, DMS, and EDI-DT Across Surveys

		Survey 1			Survey 2		
Measure	Item	*M*	Skewness	Kurtosis	*M*	Skewness	Kurtosis
M-DLS							
	1. body looks best well-toned	4.30	-0.64	-0.49	4.50	-0.75	-0.36
	2. feel disciplined when body firm	3.36	0.05	-1.13	3.77	-0.16	-1.06
	3. goal to have well-toned muscles	3.79	-0.21	-1.06	4.09	-0.46	-0.96
	4. would be attractive if looked athletic	4.00	-0.28	-0.91	4.26	-0.56	-0.78
	5. important to have well-defined abs	2.96	0.44	-0.78	3.26	0.29	-1.13
	6. look better in clothes if well-toned	4.13	-0.42	0.26	4.30	-0.55	-0.88
DMS-B							
	2. lift weights to build muscle	3.02	0.32	-1.15	3.01	0.44	-1.04
	3. use protein or energy supplements	2.12	1.20	0.19	1.99	1.47	1.08
	4. drink weight gain or protein shakes	1.99	1.43	0.93	1.91	1.62	1.46
	5. consume as many cals as can in day	1.80	1.69	2.29	1.62	2.26	4.76
	6. feel guilty if miss weight training	2.39	0.83	-0.43	2.19	1.15	0.29
	8. others think I lift too often	1.52	2.35	5.88	1.45	2.63	7.42
	10. think about taking anabolic steroids	1.17	4.57	23.53	1.14	4.83	28.37
DMS-C							
	1. wish more muscular	3.71	-0.01	-1.10	3.85	-0.14	-0.96
	7. feel confident w/ more muscle	3.49	0.05	-1.25	3.31	0.15	-1.21
	9. look better if gain 10 pounds bulk	2.21	1.17	0.16	2.11	1.28	0.36
	11. feel stronger if gain more muscle	3.74	-0.17	-1.04	3.27	0.14	-1.27
	12. weight training interferes with life	1.91	1.45	1.44	1.58	2.26	4.85
	13. arms not muscular enough	3.47	0.06	-1.11	3.38	0.16	-1.13
	14. chest not muscular enough	2.53	0.76	-0.58	2.67	0.68	-0.87
	15. legs not muscular enough	3.09	0.34	-0.94	3.11	0.35	-1.02
EDI-DT							
	1. eat sweets and carbs without nerves	3.73	-0.19	-1.04	3.75	-0.11	-1.00
	2. think about dieting	3.34	0.17	-1.12	3.28	0.18	-1.04
	3. feel extremely guilty after overeating	2.98	0.48	-1.05	3.07	0.38	-1.18
	4. terrified of gaining weight	3.09	0.40	-1.21	3.01	0.41	-1.10
	5. exaggerate importance of weight	2.59	0.74	-0.38	2.68	0.73	-0.46
	6. preoccupied with desire to be thinner	2.77	0.60	-0.84	2.70	0.67	-0.79
	7. if gain pound, worry keep gaining	2.79	0.59	-0.97	2.69	0.64	-0.99

Note. Survey 1 $N = 360$; Survey 2 $N = 350$. M = Mean. M-DLS = Modified Drive for Leanness Scale; DMS = Drive for Muscularity Scale; EDI-DT = Eating Disorder Inventory – Drive for Thinness subscale. Item wording is abbreviated to save space but relay meaning.

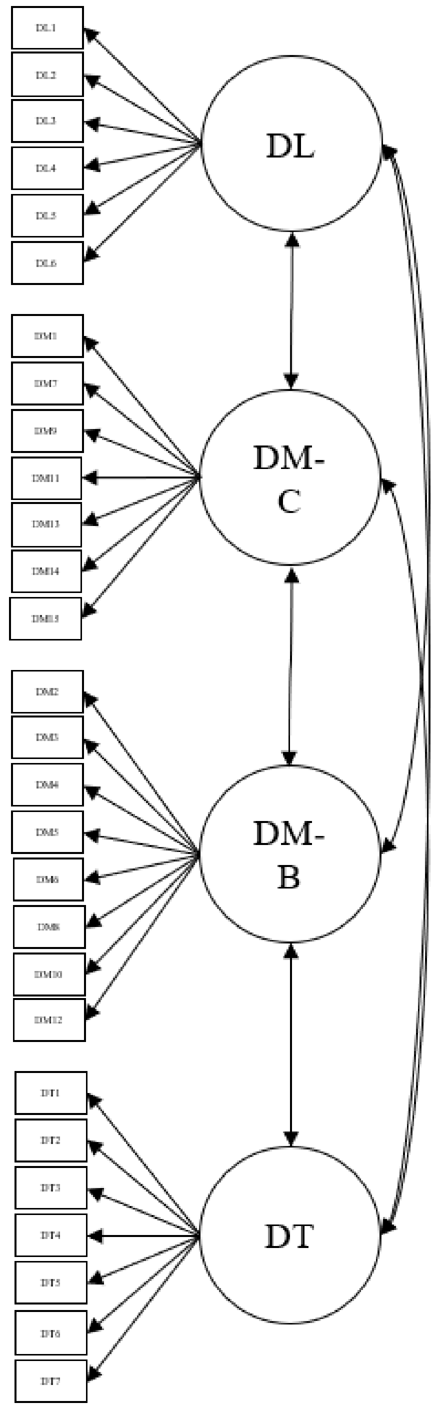

Figure 1

Proposed First-Order Correlated-Factor CFA Model

Note. DL = drive for leanness; DM-C = drive for muscularity cognitions; DM-B = drive for muscularity behaviors; DT = drive for thinness.

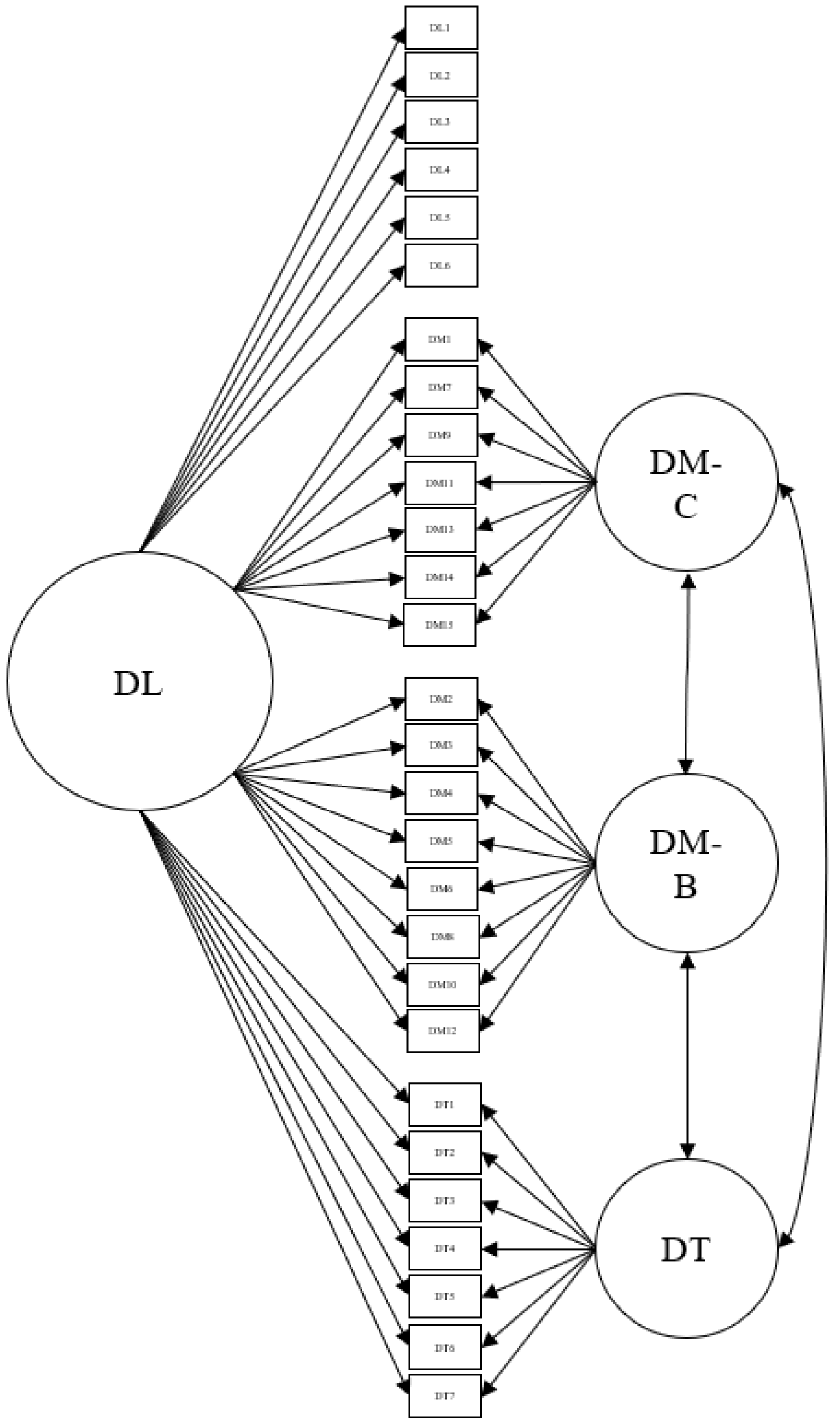

Figure 2

Proposed Bifactor S-1 CFA Model

Note. DL = drive for leanness; DM-C = drive for muscularity cognitions; DM-B = drive for muscularity behaviors; DT = drive for thinness.

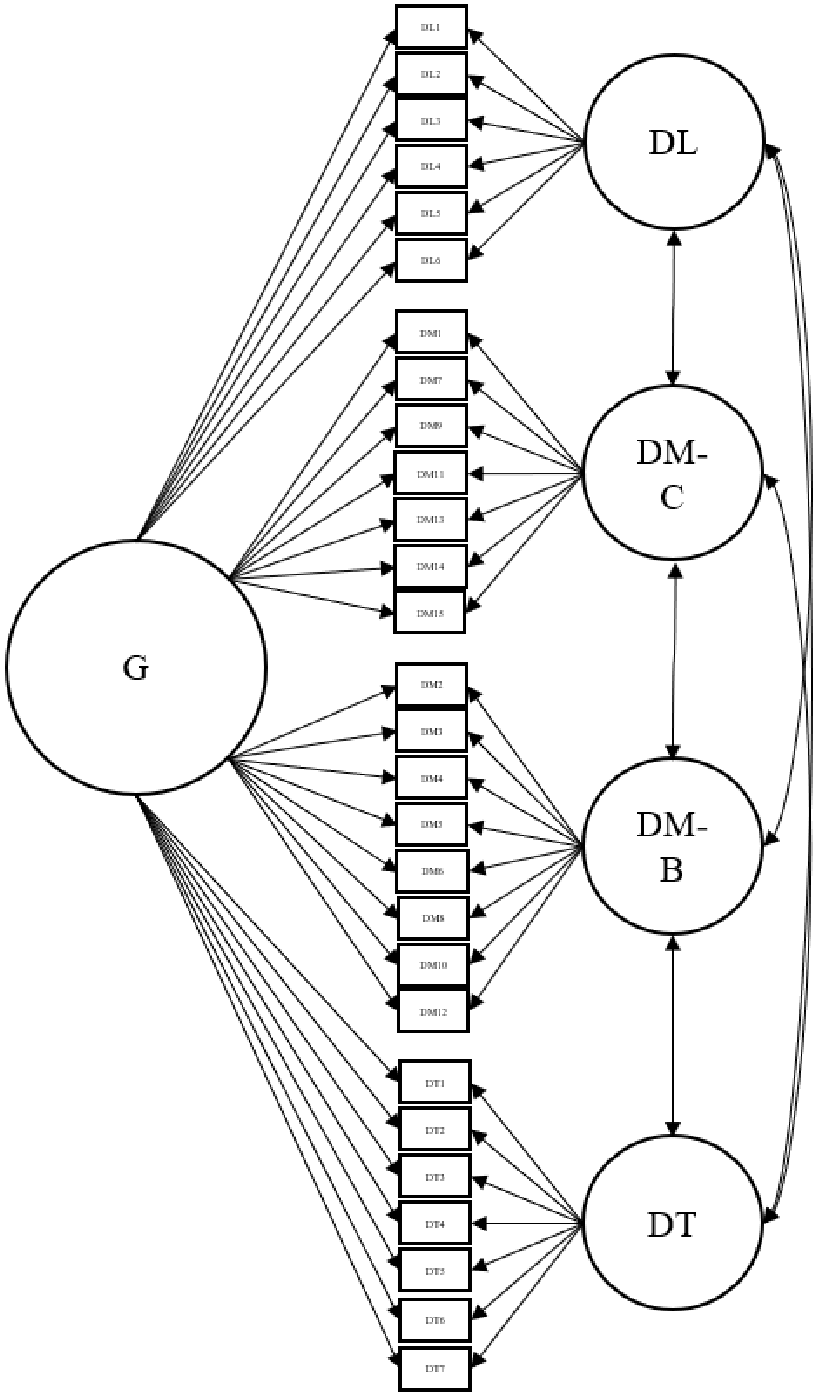

Figure 3

Proposed Full Bifactor CFA Model

Note. G = general factor; DL = drive for leanness; DM-C = drive for muscularity cognitions;

DM-B = drive for muscularity behaviors; DT = drive for thinness.

RESULTS

Breakdown of all demographic variables by survey is given in Table 1. Item level drive data are provided in Table 2. Sample sizes, means, and standard deviations of all variables of interest from both surveys are listed in Table 3. Correlations between all demographics and variables of interest within each survey can be found in Table 4.

Hypothesis 1

The Modified DLS will show good preliminary psychometric properties – this hypothesis was supported.

Cronbach's alphas were deemed adequate for the M-DLS across both survey administrations (Survey 1 α = .87; Survey 2 α = .92). Consistent with expectations, the EFA suggested one factor (via eigen values and parallel analysis, the majority of the fit statistics, and theory; see Table 5), and fit statistics were acceptable (X^2 (9, N = 360) = 76.60, p < .001; SRMR = .04; CFI = .93; RMSEA = .14; see Table 6). No items met drop requirements, and all M-DLS items loaded significantly onto one factor. The pattern of correlations between the M-DLS and other variables of interest was comparable with the pattern of correlations between the original DLS and the same variables (see Table 4).

Hypothesis 2

The hypotheses that scales measuring drive for leanness are psychometrically distinct from the EDI-DT and DMS, and drive for leanness is mostly unique from drives for thinness and muscularity, were partially supported. While no model reached predetermined levels for adequate model fit, all models approached adequate fit, lending some support to the idea that measures assessing drive for leanness are psychometrically distinct from the EDI-DT and DMS and that drive for leanness as a factor is mostly distinct from drives for thinness and muscularity.

Drive for Leanness Scale. The initial correlated, four-factor CFA including the DLS, EDI-DT, and DMS from Survey 1 demonstrated less than ideal fit (X^2 (344, N = 360) = 1253.42, $p < .001$; SRMR = .10; CFI = .83, RMSEA = .09; see Table 7). Upon examination of item loadings, it was noted that DMS item 10 (“I think about taking anabolic steroids.”) did not significantly load onto its predetermined factor; this item was removed and the CFA was re-estimated. This modified CFA resulted in similar model fit (X^2 (318, N = 360) = 1144.54, $p <$ .001; SRMR = .10; CFI = .85; RMSEA = .09). Modification indices suggested improved model fit if the errors of DMS items 3 (“I use protein or energy supplements.”) and 4 (“I drink weight gain or protein shakes.”) were correlated. Correlating these errors resulted in marginally enhanced model fit (X^2 (317, N = 360) = 1020.78, $p < .001$; SRMR = .09; CFI = .87; RMSEA = .08). No other modifications to this model were believed to be appropriate; this was deemed the final model.

While this final model did not meet the previously determined adequate fit statistic thresholds, it approached these thresholds. This is particularly noteworthy given that all items were randomly presented within this survey distribution, thereby removing the potential for survey-specific, item-position grouping effects that may enhance model fit. Of note, high latent factor correlations were observed between leanness and muscularity behaviors (r = .53), leanness and muscularity cognitions (r = .74), and muscularity behaviors and muscularity cognitions (r = .60), indicative of possible overlap between latent factors that may have impacted model fit. Thinness did not correlate highly with any other latent factor (rs < .30). Nonetheless, as this model demonstrated good global model fit in previous studies (Lang & Rancourt, 2019), it was deemed important to undertake additional analyses to try and determine the cause of the less than ideal model fit in this sample.

Given that items were randomly presented in Study 1 and produced moderate fit, a correlated-factor CFA was undertaken utilizing the DLS, EDI-DT, and DMS from Study 2 (where all items were presented in standard groupings) to discern if item- position grouping effects may have played a role in the less than ideal model fit in the previous sample. In the initial CFA including Study 2 measures, the original four-factor model demonstrated comparable fit to that observed with the Survey 1 sample (X^2 (344, N = 349) = 1213.33, $p < .001$; SRMR = .09; CFI = .87, RMSEA = .09; see Table 8). Upon examination of item loadings, it was noted that DMS item 10 ("I think about taking anabolic steroids.") did not significantly load onto its predetermined factor; this item was removed and the CFA was re-estimated. This modified CFA resulted in similar model fit (X^2 (318, N = 349) = 1121.36, $p < .001$; SRMR = .09; CFI = .88; RMSEA = .09). While this model only approached previously determined adequate global fit statistic thresholds, no other modifications to this model were believed to be appropriate; therefore, this was deemed the final model.

Of note, these final global fit statistics were comparable to that seen in the CFA from Survey 1. Further, similar to the Survey 1 model, high latent factor correlations were noted between leanness and muscularity behaviors (r = .48), leanness and muscularity cognitions (r = .63), and both muscularity factors (r = .53), while overall correlations with thinness remained low (rs < .30).

Taken together, confirmatory fit statistics for models undertaken on each survey group approached good global fit thresholds for a four-factor model in which all drive items loaded significantly onto their matching latent drive factor. While not fully supportive, these results provide more support for psychometric distinction of these drive scales, as well the uniqueness of these drive factors, than the alternative amalgamated hypothesis. Interestingly, the final model from the sample utilizing all measures in their standard groupings (presented as discrete measures) fit comparably to the final model from the sample where all items were randomly presented, suggesting that grouping effects were not responsible for the less than ideal model fit for data from Study 1. Further, neither model fit as well as comparable models in previous drive research (Lang & Rancourt, 2019).

Modified Drive for Leanness Scale. The initial correlated-factors CFA including the M-DLS, EDI-DT, and DMS demonstrated less than ideal fit (X^2 (344, N = 358) = 1333.23, $p < .001$; SRMR = .10; CFI = .82; RMSEA = .09; see Table 9). Similar to previous CFAs, DMS item 10 (“I think about taking anabolic steroids.”) did not load onto its respective factor; this item was removed and the CFA was re-estimated. This modified CFA resulted in similar model fit (X^2 (318, N = 358) = 1227.05, $p < .001$; SRMR = .10; CFI = .83; RMSEA = .09). Modification indices suggested improved model fit if the errors of DMS items 3 (“I use protein or energy supplements.”) and 4 (“I drink weight gain or protein shakes.”) were correlated; this change resulted in minorly improved model fit (X^2 (317, N = 358) = 1098.14, $p < .001$; SRMR = .10; CFI = .86; RMSEA = .08). No other modifications to this model were believed to be appropriate; this was deemed the final model.

While this final model did not meet the previously determined global fit statistic thresholds, it approached these thresholds. This is particularly noteworthy given that these analyses were run with modified DLS items and that all items were randomly presented within the survey. Of note, high latent factor correlations were observed between leanness and muscularity behaviors (*r* = .59), leanness and muscularity cognitions (*r* = .81), leanness and thinness (*r* = .33), and both muscularity factors (*r* = .60). Thinness did not correlate highly with either muscularity factor (*r*s < .30). This is similar to the pattern of correlations seen in this study's DLS models, indicative of possible overlap between latent factors that may have impacted model fit. Nonetheless, as similar models including the DLS instead of the M-DLS surpassed these same pre-determined fit statistic thresholds in previous studies (Lang & Rancourt, 2019) and it was deemed important to undertake post-hoc analyses to try and determine the cause of the less than ideal model fit in this sample.

Given that items were randomly presented in Study 1 and produced moderate fit, a correlated-factors CFA was undertaken utilizing the M-DLS, EDI-DT, and DMS from Study 2 (where all items were presented in standard groupings) to discern if measure grouping, item-position effects may have played a role in the less than ideal model fit. In the initial CFA including Study 2 measures, the original four factor model demonstrated comparable fit to that observed with the Survey 1 sample (X^2 (344, *N* = 350) = 1338.39, $p < .001$; SRMR = .10; CFI = .86, RMSEA = .09; see Table 10). Upon examination of item loadings, it was noted that DMS item 10 ("I think about taking anabolic steroids.") did not significantly load onto its predetermined factor; this item was removed and the CFA was re-estimated. This modified CFA resulted in similar model fit (X^2 (318, *N* = 350) = 1245.28, $p < .001$; SRMR = .09; CFI = .87; RMSEA = .09). While this model only approached previously determined global fit statistic thresholds, no other modifications to this model were believed to be appropriate; therefore, this was deemed the final model.

Of note, these final global fit statistics were comparable to that seen in the CFA from Survey 1. Further, similar to all other models, high latent factor correlations were noted between leanness and muscularity behaviors (r = .44) leanness and muscularity cognitions (r = .69), leanness and thinness (r = .30), and both muscularity factors (r = .53). Thinness did not correlate highly with either muscularity factor (rs < .30).

Taken together, confirmatory fit statistics for models undertaken on each survey group approached good global fit thresholds for the original four-factor model in which all drive items loaded significantly onto their matching latent drive factor. Again, while not fully supportive, these results provide more support for psychometric distinction of these drive scales, as well the uniqueness of these drive factors, than the alternative amalgamated hypothesis. Interestingly, the final model from the sample utilizing all measures in their standard groupings (presented as discrete measures) fit comparably to the final model from the sample where all items were randomly presented. This lends more evidence to the idea that grouping effects did not play a role in less than ideal global model fit for these specific samples.

Hypothesis 2 Summary. The final confirmatory models in this study using the DLS and M-DLS did not fit as well as similar models in extant leanness work; however, the idea that perhaps there were survey grouping, item-position effects and semantic effects in past factor analysis attempts including the drive scales was not supported. Overall, in direct comparisons, while models using Survey 2 data (where items were presented in their standard measure ordering) fit better than models using Survey 1 data (where items were randomized), these fits were only negligibly better, suggesting minimal impact of item-positioning effects on model fit. Similarly, while models using the original DLS fit better than models utilizing the M-DLS, fit statistics were only marginally better, suggesting minimal impact of wording effects. Nonetheless, while not reaching predetermined levels of adequate model fit, most analyses approached these thresholds. This lends partial support to the hypothesis that measures assessing drive for leanness are psychometrically distinct from the EDI-DT and DMS, and that drive for leanness is best described as unique from drives for muscularity and thinness. However, high intercorrelations between leanness and muscularity latent variables across all models support investigation into overlap between these latent drive constructs.

Finally, as the fit of models including the M-DLS was only marginally worse than those utilizing the DLS, and because the wording of the M-DLS is more comparable to phrasing used in the other drive measures, the M-DLS was utilized for the remainder of analyses.

Hypothesis 3

The hypothesis that drive for leanness is *not* best described as an amalgamation of drives for muscularity and thinness was supported. While the model showed decent global fit, factor loadings did not support that drive for leanness is best described as an amalgamation of the other drives. Rather, there was factor overlap between drives for leanness and muscularity, while thinness remained distinct at a factor level.

The initial bifactor *S*-1 CFA including the M-DLS, EDI-DT, and DMS demonstrated less than ideal global model fit (X^2 (325, N = 350) = 1102.84, $p < .001$; SRMR = .07; CFI = .89; RMSEA = .08; see Table 11). Upon investigation of item loadings, DMS item 10 (“I think about taking anabolic steroids.”) did not load onto its respective group factor, nor the general factor; this item was removed and the CFA was re-estimated. This modified CFA resulted in similar global model fit (X^2 (300, N = 350) = 1030.53, $p < .001$; SRMR = .07; CFI = .89; RMSEA = .08). Modification indices suggested improved model fit if the errors of M-DLS items 4 (“I think I would be more attractive if I looked more athletic.”) and 6 (“I think I would look better in clothes if I was well-toned.”) were correlated; this change resulted in minor improvements in global model fit (X^2 (299, N = 350) = 930.86, $p < .001$; SRMR = .07; CFI = .91; RMSEA = .08).

In this model, DMS item 12 ("I think that my weight training schedule interferes with other aspects of my life.") did not load onto its respective group factor, nor the general factor; this item was removed and the CFA was re-estimated. This modified CFA resulted in similar global model fit (X^2 (275, N = 350) = 853.22, $p < .001$; SRMR = .07; CFI = .91; RMSEA = .08). No other modifications to this model were believed to be appropriate; this was deemed the final model with most of the global fit statistics evidencing adequate model fit.

Examination of item loadings in this model revealed that all retained items loaded significantly and strongly onto their group factor (> .40), but that only about a third also loaded significantly and strongly onto the general factor (see Table 12). More specifically, items that loaded strongly onto the general factor included all M-DLS items, as well as 8 of the 15 DMS items, suggesting some overlap between drives for leanness and muscularity. However, no EDI-DT items loaded significantly onto the latent general leanness factor, suggesting that drive for leanness is not best described as an amalgamation of drives for thinness and muscularity.

Ancillary measures further provided evidence that did not support the amalgamation hypothesis. In terms of observed scores, the M-DLS correlated > .30 with both DMS subscales, supporting a general factor that represents an overlap of muscularity onto leanness; however, the EDI-DT did not correlate > .30 with any other drive measure. In looking at latent constructs, while the general leanness latent factor was not allowed to correlate with any of the group factors in this model, none of the latent group factors correlated > .30. The explained common variance (ECV_{GEN} = .60) supported the utility of retaining the group factors, suggesting that the variance associated with the drive items could not be completely explained by the general factor. The percent of uncontaminated correlations (PUC = .78) was small enough that, when interpreted in conjunction with ECV_{GEN}, retention of the group factors was supported. Of twenty individual explained common variances ($IECV_{GEN}$), the latent general leanness factor accounted for more common variance than the specific group factor for only seven items, further supporting the retention of group factors (see Table 13). Overall, these ancillary measures did not support full amalgamation, lending evidence to the idea that drive for leanness *is not* best described as an amalgamation of drives for thinness and muscularity.

To better understand the relationship of drive for leanness with the general drive factor, post-hoc analyses, including a full bifactor CFA and calculation of $IECV_{GEN}$, were undertaken. In this model, drives for leanness, thinness, and muscularity were all entered as group factors, while the general factor was left unidentified (see Figure 3). The initial full bifactor CFA including the M-DLS, EDI-DT, and DMS demonstrated less than ideal global model fit (X^2 (316, N = 350) = 940.16, $p < .001$; SRMR = .06; CFI = .91; RMSEA = .08; see Table 14). Upon investigation of item loadings, DMS item 10 ("I think about taking anabolic steroids.") did not load onto its respective group factor, nor the general factor; this item was removed and the CFA was re-estimated. This modified CFA resulted in similar global model fit (X^2 (291, N = 350) = 868.68, $p < .001$; SRMR = .05; CFI = .92; RMSEA = .08). No other modifications to this model were believed to be appropriate so this was deemed the final model.

Examination of M-DLS item loadings in this model revealed that while only two-thirds of the items loaded significantly onto the specific leanness group factor (> .40), *all* M-DLS items loaded significantly and strongly onto the latent general drive factor (see Table 15). Further, of all individual explained common variances ($IECV_{GEN}$) for M-DLS items, the latent general drive factor accounted for more common variance than the specific leanness group factor for every single item. Taken together, these analyses support the idea that while there is some variance in drive for leanness attributable to a specific drive for leanness group factor, the vast majority of the variance globally, as well as within each individual M-DLS item, is better attributable to a general drive factor. More simply put, drive for leanness is best quantified by a general drive factor, as opposed to a specific group factor. Finally, of note, in terms of $IECV_{GEN}$ for EDI-DT and DMS items, about half the drive for muscularity cognition items, no drive for muscularity behavior items, and a quarter of the drive for thinness items had more variance attributable to the general factor than their respective groups factors (see Table 16). This supports the retention of the latent thinness group factor, as well as both latent muscularity group factors.

Hypothesis 3 Summary: The final bifactor *S*-1 CFA model evidenced adequate fit based on most global fit statistics. Exploration of item loadings revealed that while about half of the items from the DMS loaded significantly onto the latent general leanness factor, no items from the EDI-DT loaded significantly onto it. No ancillary measures of model fit reached their predetermined fit thresholds, thereby not supporting a fully amalgamated model. Further, only about one-third of all items (all from the DMS) were more strongly associated with the general factor than their group factor, once again indicating the absence of a fully encapsulating general factor. However, a full bifactor model supported the idea that drive for leanness is best quantified as a general factor, while lending little support to simultaneous retention of a specific drive for leanness group factor.

In sum, these findings provide support for the hypothesis that drive for leanness is *not* best described as an amalgamation of drives for thinness and muscularity; however, further exploration of the overlap between leanness and muscularity is warranted. The bifactor *S*-1 model, including the overlapping leanness/muscularity general latent factor, as well as the two muscularity latent group factors and one thinness latent group factor, was therefore used as the associative model for the remainder of analyses.

Hypothesis 4

First, the hypothesis that the drive for thinness latent group factor would only be associated with constructs typically aimed at achieving thinness (i.e., purging, restricting, binge eating, body dissatisfaction, cognitive restraint, excessive exercise) was fully supported. Second, the hypothesis that both drive for muscularity latent group factors would only be associated with constructs typically aimed at achieving muscularity (i.e., muscle-building behaviors, body dissatisfaction, cognitive restraint, excessive exercise) was partially supported. Finally, the hypothesis that the overlapping leanness/muscularity general latent factor would only be associated with constructs aimed at simultaneous muscle gain and body fat loss (body dissatisfaction, cognitive restraint, excessive exercise), as well as outcomes solely associated with attempting to achieve muscularity (muscle building), was partially supported.

Drive for thinness latent group factor. Consistent with hypotheses, extensions of the final bifactor *S*-1 CFA suggested that greater drive for thinness was significantly associated with more purging (*Standardized Est.* = .42, $p < .001$; see Table 17), restricting (*Standardized Est*. = .33, $p < .001$), binge eating (*Standardized Est*. = .48, $p < .001$), and excessive exercise (*Standardized Est.* = .22, $p < .001$), as well as higher levels of body dissatisfaction (*Standardized Est.* = .65, $p < .001$) and cognitive restraint (*Standardized Est.* = .51, $p < .001$). As anticipated, this latent group factor was not significantly associated with muscle building (*Standardized Est.* = .08, $p = .02$; non-significant after Holm-Bonferroni adjustment).

Drive for muscularity cognitions latent group factor. Consistent with hypotheses, extensions of the final bifactor *S*-1 CFA suggested that more drive for muscularity cognitions was significantly associated with greater levels of muscle building behaviors (*Standardized Est.* = .18, $p < .001$; see Table 18) and body dissatisfaction (*Standardized Est.* = .15, $p = .001$). As anticipated, this latent group construct was not significantly associated with purging (*Standardized Est.* = -.06, *p* = .28), restricting (*Standardized Est.* = .16, *p* = .008; non-significant after adjustment), nor binge eating (*Standardized Est*. = .05, *p* = .36). However, contrary to hypotheses, more drive for muscularity cognitions was significantly associated with *less* cognitive restraint (i.e., less dieting behavior, *Standardized Est.* = -.15, *p* = .001) and *less* excessive exercise (*Standardized Est.* = -.16, *p* < .001).

Drive for muscularity behaviors latent group factor. Consistent with hypotheses, extensions of the final bifactor *S*-1 CFA suggested that more drive for muscularity behaviors was significantly associated with more muscle building behaviors (*Standardized Est*. = .67, *p* < .001; see Table 19), more cognitive restraint (*Standardized Est.* = .40, *p* < .001), and more excessive exercise (*Standardized Est.* = .61, *p* < .001). As anticipated, this latent group factor was not significantly associated with restricting (*Standardized Est.* = .13, *p* = .03; non-significant after adjustment). However, inconsistent with hypotheses, more drive for muscularity behaviors was significantly associated with more frequent purging (*Standardized Est.* = .23, *p* < .001) and binge eating (*Standardized Est*. = .17, *p* = .001). This latent group factor was *not* significantly associated with body dissatisfaction (*Standardized Est.* = -.04, *p* = .44).

Overlapping leanness/muscularity general latent factor. Consistent with hypotheses, extensions of the final bifactor *S*-1 CFA suggested that higher scores on the overlapping leanness/muscularity general latent factor was significantly associated with more muscle-building behavior (*Standardized Est.* = .42, *p* < .001; see Table 20), more excessive exercise (*Standardized Est.* = .47, *p* < .001), more body dissatisfaction (*Standardized Est.* = .33, *p* < .001), and more cognitive restraint (*Standardized Est.* = .33, *p* < .001). As anticipated, this general latent factor was not significantly associated with restricting (*Standardized Est*. = -.01, *p* = .86).

However, inconsistent with hypotheses, greater drive for leanness was significantly associated with more frequent purging (*Standardized Est.* = .15, *p* = .004) and binge eating (*Standardized Est*. = .22, *p* < .001).

Hypothesis 4 Summary. While the hypothesis regarding drive for thinness was fully supported, none of the other hypotheses involving drive for muscularity cognitions, drive muscularity behaviors, nor the overlapping leanness/muscularity construct and disordered eating-related outcomes were fully supported. Overall, associations amongst the *S*-1 derived latent drive factors and disordered eating outcomes varied from what was predicted in an over-representation of negative associations. Specifically, and most relevant to study aims, drive for leanness, when quantified as an overlapping general latent drive factor of drive for leanness and drive for muscularity, was associated with all the leanness and muscularity outcomes that were predicted; however, not congruent with hypotheses, drive for leanness was positively related to most solely thinness-related outcomes as well.

Hypothesis 5

The hypothesis that the overlapping leanness/muscularity general latent factor and the drive for muscularity latent group factors would predict good global mental health, while the drive for thinness latent group factor would predict poor global mental health, was partially supported.

In support of hypotheses, an extension of the final bifactor *S*-1 CFA suggested that greater drive for thinness was significantly associated with worse global mental health (*Standardized Est.* = -.32, *p* < .001; see Table 21). However, discrepant from hypotheses predicting positive relationships, neither the overlapping leanness/muscularity general latent factor (*Standardized Est.* = .00, *p* = .97), nor drive for muscularity behaviors (*Standardized Est.*

= -.05, p = .43), were significantly associated with global mental health. Further discrepant from hypotheses, more drive for muscularity cognitions was associated with poorer global mental health (*Standardized Est.* = -.27, $p < .001$). Similar to what was found with disordered eating outcomes, associations amongst the *S*-1 derived latent drive factors and global mental health varied from what was predicted.

Exploratory Analysis

All latent group factors were significantly and negatively related to global physical health; however, the overlapping leanness/muscularity general latent factor was not significantly associated with global physical health.

An extension of the final bifactor *S*-1 CFA suggested that greater drive for thinness was significantly associated with worse global physical health (*Standardized Est.* = -.29, $p < .001$; see Table 22). Similarly, more drive for muscularity behaviors (*Standardized Est.* = -.16, p = .006) and more drive for muscularity cognitions (*Standardized Est.* = -.15, p = .01) were significantly associated with worse global physical health; however, these associations were weaker than those observed with drive for thinness. The overlapping leanness/muscularity general latent factor was not significantly associated with global physical health (*Standardized Est.* = .07, p = .20).

Table 3

Ns, Means, and SDs for All Variables, as well as Comparison Statistics Via Independent Sample t-tests for Main Continuous Variables and Chi Squares for Main Categorical Variables

	Survey 1			Survey 2					
	N	*M*	*SD*	*N*	*M*	*SD*	*t(df)* or $X^2(df)$	*p*	*d or v*
DL	360	3.73	1.12	349	3.83	1.21	*t*(707) = -1.15	.25	0.08
MDL	360	3.76	1.21	350	4.03	1.33	*t*(696) = -2.85	**.004**	0.21
DM	360	2.54	0.91	350	2.44	1.00	*t*(708) = 1.48	.14	0.10
DT	358	2.98	1.32	350	2.95	1.35	*t*(760) = 0.23	.82	0.02
GPH				348	19.41	3.01			
GMH				349	12.77	3.56			
BD				347	6.28	5.53			
Binge Eating				347	4.02	4.02			
Cog Res				346	2.38	2.31			
Purging				346	0.48	1.31			
Restricting				347	2.89	3.58			
Exc Ex				347	3.16	3.79			
Musc Build				347	1.84	2.67			
Age	360	20.93	4.79	350	20.61	4.09	*t*(708) = 0.94	.35	0.07
BMI	359	25.02	6.02	350	25.05	6.10	*t*(707) = -0.07	.94	0.00
Sex	360			350			$X^2(1) = 0.16$	.69	0.00
Race	360			350			$X^2(5) = 2.05$	.84	0.00
Ethnicity	360			350			$X^2(1) = 0.28$	.28	0.00
Year College	360			350			$X^2(4) = 1.11$	.89	0.00
Marital Status	360			350			$X^2(5) = 1.68$	.89	0.00
Sex Orient	360			350			$X^2(3) = 2.47$	.48	0.00

Note. **Bold** indicates significant *p* value. *t* = t-test, X^2 = Chi-square, *df* = degrees of freedom, *d* = Cohen's d, *v* = Cramer's v, DL = Drive for Leanness; MDL = Modified Drive for Leanness; DM = Drive for Muscularity; DT = Drive for Thinness; GPH = Global Physical Health; GMH = Global Mental Health; BD = Body Dissatisfaction; Cog Res = Cognitive Restraint; Exc Ex = Excessive Exercise; Musc Build = Muscle Building; BMI = Body Mass Index; Sex Orient = Sexual Orientation.

Table 4

Correlations Between All Inter-Survey Measures and Important Demographic Variables

	Age	Sex	BMI	DL	MDL	DM	DT	GPH	GMH	BD	Binge	Cog Res	Purge	Restr	Exc Ex	MuscBuild
Age	-	.04	.25**	.02	.01	-.05	.01									
Sex	-.00	-	.05	-.13*	-.10	-.38**	.27**									
BMI	.29**	-.04	-	-.02	.02	-.10	.37**									
DL	-.06	-.16**	-.06	-	.90**	.63**	.25**									
MDL	-.05	-.12*	-.02	.86**	-	.66**	.33**									
DM	-.06	-.41**	-.09	.60**	.61**	-	.06									
DT	.03	.19**	.31**	.22**	.29**	.01	-									
GPH	-.13*	-.07	-.17**	.07	.03	-.09	-.18**	-								
GMH	.01	-.13*	-.00	.01	-.03	-.11*	-.24**	.42**	-							
BD	.10	.25**	.29**	.27**	.35**	.13*	.67**	-.29**	-.39**	-						
Binge	-.07	.06	.16**	.25**	.24**	.17**	.45**	-.21**	-.24**	.48**	-					
Cog Res	.10	.06	.16**	.28**	.29**	.23**	.54**	-.08	-.03	.36**	.27**	.				
Purge	.11*	.09	.23**	.15**	.17**	.12*	.38**	-.21**	-.08	.36**	.42**	.28**	.			
Restr	.03	.06	-.07	.02	.02	.08	.22**	-.25**	-.23**	.32**	.24**	.14**	.25**	-		
Exc Ex	.02	-.16**	.02	.47**	.43**	.53**	.25**	-.05	-.02	.17**	.25**	.55**	.25**	.08	-	
Musc Build	-.01	-.33**	-.08	.45**	.42**	.75**	.03	-.12*	-.12*	.17*	.23**	.31**	.15**	.16**	.61**	-

Note. Data above the diagonal are from Survey 1; data below the diagonal are from Survey 2. *p < .05; **p < 0.01; BMI = Body Mass Index; DL = Drive for Leanness; MDL = Modified Drive for Leanness; DM = Drive for Muscularity; DT = Drive for Thinness; GPH = Global Physical Health; GMH = Global Mental Health; BD = Body Dissatisfaction; Binge = Binge Eating; Cog Res = Cognitive Restraint; Purge = Purging; Restr = Restricting; Exc Ex = Excessive Exercise; Musc Build = Muscle Building.

Table 5

Goodness-of-fit Indicators from the EFA Including Items from the Modified Drive for Leanness Scale

Factor Extraction	$X^2(df)$	SRMR	CFI	RMSEA	Eigen Values	Parallel Analysis
1	$X^2(9)=76.604^{***}$	**.043**	**.930**	.144	X	X
2	$X^2(4)=20.870^{***}$	**.022**	**.983**	.108		
3	-	-	-	-		

Note. N = 360. **p* < .05; ***p* < .01; ****p* < .001. The 3-factor model did not converge. **Bold** indicates good fit. SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

Table 6

EFA Pattern Coefficients from the Model of Best Fit for the Items from the Modified Drive for Leanness Scale

Item	Drive for Leanness
1. I think my body looks best when it is well-toned.	**.802**
2. When my body is hard and firm, it says I am well-disciplined.	**.728**
3. My goal is to have well-toned muscles.	**.760**
4. I think I would be more attractive if I looked more athletic.	**.705**
5. It is important for me to have well-defined abs.	**.607**
6. I think I would look better in clothes if I was well-toned.	**.744**

Note. *N* = 360. Factor loadings and eigenvalues were obtained using a Geomin rotation. **Bold** indicates factor loadings > .40.

Table 7

Goodness-of-fit Indicators for CFAs Including Items from the Survey 1 Collection of the Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale

Model	$X^2(df)$	SRMR	CFI	RMSEA
1 Original	$X^2(344)=1253.419$***	.097	.833	.086
2 Dropped DM10	$X^2(318)=1144.541$***	.095	.846	.085
3 Model 2 + Correlated errors DM3 & DM4	$X^2(317)=1020.782$***	.091	.869	.079

Note. $N = 360$. *$p < .05$; **$p < .01$; ***$p < .001$. DM = Drive for Muscularity Scale item; SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

Table 8

Goodness-of-fit Indicators for CFAs Including Items from the Survey 2 Collection of the Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale

Model	$X^2(df)$	SRMR	CFI	RMSEA
1 Original	$X^2(344)=1213.325^{***}$	.091	.871	.085
2 Dropped DM10	$X^2(318)=1121.361^{***}$	.089	.879	.085

Note. $N = 349$. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$. DM = Drive for Muscularity Scale item; SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

Table 9

Goodness-of-fit Indicators for CFAs Including Items from the Survey 1 Collection of the Modified Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale

Model	$X^2(df)$	SRMR	CFI	RMSEA
1 Original	$X^2(344)=1333.233^{***}$	.102	.821	.090
2 Dropped DM10	$X^2(318)=1227.051^{***}$	.100	.833	.089
3 Model 2 + Correlated errors DM3 & DM4	$X^2(317)=1098.138^{***}$	.097	.856	.083

Note. N = 358. *$p < .05$; **$p < .01$; ***$p < .001$. DM = Drive for Muscularity Scale item; SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

Table 10

Goodness-of-fit Indicators for CFAs Including Items from the Survey 2 Collection of the Modified Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale

Model	$X^2(df)$	SRMR	CFI	RMSEA
1 Original	$X^2(344)=1338.391$***	.095	.857	.091
2 Dropped DM10	$X^2(318)=1245.284$***	.093	.865	.091

Note. N = 350. *p < .05; **p < .01; ***p < .001. DM = Drive for Muscularity Scale item; SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

Table 11

Goodness-of-fit Indicators for S-1 CFAs Including Items from the Modified Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale

Model	$X^2(df)$	SRMR	CFI	RMSEA
1 Original	$X^2(325)=1120.839$***	**.072**	.886	.084
2 Dropped DM10	$X^2(300)=1030.532$***	**.067**	.894	.083
3 Model 2 + Correlated errors MDL4 & MDL6	$X^2(299)=930.856$***	**.069**	**.908**	.078
4 Model 3 + Dropped DM12	$X^2(275)=853.222$***	**.068**	**.914**	.078

Note. $N = 350$. *$p < .05$; **$p < .01$; ***$p < .001$. **Bold** indicates good fit. DM = Drive for Muscularity Scale item; MDL = Modified Drive for Leanness Scale item; SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

Table 12

Bifactor S-1 CFA Pattern Coefficients from the Final CFA for the Items of the Modified Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale

Item	General Leanness	Thinness	DM: Bx	DM: Cog
1. I think my body looks best when it is well-toned. (MDL1)	**.764**			
2. When my body is hard and firm, it says I am well-disciplined. (MDL2)	**.796**			
3. My goal is to have well-toned muscles. (MDL3)	**.887**			
4. I think I would be more attractive if I looked more athletic. (MDL4)	**.799**			
5. It is important for me to have well-defined abs. (MDL5)	**.777**			
6. I think I would look better in clothes if I was well-toned. (MDL6)	**.792**			
7. I wish that I were more muscular. (DM1)	**.718**			**.439**
8. I lift weights to build my muscle. (DM2)	**.610**		**.459**	
9. I use protein or energy supplements. (DM3)	.305		**.763**	
10. I drink weight gain or protein shakes. (DM4)	.276		**.809**	
11. I try to consume as many calories as I can in a day. (DM5)	.179		**.680**	
12. I feel guilty if I miss a weight training session. (DM6)	**.499**		**.518**	
13. I think I would feel more confident if I had more muscle mass. (DM7)	**.601**			**.663**
14. Other people think I work out with weights too often. (DM8)	.264		**.584**	
15. I think that I would look better if I gained 10 pounds of bulk. (DM9)	.283			**.556**
16. I think that I would feel stronger if I gained a little more muscle mass. (DM11)	**.552**			**.616**
17. I think that my arms are not muscular enough. (DM13)	**.536**			**.625**
18. I think that my chest is not muscular enough. (DM14)	**.470**			**.630**
19. I think that my legs are not muscular enough. (DM15)	**.513**			**.525**
20. I eat sweets and carbohydrates without feeling nervous. (DT1)	.138	**.428**		
21. I think about dieting. (DT2)	.338	**.621**		
22. I feel extremely guilty after overeating. (DT3)	.275	**.780**		
23. I am terrified of gaining weight. (DT4)	.189	**.883**		
24. I exaggerate or magnify the importance of weight. (DT5)	.279	**.709**		
25. I am preoccupied with the desire to be thinner. (DT6)	.242	**.853**		
26. If I gain a pound, I worry that I will keep gaining. (DT7)	.186	**.892**		

Note. $N = 350$. Factor loadings and eigenvalues were obtained using a Geomin rotation. **Bold** indicates factor loadings > .40. Bx = behaviors; Cog = cognitions; MDL = Modified Drive for Leanness Scale item; DM = Drive for Muscularity Scale item; DT = Drive for Thinness subscale item.

Table 13

$IECV_{GEN}$ Values for Each Item from the DMS and EDI-DT in the Final Bifactor S-1 Model

Measure	Item	$IECV_{GEN}$
DMS-B		
	2. I lift weights to build my muscle.	**.729**
	3. I use protein or energy supplements.	.197
	4. I drink weight gain or protein shakes.	.151
	5. I try to consume as many calories as I can in a day.	.096
	6. I feel guilty if I miss a weight training session.	**.586**
	8. Other people think I work out with weights too often.	.238
DMS-C		
	1. I wish that I were more muscular.	**.825**
	7. I think I would feel more confident if I had more muscle mass.	**.591**
	9. I think that I would look better if I gained 10 pounds of bulk.	.313
	11. I think that I would feel stronger if I gained a little more muscle mass.	**.586**
	13. I think that my arms are not muscular enough.	**.565**
	14. I think that my chest is not muscular enough.	.495
	15. I think that my legs are not muscular enough.	**.627**
EDI-DT		
	1. I eat sweets and carbohydrates without feeling nervous.	.177
	2. I think about dieting.	.380
	3. I feel extremely guilty after overeating.	.205
	4. I am terrified of gaining weight.	.087
	5. I exaggerate or magnify the importance of weight.	.244
	6. I am preoccupied with the desire to be thinner.	.143
	7. If I gain a pound, I worry that I will keep gaining.	.083

Note. $N = 350$. **Bold** indicates items that fit the general factor better than their own specified group factor. DMS-B = Drive for Muscularity Scale – Behaviors subscale; DMS-C = Drive for Muscularity Scale – Cognitions subscale; EDI-DT = Eating Disorder Inventory – Drive for Thinness subscale.

Table 14

Goodness-of-fit Indicators for Full Bifactor CFAs Including Items from the Modified Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale

Model	$X^2(df)$	SRMR	CFI	RMSEA
1 Original	$X^2(316)=940.160^{***}$	**.059**	**.910**	.075
2 Dropped DM10	$X^2(291)=868.681^{***}$	**.054**	**.916**	.075

Note. N = 350. **p* < .05; ***p* < .01; ****p* < .001. **Bold** indicates good fit. DM = Drive for Muscularity Scale item; MDL = Modified Drive for Leanness Scale item; SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

Table 15

Full Bifactor CFA Pattern Coefficients from the Final CFA for the Items of the Modified Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale

Item	G	Drive for Leanness	Drive for Thinness	DM: Cognitions	DM: Behaviors
1. I think my body looks best when it is well-toned. (MDL1)	**.560**	**.530**			
2. When my body is hard and firm, it says I am well-disciplined. (MDL2)	**.552**	**.587**			
3. My goal is to have well-toned muscles. (MDL3)	**.612**	**.644**			
4. I think I would be more attractive if I looked more athletic. (MDL4)	**.791**	.359			
5. It is important for me to have well-defined abs. (MDL5)	**.584**	**.494**			
6. I think I would look better in clothes if I was well-tones. (MDL6)	**.803**	.335			
7. I wish that I were more muscular. (DM1)	**.717**			**.458**	
8. I lift weights to build my muscle. (DM2)	.311				**.685**
9. I use protein or energy supplements. (DM3)	.017				**.790**
10. I drink weight gain or protein shakes. (DM4)	-.043				**.819**
11. I try to consume as many calories as I can in a day. (DM5)	-.155				**.708**
12. I feel guilty if I miss a weight training session. (DM6)	.253				**.698**
13. I think I would feel more confident if I had more muscle mass. (DM7)	**.632**			**.634**	
14. Other people think I work out with weights too often. (DM8)	-.004				**.668**
15. I think that I would look better if I gained 10 pounds of bulk. (DM9)	.110			**.730**	
16. I think that I would feel stronger if I gained a little more muscle mass. (DM11)	**.452**			**.721**	
17. I think that my weight training schedule interferes with other aspects of my life. (DM12)	.185				**.479**
18. I think that my arms are not muscular enough. (DM13)	**.621**			**.530**	
19. I think that my chest is not muscular enough. (DM14)	**.492**			**.591**	
20. I think that my legs are not muscular enough. (DM15)	**.526**			**.504**	
21. I eat sweets and carbohydrates without feeling nervous. (DT1)	.186		**.416**		
22. I think about dieting. (DT2)	**.453**		**.527**		
23. I feel extremely guilty after overeating. (DT3)	**.478**		**.674**		
24. I am terrified of gaining weight. (DT4)	**.474**		**.766**		
25. I exaggerate or magnify the importance of weight. (DT5)	**.460**		**.600**		
26. I am preoccupied with the desire to be thinner. (DT6)	**.478**		**.735**		
27. If I gain a pound, I worry that I will keep gaining. (DT7)	**.471**		**.777**		

Note. $N = 350$. Factor loadings and eigenvalues were obtained using a Geomin rotation. **Bold** indicates factor loadings > .40. MDL = Modified Drive for Leanness Scale item; DM = Drive for Muscularity Scale item; DT = Drive for Thinness subscale item

Table 16

$IECV_{GEN}$ Values for Each Item from the M-DLS, DMS, and EDI-DT in the Final Full Bifactor Model

Measure	Item	$IECV_{GEN}$
M-DLS		
	1. I think my body looks best when it is well-toned.	**.570**
	2. When my body is hard and firm, it says I am well-disciplined.	**.502**
	3. My goal is to have well-toned muscles.	**.504**
	4. I think I would be more attractive if I looked more athletic.	**.839**
	5. It is important for me to have well-defined abs.	**.604**
	6. I think I would look better in clothes if I was well-toned.	**.862**
DMS-B		
	2. I lift weights to build my muscle.	.221
	3. I use protein or energy supplements.	.001
	4. I drink weight gain or protein shakes.	.014
	5. I try to consume as many calories as I can in a day.	.064
	6. I feel guilty if I miss a weight training session.	.147
	8. Other people think I work out with weights too often.	.004
DMS-C		
	1. I wish that I were more muscular.	**.790**
	7. I think I would feel more confident if I had more muscle mass.	**.606**
	9. I think that I would look better if I gained 10 pounds of bulk.	.025
	11. I think that I would feel stronger if I gained a little more muscle mass.	.380
	12. I think that my weight training schedule interferes with other aspects of my life.	.158
	13. I think that my arms are not muscular enough.	**.679**
	14. I think that my chest is not muscular enough.	**.505**
	15. I think that my legs are not muscular enough.	**.615**
EDI-DT		
	1. I eat sweets and carbohydrates without feeling nervous.	.242
	2. I think about dieting.	**.557**
	3. I feel extremely guilty after overeating.	.472
	4. I am terrified of gaining weight.	.411
	5. I exaggerate or magnify the importance of weight.	**.506**
	6. I am preoccupied with the desire to be thinner.	.452
	7. If I gain a pound, I worry that I will keep gaining.	.398

Note. $N = 350$. **Bold** indicates items that fit the general factor better than their own specific group factor. M-DLS = Modified Drive for Leanness Scale; DMS-B = Drive for Muscularity Scale – Behaviors subscale; DMS-C = Drive for Muscularity Scale – Cognitions subscale; EDI-DT = Eating Disorder Inventory – Drive for Thinness subscale.

Table 17

Drive for Thinness Latent Group Factor in the Prediction of Eating Disorder-Related Outcomes

Outcome Category	Outcome	*Est.*	*SE*	*p*
Thinness-Related				
	Purging	.418	.048	**<.001**
	Restricting	.334	.052	**<.001**
	Binge Eating	.477	.045	**<.001**
Muscularity-Related				
	Muscle Building	.083	.036	.02
Both Thinness- and Muscle-Related				
	Excessive Exercise	.217	.042	**<.001**
	Body Dissatisfaction	.645	.032	**<.001**
	Cognitive Restraint	.509	.039	**<.001**

Note. N = 345. **Bold** indicates significant p value as determined by the Holm-Bonferroni Method. *Est.* = Standardized Estimate; *SE* = Standard Error.

Table 18

Drive for Muscularity Cognitions Latent Group Factor in the Prediction of Eating Disorder-Related Outcomes

Outcome Category	Outcome	*Est.*	*SE*	*p*
Thinness-Related				
	Purging	-.061	.057	.28
	Restricting	.157	.059	.008
	Binge Eating	.050	.055	.36
Muscularity-Related				
	Muscle Building	.180	.037	**<.001**
Both Thinness- and Muscle-Related				
	Excessive Exercise	-.156	.045	**<.001**
	Body Dissatisfaction	.150	.044	**.001**
	Cognitive Restraint	-.154	.048	**.001**

Note. *N* = 345. **Bold** indicates significant *p* value as determined by the Holm-Bonferroni Method. *Est.* = Standardized Estimate; *SE* = Standard Error.

Table 19

Drive for Muscularity Behaviors Latent Group Factor in the Prediction of Eating Disorder-Related Outcomes

Outcome Category	Outcome	*Est.*	*SE*	*p*
Thinness-Related				
	Purging	.229	.056	<**.001**
	Restricting	.131	.060	.028
	Binge Eating	.174	.055	**.001**
Muscularity-Related				
	Muscle Building	.667	.030	<**.001**
Both Thinness- and Muscle-Related				
	Excessive Exercise	.605	.038	<**.001**
	Body Dissatisfaction	-.035	.045	.44
	Cognitive Restraint	.401	.046	<**.001**

Note. N = 345. **Bold** indicates significant *p* value as determined by the Holm-Bonferroni Method. *Est.* = Standardized Estimate; *SE* = Standard Error.

Table 20

Overlapping Leanness/Muscularity General Latent Factor in the Prediction of Eating Disorder-Related Outcomes

Outcome Category	Outcome	*Est.*	*SE*	*p*
Thinness-Related				
	Purging	.146	.050	**.004**
	Restricting	-.010	.053	.86
	Binge Eating	.223	.047	<**.001**
Muscularity-Related				
	Muscle Building	.424	.030	<**.001**
Both Thinness- and Muscle-Related				
	Excessive Exercise	.469	.035	<**.001**
	Body Dissatisfaction	.330	.037	<**.001**
	Cognitive Restraint	.334	.041	<**.001**

Note. $N = 345$. **Bold** indicates significant *p* value as determined by the Holm-Bonferroni Method. *Est.* = Standardized Estimate; *SE* = Standard Error.

Table 21

Predicting Global Mental Health by the Latent Variable Structure of the Final Bifactor S-1 CFA Model

Latent Variable	*Est.*	*SE*	*p*
Overlapping Drive for Leanness/Muscularity	.002	.053	.98
Drive for Muscularity Behaviors	-.047	.060	.43
Drive for Muscularity Cognitions	-.265	.057	**<.001**
Drive for Thinness	-.319	.052	**<.001**

Note. N = 345. **Bold** indicates significant p value as determined by the Holm-Bonferroni Method. *Est.* = Standardized Estimate; *SE* = Standard Error.

Table 22

Predicting Global Physical Health by the Latent Variable Structure of the Final Bifactor S-1 CFA Model

Latent Variable	*Est.*	*SE*	*p*
Overlapping Drive for Leanness/Muscularity	.068	.053	.20
Drive for Muscularity Behaviors	-.164	.060	**.006**
Drive for Muscularity Cognitions	-.152	.059	**.010**
Drive for Thinness	-.293	.054	**<.001**

Note. N = 345. **Bold** indicates significant *p* value as determined by the Holm-Bonferroni Method. *Est.* = Standardized Estimate; *SE* = Standard Error.

DISCUSSION

As the most recent drive variable to be established, there is still a lot to be learned about drive for leanness, particularly related to its relationships with the more established drives for thinness and muscularity. Most extant work looking at these relationships has found that drive for leanness is best described as a construct unique from the other drives. However, given limited data, there are also skeptics who believe the drive for leanness is merely an amalgamation of drives for thinness and muscularity. Elucidating the relationships between these drives has methodological, theoretical, and practical implications, particularly in terms of prevention and treatment of eating disorders and body image disturbance. This study tested the competing hypotheses that drive for leanness is best described as unique from, or rather an amalgamation of, drives for thinness and muscularity.

Uniqueness Hypothesis

Inconsistent with extant research, there was not strong evidence to support that drive for leanness is unique from drives for thinness and muscularity in the current study. Comparable to past work, in the current study observed drive for leanness had more unique than shared variance across most samples (up to 59%); however, there were overall lower percentages of unique variance than seen in previous work (e.g., 71%; Lang & Rancourt, 2019). In looking at observed associations from the randomized sample that included the M-DLS, drive for leanness evidenced *less* unique variance (47%) than variance shared with thinness and muscularity. However, this finding was not surprising given that this particular sample's items were both randomized and modified to ensure the least amount of response bias possible. Inconsistent with previous work in which all factor analyses testing uniqueness evidenced good global fit (Lang & Rancourt, 2019), all factor analyses undertaken to test the uniqueness hypothesis for this study *approached* good fit, but did not reach it. Overall, while findings from the current study are incongruous with extant work, proper interpretation of these results is reliant upon consideration of multiple factors that may have impacted these inconsistencies.

Drive for Leanness Measurement Considerations. Past exploration of drive for leanness' uniqueness has been limited by potential wording response bias. As mentioned previously, the DLS includes items that use other-reference wording while the EDI-DT and DMS use purely self-reference wording. Wording effects are noted to be particularly problematic to factor analyses as items tend to group together by semantic similarities sometimes regardless of item content (DiStefano & Motl, 2006; Schmitt & Stuits, 1985; Schriesheim & Eisenbach, 1995). Potential for wording effects is therefore particularly concerning for extant factor analytic drive work. The current study addressed this limitation by adapting the DLS to be more semantically similar to the other drive scales. As expected, the modified DLS (M-DLS) demonstrated acceptable initial psychometrics. However, while wording effects were anticipated such that the latent leanness construct would appear more distinct in analyses using the DLS than in analyses in which the M-DLS was utilized due to its differential wording, the fit of correlated factor CFAs within the current study was comparable regardless of whether the DLS or M-DLS was included. This is discrepant with extant studies that found wording effects to be particularly problematic to factor analysis (DiStefano & Motl, 2006; Schmitt & Stuits, 1985; Schriesheim & Eisenbach, 1995). Further, the DLS in and of itself is composed of differently worded items including both other- and self-reference items, while the M-DLS is more lexically consistent and includes only self-reference items. As differently worded items within a measure can reduce measure reliability (Ye, 2009), it was anticipated that the DLS would have lower reliability than the M-DLS. However, this was also not the case as reliability looked identical across leanness measures (DLS Survey 1 α = .87; M-DLS Survey 1 α = .87; DLS Survey 2 α = .92; M-DLS Survey 2 α = .92). It is possible that no wording effect was observed as these effects are more prominent in less-educated individuals (Quilty et al., 2006), and this study's samples were university-based. Nonetheless, while the DLS and M-DLS behaved comparably in terms of internal reliability and model fitting, it does not appear that poor model fit in this study can be attributed to wording effects.

One of the hallmarks of drive for leanness is its sex neutrality. Drive for leanness was originally posited to be a more sex neutral drive than drives for thinness or muscularity (Smolak & Murnen, 2008), and therefore useful in building sex-neutral etiological and maintenance models of body image disturbance and disordered eating. Men and women have endorsed comparable levels of drive for leanness via the DLS in extant work (Lang & Rancourt, 2019). However, the DLS has shown scalar, or intercept, variance across sex (Tod et al., 2012). This denotes item variance, or that it is unclear if men and women with similar scores on the DLS actually possess similar levels of drive for leanness, or if there were potential item interpretation differences across sexes. This could make models including the sexes together uninterpretable given the potential for differential responding impacting the latent factor and modeling process. Further, incongruous with extant work, mean DLS scores were different across sexes in the current study (Survey 1: d = 0.27, p = .014; Survey 2: d = 0.32, p = .003; see Table 1), as were mean M-DLS scores across sexes in the standard format sample (Survey 2: d = 0.24, p = .03). The randomized sample was the only sample that endorsed comparable levels of M-DLS regardless of sex (Survey 1: d = 0.20, p = .06). However, the model including the randomized sample (in which leanness means were comparable across sex) fit similarly to all other models in this study and the effects sizes were similar for all comparisons. It is therefore unlikely that mean level sex differences on drive for leanness measures caused discrepancies between this and extant work.

Overall, these findings provide support for use of the M-DLS instead of the DLS in the future. The M-DLS evidenced comparable internal reliability to the DLS, while drive model fit appeared to be comparable whether the DLS or the M-DLS was used. The M-DLS is most appropriate for capturing an individual's endorsement of *their own* drive for leanness. Further, as a whole the M-DLS appears to be more sex neutral than the DLS. Additional psychometric work needs to be undertaken with the M-DLS. While it appears to have advantages over the DLS, utilizing the M-DLS instead of the DLS would make it more difficult to synthesize future leanness work with extant studies. More investigation into the pros and cons of switching over solely to the M-DLS from the DLS is warranted. Further, determining the validity of the M-DLS and looking at its measurement invariance across samples (i.e., sex, age, etc.) would be advantageous. If this work concludes that the M-DLS appropriately captures drive for leanness, then it would be advantageous to use the M-DLS in place of the DLS in the future given its comparable wording to the other most utilized drive scales (i.e., the EDI-DT and DMS).

Methodological Considerations. In further exploring why uniqueness of drive for leanness was not strongly supported in this study, differences in methodology between the current study and extant work might play a role. For example, in general, larger sample sizes are associated with improved factor model fit (Fan et al., 1999). While the current study had adequate power across samples, this study's sample sizes (Survey 1: N = 360; Survey 2: N = 350) were substantially smaller than those in extant work where factor models including the

DLS, EDI-DT, and DMS demonstrated good fit (N = 550; Lang & Rancourt, 2019). It is possible that model fit in the current study might have been improved with larger sample sizes.

Further, extant work has found that item-position effects can bias participant response by providing a potential context cue for item similarity (Campbell & Mohr, 1950; Mollenkopf, 1950). Past drive work may have been biased by use of measures in their standard format such that items that were closer together were answered more similarly due to position as opposed to content, resulting in drives that look unique. This study addressed this limitation by collecting data in both standard and randomized formats. Notably, results from correlated factor CFAs looked comparable regardless of whether items had been randomized or presented as part of existing scales. Contrary to extant work supporting the item-position effect (Campbell & Mohr, 1950; Hartig et al., 2007; Mollenkopf, 1950; Schweizer et al, 2009; Schweizer, 2012), across models using randomized and standard format data, most items loaded comparably onto their expected latent factors.

Some work, however, has shown that susceptibility to item-position effect is moderated by effort, such that those putting forth higher effort are less susceptible to item-position effects (Sebastian et al., 2017). Effort tends to diminish with prolonged survey exposure (Sebastian et al., 2017), and longer surveys are associated with lower internal reliability of measures and higher respondent burden (Galesic & Bosnjak, 2009; Kost & da Rosa, 2018; Rolstad et al., 2011). The overall survey lengths in this study were intentionally kept short to try to minimize participant burden and maximize effort. The survey used in comparable factor analytic work (Lang & Rancourt, 2019) was five times longer than Survey 1 and three times longer than Survey 2. While the extended length of the Lang and Rancourt (2019) survey was certainly more burdensome to participants, reliabilities of measures utilized in both this and the current study were comparable (Survey 1: DLS α = .87, EDI-DT α = .90, DMS α = .88; Survey 2: DLS α = .92, EDI-DT α = .91, DMS α = .91; Lang & Rancourt (2019): DLS α = .88, EDI-DT α = .91, DMS α = .92). Further, Lang and Rancourt (2019) included attention checks in their survey, a proxy for effort, and removed participants who missed a certain percentage of these checks. It is therefore likely that those displaying the lowest effort who had the most probability of being impacted by item-position effects were removed from this sample. Taken together, there is little evidence that the impact of survey length on response played a role in result discrepancies between the current study and previous work.

Finally, this study estimated CFAs to determine model fit while extant work supporting drive uniqueness estimated EFAs (Lang & Rancourt, 2019). Utilizing CFAs for this study was intended to replicate past EFA findings with a more theory driven modeling technique to show that drives for leanness, thinness, and muscularity were unique constructs. Previous uniqueness findings were not replicated; all models in this study only approached predetermined model fit thresholds. If an EFA is accurately representing a theoretical model, then a subsequent, comparable CFA should fit well. However, there are a few possibilities why the Lang and Rancourt (2019) EFA fit well, but could not be replicated using CFAs in the current study. First, CFAs are more restricted models than EFAs, making them more difficult to fit (Tabachnick & Fidell, 2013). It therefore could be the case that CFAs in this study did not fit as well as EFAs in past work purely due to the more restrictive fitting methods used in CFAs in general. However, it is notable that when CFAs did not fit as expected in this study, EFAs were estimated with the same data and good model fit still was not achieved (see Tables 24-27). This indicates discrepancies between studies apart from factor analytic method used, leading to the second potential reason for this study's inability to replicate previous work - sample differences. If samples are significantly different on demographics or variable of interests, these differences can cause discrepancies in model fit. For example, variability in model fit linked to variance across measures as a product of ethnicity is a major concern when attempting to fit models describing the etiology of disordered eating and body image concerns (Belon et al., 2015; Kelly et al., 2012). Differences in factor analytic method chosen did not seem to explain discrepancies in model fit across studies; therefore, it is possible that differences between the current and past samples may provide an explanation for why this study failed to replicate extant uniqueness findings

Sample Considerations. As sex is known to differentially impact drive endorsement, it is possible that differences in the breakdown of samples by sex was a factor in global fit discrepancies between this and extant work. For example, past work has found that women tend to endorse higher levels of drive for thinness while men tend to endorse higher levels of drive for muscularity (Gray & Ginsberg, 2007; Lang & Rancourt, 2019). The current study replicated this finding (Survey 1: EDI-DT $d = 0.59$, $p < .001$; DMS $d = 0.82$, $p < .001$; Survey 2: EDI-DT $d = 0.42$, $p < .001$; DMS $d = 0.92$, $p < .001$). However, both current study samples endorsed lower levels of drive for muscularity (DMS: Survey 1 $d = 0.15$, $p = .03$; Survey 2 $d = 0.24$, $p < .001$; see Table 23) than in comparable previous work (Lang & Rancourt, 2019). The higher percentage of females across both current study samples compared to Lang and Rancourt's sample (Survey 1: $v = 0.11$, $p = .003$; Survey 2: $v = 0.12$, $p = .001$) could account for this study's lower DMS means. However, it was further anticipated that a greater percentage of females in the current samples would be associated with higher levels of drive for thinness as well; this was not observed as drive for thinness levels were comparable across studies (Survey 1: $d = 0.05$, $p = .43$; Survey 2: $d = 0.08$, $p = .27$).

Alternatively, lower drive for muscularity levels in this study could be due to changing cultural trends. Recent literature has noted that cultural ideals for men no longer emphasize purely bulk and muscularity (Hargreaves & Tiggemann, 2004). While men previously endorsed primarily wanting to be muscular (Gray & Ginsberg, 2007), more recently men have reported wanting to both build muscle and lose fat (Neighbors & Sobal, 2007; Ridgeway & Tylka, 2005; Smolak and Murnen, 2008). If this trend is accurate, it is potentially the case that lower drive for muscularity endorsement was noted in this study because drive for muscularity is going out of style, being replaced by the more current culturally relevant drive for leanness. However, as the gap between when this study and when Lang and Rancourt (2019) collected their samples was only three years, it seems unlikely that there was a shift in body ideals fast and drastic enough to significantly impact model fit results.

Nonetheless, if it is true that drive for muscularity is being replaced by drive for leanness, it would be expected that drive for leanness levels would be higher in the current samples than in Lang and Rancourt's samples (2019). However, data do not support this possibility. This study's standard format sample evidenced comparable drive for leanness levels as the Lang and Rancourt (2019) sample (DLS Survey 2: $d = 0.11$, $p = .12$; see Table 23), while this study's randomized sample endorsed *lower* levels of drive for leanness in comparison (DLS Survey 1: $d = 0.20$, $p = .007$). Further, as previously noted, while men and women tend to endorse similar levels of drive for leanness (Lang & Rancourt, 2019; Smolak & Murnen, 2008; Tod et al., 2012), this was generally not the case in the current study's samples. Due to differences between this study and the Lang and Rancourt (2019) sample in endorsement of both drives for muscularity and leanness, post-hoc CFAs were explored separately among male and female participants to investigate whether sex differences in factor structure and fit may have contributed to the current findings (see Tables 28-31). Models were similar in terms of structure and fit across men and women, suggesting that sex differences are not a good explanation of why the current findings do not replicate published drive work in terms of factor structure.

In general, as individuals get older, they endorse lower drive levels (Bucchianeri et al., 2014; Keel et al., 2007; Lewis & Cachelin, 2001; Murray & Lewis, 2014; Schneider et al., 2016). Individuals in college report more body dissatisfaction and higher drive levels than other age groups (Eisenberg et al., 2011; Neighbors & Sobal, 2007). This could be due to the increasing egocentrism and public self-consciousness seen in this age group (Frankenberger, 2000), which contributes to greater vulnerability to sociocultural risk factors of disordered eating behaviors (Chen & Jackson, 2012). Consistent with self-discrepancy theory (Higgins, 1987), as one pays more attention to the self, as well as to how the self is discrepant from an ideal, more body dissatisfaction and drive endorsement will occur. Both the current study and the Lang and Rancourt (2019) study recruited participants from university research pools; however, the current study's randomized sample was older on average than Lang and Rancourt's sample (Survey 1: $d = 0.17$, $p = .008$; see Table 23). This makes sense as the current study had a lower percentage of first year students compared to Lang and Rancourt (Survey 1: $v = 0.12$, $p = .01$; Survey 2: $v = 0.12$, $p = .008$). Based on previous work, it would be anticipated that the older sample would have reported lower endorsement of all drive variables. Incongruous with this prediction, this sample only reported lower drives for leanness and muscularity, not lower drive for thinness. Further, while age differences from extant work were only noted in this study's randomized sample, model fit was discrepant across all samples regardless of age differences and the effect size was small. There is not strong support for age differences explaining the lack of model fit replication seen in this study.

Drive endorsement also varies by sexual orientation. Specifically, men who identify as homosexual endorse higher levels of drives for thinness and muscularity than their heterosexual counterparts (Cella et al., 2013; Kaminski et al., 2005; Yelland & Tiggemann, 2003). However, the only discrepancy seen between this study and Lang and Rancourt's study (2019) was the higher endorsement of *bisexuality* in this study's standard format sample (Survey 2: $v = 0.11$, $p = .01$; see Table 23). Work looking at the impact of bisexuality on drive endorsement is scant. One study found that men identifying as bisexual experience an increase in weight and shape concern as they age (Calzo et al., 2013). Based on self-discrepancy theory (Higgins, 1987), greater body image concern should be associated with more body dissatisfaction and subsequent drive endorsement. With this in mine, the current study's older, more heavily bisexual sample should have endorsed higher drive levels, but the opposite was true in that this study's samples endorsed either comparable or lower drive levels than the Lang and Rancourt (2019) sample. Further, only one of the current study's samples was discrepant in terms of sexual orientation with the Lang and Rancourt (2019) sample. As results across samples were similar, there is not strong support for differences in sexual orientation impacting model fit. Nonetheless, given the lack of work done with bisexual samples, future studies should investigate this population to better discern how bisexuality impacts drive endorsement.

Finally, an extant study has suggested that college samples tend to endorse higher drive levels during the summer compared to fall or spring seasons (Lang & Rancourt, 2019). Body shape and size are more evident in the summer due to warmer weather leading people to wear more revealing clothing (e.g., tank tops, shorts, swimsuits, etc.). Social comparison work describes how comparing one's body to others draws attention to ways in which one's body can be improved (Festinger, 1954; Schaefer & Thompson, 2014; Thompson et al., 1991). Consistent with self-discrepancy theory, this added attention to the discrepancy between one's current and ideal body can lead to body dissatisfaction, along with heightened drive levels (Cahill & Mussap, 2007; Diehl & Baghurst, 2016; Garner, 2002; Lang & Rancourt, 2019; Lewis & Cachelin, 2001; Morrison et al., 2006; Smolak & Murnen, 2008). Further, physical activity is more common among college students during summer months (Buckworth, 2001) and exercise is positively associated with drive endorsement (Hartmann et al., 2018; Lang & Rancourt, 2019; Tod et al., 2012; Tod et al., 2013). Therefore, college-based samples collected during the summer may be more likely to endorse higher drive levels than samples collected at other times in the year. The Lang and Rancourt (2019) sample had a higher percentage of survey completion in summer months than the current study. While both samples were collected in Florida where warm weather clothes are worn year-round, the Lang and Rancourt (2019) having more of their data collection happen in summer months might have played a role in drive endorsement differences between these samples. Further, it is possible that higher drive levels would have been endorsed and better model fit could have been achieved in the current study had more data collection occurred in summer months. Seasonal effects are rarely acknowledged or investigated in drive work, but timing of data collection is an important factor to take into account when investigating body ideal drives in college populations.

Taken together, results from this study did not support drive uniqueness as unequivocally as extant work. While all models approached acceptable model fit, factor models did not fit as well as comparable extant factor analytic work (Lang & Rancourt, 2019), despite using the same measures in the same format. Congruent with past work, across samples there was generally a larger portion of unique variance in drive for leanness than variance in drive for leanness accounted for by the other drives; however, the percentage of unique variance was smaller across all samples in this study than it was in extant work (Lang & Rancourt, 2019). In sum, while extant studies provided strong support for the uniqueness hypothesis (Lang & Rancourt, 2019; Smolak & Murnen, 2008), this study's evidence was less conclusive.

Amalgamated Hypothesis

Alternative to the idea of uniqueness, it is possible that drive for leanness is better described as an amalgamation of drives for thinness and muscularity. While extant work has largely supported uniqueness (Lang & Rancourt, 2019; Smolak & Murnen, 2008), some level of drive overlap is also evident. For example, congruent with past work (Hartmann et al., 2018; Lang & Rancourt, 2019; Smolak & Murnen, 2008; Smolak & Murnen, 2011; Tod et al., 2012; Tod et al., 2013), in this study all correlations between both observed and latent drive variables were positive and significant. Further, variance in drive for leanness attributable to the other drives was higher in this study than in past work (Lang & Rancourt, 2019) with one sample attributing *less* unique variance to drive for leanness than variance of drive for leanness shared with the other drives.

Despite moderate levels of shared variance, there was not unequivocal support for the amalgamated model. Although the bifactor *S*-1 model evidenced good global fit, bifactor models *generally* fit better than simple correlated-factor models due to the increased flexibility in being able to contribute variance to more sources (Bornovolova et al., 2020). Most ancillary analyses looking at the utility of the bifactor structure in describing this study's data supported some uniqueness among drives. As anticipated, drive for thinness emerged as a distinct drive construct, with items from the EDI-DT contributing marginal levels of variance to the drive for leanness latent factor. These outcomes replicate extant findings that drive for leanness is *not* best described as an amalgamation of drives for thinness and muscularity.

Alternatively, what the bifactor *S*-1 model suggested was an overlap of drive for muscularity onto drive for leanness. This could explain why within the full bifactor model run for this study, drive for leanness was supported more as a general drive factor than as a specific drive factor. Further, drive for thinness remained fairly distinct. This pattern of findings is congruent with extant work showing that drives for leanness and muscularity are more strongly correlated with each other than with drive for thinness (Hartmann et al., 2018; Lang et al., 2017; Lang & Rancourt, 2019; Smolak & Murnen, 2008; Smolak & Murnen, 2011; Tod et al., 2012). Multiple explanations exist as to why the drive relationship pattern turned out the way it did. From a measurement perspective, drive for leanness measures share more comparable content characteristics with the DMS than with the EDI-DT. Most of the questions on leanness measures emphasize gaining muscle over losing fat, which is more similar to DMS item content than that of the EDI-DT. Further, items on leanness measures and the DMS are framed more positively than EDI-DT items. For example, "I think my body looks best when it is well-toned" seems more emotionally neutral than the potentially more emotionally activating "I am terrified of gaining weight." These discrepancies might have played a part in past work showing that drives for leanness and muscularity are perceived as healthier than drive for thinness (Lang & Rancourt, 2019). In relation to factor analysis, past work has looked at positive versus negatively worded item's effects on item response patterns (DiStefano & Motl, 2006; Schmitt & Stuits, 1985). Results imply that such wording discrepancies can result in items loading together due to the positive or negative connotation of the wording as opposed to loading on latent factors due to content similarities. In the current study, this could explain the overlap between drives for leanness and muscularity, as well as why drive for thinness remained distinct. Of note, these wording effects are methodological in nature.

It is also possible that the overlap of drive for muscularity onto drive for leanness has true construct-related explanations. For example, drives for leanness and muscularity both involve focus on muscle gain. Behaviors aimed at muscle gain, such as weight lifting and use of protein products, are associated similarly with drives for leanness and muscularity both cross-sectionally (Hartmann et al., 2018; Lang & Rancourt, 2019; Tod et al., 2013) and longitudinally (Lang, 2018). This was replicated in the current study as the overlapping leanness/muscularity general latent factor, as well as both drive for muscularity cognitions and behaviors latent group factors, were significantly associated with muscle building behaviors. Similarly, as predicted, both excessive exercise and cognitive restraint were associated with the overlapping leanness/muscularity factor, as well as both drive for muscularity latent group factors. Further, on the basis of shared focus on muscle achievement, it was hypothesized that the overlapping leanness/muscularity factor, as well as both muscularity latent group factors, would *not* be associated with behaviors typically attributed to thinness. While past work has found that both drives for leanness and muscularity were less predictive of disordered eating outcomes than drive for thinness (Hartmann et al., 2018; Lang et al., 2019), this was not the case in the current study. While not associated with restricting, the current study found that the leanness/muscularity general latent factor and the muscularity behaviors latent group factor were significantly associated with binge eating and purging. Binge eating may serve the purpose of putting on bulk, but the reasoning behind the associations between purging and these drives is unclear. Given this unprecedented pattern of relationships, more research is needed to understand the shared behavioral variables that may contribute to the overlap of drives for leanness and muscularity.

Beyond a shared muscle gaining component, the overlap between drives for leanness and muscularity is further demonstrated by the similar patterns of associations they show with health-related outcomes (Hartmann et al., 2018; Lang et al., 2017; Lang & Rancourt, 2019; Smolak & Murnen, 2008; Smolak & Murnen, 2011; Tod et al., 2012). For example, past work has shown that drives for leanness and muscularity are not related to negative mental health outcomes such as anxiety and depression (Lang & Rancourt, 2019). Comparably, in this study the overlapping leanness/muscularity general latent factor and the drive for muscularity behaviors latent group factor were not related to poor global mental health. However, while the overlapping leanness/ muscularity general latent factor was not associated with poor global physical health, both latent drive for muscularity latent group factors were. As drives have been shown to be closely tied to eating disorders, as well as serious physical health complications including cardiac arrhythmia, gastrointestinal problems, and electrolyte abnormalities (Mehler & Anderson, 2017; Morton, 2016; Neale et al., 2020), the positive association found between drive for muscularity and poor global physical health is unsurprising. However, it is unclear why the overlapping leanness/ muscularity general latent factor was not associated with this outcome. Discrepancies in relationships with outcomes variables such as this make it important to investigate both the similarities and differences between drives for leanness and muscularity in future work.

Consistent with extant work (Lang & Rancourt, 2019), drive for thinness emerged as distinct from drives for leanness and muscularity in this study. This could be due to the fact that there is an indiscriminate weight loss associated with drive for thinness that is attainable through extreme weight loss behaviors. While there is a component of drive for leanness that includes wanting fat levels to be low enough for muscle to be seen, the focus is on displaying muscle, not on low weight. Drive for muscularity itself has no weight loss component. Muscle development is difficult in the context of extreme weight loss behaviors; this could be why drive for thinness is consistently associated with different behaviors and outcomes than drives for leanness and muscularity. For example, in extant work including all drives, drive for thinness is positively associated with dieting, disordered eating, and laxative use, when in the same samples the other drives were not (Hartmann et al., 2018; Lang & Rancourt, 2019; Tod et al., 2013). The current study expanded upon this work and found that the drive for thinness latent group factor was associated with restricting while the other latent drive factors were not. As anticipated, the drive for thinness latent group factor did not predict muscle-building behaviors.

Further, associations of health-related outcomes with drive for thinness tend to be distinct from relationships seen between these same outcomes and the other drives (Hartmann et al., 2018; Lang et al., 2017; Lang & Rancourt, 2019; Smolak & Murnen, 2008; Smolak & Murnen, 2011; Tod et al., 2012). Drive for thinness has been found to be positively associated with anxiety and depression, while in the same sample the other drives were not (Lang & Rancourt, 2019). Comparably, in the current study greater drive for thinness was associated with worse global mental health; the other latent drive constructs evidenced no association with global mental health. While historically drive for thinness has not been studied in association with global physical health, this study showed that drive for thinness was more strongly associated with poor global physical health than any of the other drive constructs. This supports previous work showing that drive for thinness is potentially an unhealthier construct than the other drives (Lang & Rancourt, 2019). Overall, drive for thinness consistently appears unique from drives for leanness and muscularity across studies and methodologies and is consistently associated with worse mental and physical health outcomes.

Implications of Leanness/Muscularity Overlap

Finding the overlap of drive for muscularity onto drive for leanness has multiple implications for the field. First, it might be advantageous to revisit and modify the drive measures. This could be done with the intent to better reflect the essence of the underlying factor structure of all drive variables found in the current study. As drive for thinness appears to be a distinct drive construct, this would primarily entail reformatting measures that assess drives for leanness and muscularity. Utilizing the bifactor *S*-1 CFA results from this study as a blueprint for future drive scale creation, the heaviest overlap was seen of DMS cognitions subscale items onto the overlapping leanness/muscularity general latent factor, so a measure capturing this overlap might be a good place to start. However, this restructuring process might not be easy as it is unclear in some cases what items belong with which measures, and it might not be clear what the new measures actually capture. For example, there were only five DMS items that did not significantly load onto both their respective muscularity latent group factor as well as the overlapping leanness/muscularity general latent factor. Those items were mainly from the DMS behaviors subscale. It could be the case that the behaviorally focused component of drive for muscularity is unique. However, this loading pattern could also signify yet another measure wording issue. Most M-DLS items are cognitively phrased (e.g., "I think…") as opposed to being more active in nature. It was therefore unsurprising that many DMS cognitions subscale items (e.g., "I think…") significantly loaded onto the overlapping leanness/muscularity general latent factor while most DMS behaviors subscale items (e.g., "I lift…," "I use…," "I drink…") did not. Further, when the full bifactor model was run, almost all items across all drive scales that loaded more significantly onto the general drive factor than their specific group factor were cognitively worded items. This might signify an issue with measure wording as opposed to an actual distinction between latent drive constructs, highlighting difficulty that may arise in trying to form distinct drive scales from the items that already exist.

In this case, it might be more advantageous to start from scratch psychometrically. For example, individual interviews or focus groups could be used first to investigate whether the drive constructs are viewed as distinct, and if so, to understand the motivations and behaviors associated with each drive construct. As noted previously, age, sex, sexual orientation, etc., all impact drive endorsement, so it would be important to recruit a diverse participant pool. Based on this qualitative information, new items could be evaluated using something like item response theory (IRT) that ensures that differences in a score reflect differences in the latent trait of the drive rather than differences in item interpretation (Bock, 1997). While starting from scratch can be a daunting task, developing drive measures based on how people realistically view them, such as an overlap between drives for leanness and muscularity, will help future work be more applicable to and useful for real world application.

While not explored in this study, the findings of overlap between drives might indicate the possibility that instead of being distinct constructs, the drives are better represented by an ideal body motivation continuum. While drive for thinness lent little variance to the general leanness variable, there was still some overlap. Lang and Rancourt (2019[b]) utilized a hierarchical factor analysis to test if drives for leanness, thinness, and muscularity might be part of an overarching ideal body motivation continuum. They found acceptable, but less than ideal model fit, suggesting some indication of a potential overarching drive variable. This type of model might be advantageous to replicate to see if results are comparable, particularly if the M-DLS is utilized instead of the DLS. Alternatively, a continuum structure could also be explored using the qualitative restructuring process laid out above. If drives are found to be best described as a continuum, this would have implications for future work looking at drives as risk factors for health-related outcomes. For example, drives are known to be associated with disordered eating outcomes (i.e., Hartmann et al., 2018; Lang & Rancourt, 2019; Tod et al., 2013; Tylka, 2011). Describing drives on a continuum could lead to more parsimonious assessment of individuals' risk for engaging in a spectrum of disordered eating-related behaviors, utilizing only one predictor (the drive continuum) as opposed to three (drives for leanness, thinness, and muscularity). Assessing if drives fall on an overarching ideal body motivation continuum is a viable option to investigate when exploring the relationships between the drive constructs.

No extant etiological or maintaining models of body image disturbance or disordered eating include drive for leanness. This could be due to the fact that in the past, drive for leanness has been shown to be a healthier drive that drives for thinness and muscularity, associated with more positive outcomes that negative ones both cross-sectionally (Hartmann et al., 2018; Lang & Rancourt, 2019) and longitudinally (Lang, 2018). For example, in a longitudinal study, drive for leanness was found to predict increases in healthy exercise motivations, moderate weight training frequency, and reductions in anxiety (Lang, 2018). In the same study drive for leanness did not predict any negative outcomes across time, such as maladaptive supplement use (e.g., steroids), compulsive exercise, disordered eating symptomology, and depression. However, in the current study this same pattern was not observed. The amalgamated leanness/muscularity general latent factor was associated with such negative outcomes as binge eating, purging, body dissatisfaction, and cognitive restraint. This provides evidence that drive for leanness *should* be included in etiological and maintaining models of body image disturbance and disordered eating in the future. However, it is important to look at these relationships longitudinally to determine true predictive power, as cross-sectional relationships do not represent causality. For example, Lang (2018) found that, cross-sectionally, drive for leanness was positively associated with body shape concern. However, longitudinally, no significant predictive relationship existed. Overall, more work is needed to determine where drive for leanness might fit in both extant and new body image disturbance and disordered eating models.

This finding of divergence from past work, that drive for leanness does not appear to be as healthy as has been found previously, has clinical implications for the field. Past work has noted that, due to its healthier nature, drive for leanness might be worth promoting over drives for thinness and muscularity in attempting to ward off or treat body image disturbance and disordered eating behaviors (Lang & Rancourt, 2019). Findings in this study suggest otherwise. A large number of negative associations were found between the overlapping leanness/ muscularity general latent factor, as well as all other latent group factors, and disordered eating and health-related outcomes. More work needs to be done understanding these relationships, particularly since many of them are discrepant from previous findings. However, if these findings are replicated, it would be advantageous for prevention and treatment programs to assess for these drives with the intention or curbing negative behavioral and health-related outcomes associated with them. Knowing which outcomes are associated with which drive constructs will be a useful starting point to inform interviews or assessment tools that touch on each applicable relationship.

Limitations

Study strengths include large samples that are diverse across many demographic categories including race, ethnicity, sex, and sexual orientation, a modified drive for leanness measure that lexically mirrors other existing drive measures, and strong analytic technique. However, this study also has multiple limitations worth mentioning. First, the study samples were entirely university undergraduates, potentially limiting the generalizability of results. However, given that university populations tend to report more body dissatisfaction and disordered eating, as well as higher drive levels, than the general population (Eisenberg et al., 2011; Neighbors & Sobal, 2007), this was an appropriate sample with which to test study hypotheses. Second, this study collected purely cross-sectional data. Cross-sectional data were appropriate for factor analytic work. However, longitudinal data are needed to determine predictive utility of the drives on outcomes of interest as opposed to only being able to test cross-sectional associations. Finally, this study's samples were collected simultaneously from the same participant pool. Given that no personal identifying information was collected, for the anonymity of participants, it is impossible to tell the extent to which the samples were independent or contained some participant overlap. This may have had an influence on the similarities between model fits. While a difference in mean drive for leanness exists between samples in this study, indicating some level of independence, no significant differences were noted across any other drive variables, nor any demographic variables. Future studies would benefit from utilizing purely independent samples. A similar concern exists in discerning between participants who completed the current study and those that participated in Lang and Rancourt's (2019) work, the main study utilized for comparison with this project. Both studies recruited participants from the same university research pool. Given that no personal identifying information was collected in either study, there is no way to tell if individuals who participated in Lang and Rancourt's study also participated in the current study. However, both samples were composed primarily of first year students, while the data were collected three years apart. It is unlikely that more than a small subset of individuals would have had the opportunity to participate in both studies.

Conclusion

In sum, past work indicating the uniqueness of drive for leanness was not supported. While the amalgamation hypothesis too was unsupported, an overlap of muscularity onto drive for leanness was noted, while drive for thinness remained distinct. This new drive structure has implications for the interpretability of past drive work. While the M-DLS yielded good initial psychometrics, it might be advantageous to revisit the way drives are measured. However, reconceptualization of what the drives are, what they mean, and if they are distinct or part of a continuum might be necessary first. Subsequently, new measures could be created based on this data that better represent the true nature of the underlying drive constructs. Extant associations were not always replicated in the current study; for example, the overlapping leanness/ muscularity construct did not appear to be as healthy a quality as drive for leanness has been shown to be in the past. The findings from this study do not support past work that has endorsed the promotion of drive for leanness in disordered eating prevention and treatment programs. Rather, clinically speaking, it appears that it is important for all drives to be addressed in the prevention and treatment of body image disturbance and disordered eating. Further, it could be advantageous to investigate the inclusion of drives in predictive models of outcomes they have not been studied in conjunction with in the past, such as global physical health. Overall, understanding the relationships between drives for leanness, thinness, and muscularity is the cornerstone that can lead to more realistic work on the associations between these drives and health-related outcomes in the future.

Table 23

Goodness-of-fit Indicators from the EFA Including Items from the Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale

Factor Extraction	$X^2(df)$	SRMR	CFI	RMSEA	Eigen Values	Parallel Analysis
1	X^2(230)=2640.543***	.170	.462	.171		
2	X^2(208)=1127.117***	**.075**	.795	.111		
3	X^2(187)=646.532***	**.045**	.897	.083		
4	X^2(167)=336.940***	**.028**	**.962**	**.053**	X	
5	X^2(148)=217.188**	**.022**	**.984**	**.036**		
6	X^2(130)=173.188	**.018**	**.990**	**.030**		X

Note. *N* = 360. **p* < .05; ***p* < .01; ****p* < .001. **Bold** indicates good fit. SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

Table 24

EFA Pattern Coefficients from the Model of Best Fit for Items from the Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale

Item	Drive for Leanness	Drive for Muscularity: Behaviors	Drive for Muscularity: Cognitions	Drive for Thinness
1. I think the best-looking bodies are well-toned. (DL1)	**.886**	-.011	-.032	.051
2. When a person's body is hard and firm, it says they are well-disciplined. (DL2)	**.504**	.135	.078	.119
3. Athletic looking people are the most attractive people. (DL4)	**.838**	-.025	-.005	-.052
4. It is important to have well-defined abs. (DL5)	**.472**	.115	.190	-.240
5. People with well-toned muscles look good in clothes. (DL6)	**.641**	-.004	.148	-.005
6. I wish that I were more muscular. (DM1)	.085	.096	**.745**	.004
7. I lift weights to build my muscle. (DM2)	.137	**.512**	.267	-.120
8. I use protein or energy supplements. (DM3)	-.029	**.857**	-.040	.043
9. I drink weight gain or protein shakes. (DM4)	-.099	**.845**	.004	-.100
10. I feel guilty if I miss a weight training session. (DM6)	.075	**.560**	.144	.128
11. I think I would feel more confident if I had more muscle mass. (DM7)	.033	.001	**.846**	.027
12. Other people think I work out with weights too often. (DM8)	.040	**.497**	-.047	.012
12. I think that I would feel stronger if I gained a little more muscle mass. (DM11)	.187	-.038	**.716**	-.171
13. I think that my arms are not muscular enough. (DM13)	-.044	-.029	**.718**	.146
14. I think that my chest is not muscular enough. (DM14)	-.036	.167	**.542**	.002
15. I think that my legs are not muscular enough. (DM15)	-.012	.071	**.563**	.128
16. I eat sweets and carbohydrates without feeling nervous. (DT1)	.079	.148	-.209	**.520**
17. I think about dieting. (DT2)	.032	.047	.052	**.748**
18. I feel extremely guilty after overeating. (DT3)	-.005	.007	-.007	**.828**
19. I am terrified of gaining weight. (DT4)	-.024	-.133	-.001	**.856**
20. I exaggerate or magnify the importance of weight. (DT5)	-.010	-.134	.105	**.607**
21. I am preoccupied with the desire to be thinner. (DT6)	.073	-.063	-.004	**.833**
22. If I gain a pound, I worry that I will keep gaining. (DT7)	-.024	-.122	-.006	**.824**

Note. N = 360. Factor loadings and eigenvalues were obtained using a Geomin rotation. **Bold** indicates factor loadings > .40. DL = Drive for Leanness Scale item; DM = Drive for Muscularity Scale item; DT = Drive for Thinness subscale item.

Table 25

Goodness-of-fit Indicators from the EFA Including Items from the Modified Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale

Factor Extraction	$X^2(df)$	SRMR	CFI	RMSEA	Eigen Values	Parallel Analysis
1	$X^2(170)=2325.234$***	.181	.411	.188		
2	$X^2(151)=869.184$***	.083	.804	.115		
3	$X^2(133)=367.747$***	**.036**	**.936**	.070	X	
4	$X^2(116)=257.843$***	**.030**	**.961**	**.058**		X
5	-	-	-	-		
6	-	-	-	-		

Note. $N = 360$. *$p < .05$; **$p < .01$; ***$p < .001$. **Bold** indicates good fit. SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

Table 26

EFA Pattern Coefficients from the Model of Best Fit for the Items from the Modified Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale

Item	Drive for Leanness	Drive for Muscularity	Drive for Thinness
1. I think my body looks best when it is well-toned. (MDL1)	**.696**	.114	.078
2. When my body is hard and firm, it says I am well-disciplined. (MDL2)	**.597**	.189	.122
3. My goal is to have well-toned abs. (MDL3)	**.655**	.280	-.039
4. I think I would be more attractive if I looked more athletic. (MDL4)	**.690**	-.015	.230
6. I think I would look better in clothes if I was well-toned. (MDL6)	**.699**	-.052	.312
7. I wish that I were more muscular. (DM1)	**.680**	.177	-.010
8. I use protein or energy supplements. (DM3)	.012	**.823**	-.152
9. I drink weight gain or protein shakes. (DM4)	-.012	**.789**	-.285
11. I feel guilty if I miss a weight training session. (DM6)	.212	**.574**	.022
12. Other people think I work out with weights too often. (DM8)	-.023	**.525**	-.075
14. I think about taking anabolic steroids. (DM10)	-.129	**.410**	.029
15. I think that I would feel stronger if I gained a little more muscle mass. (DM11)	**.733**	.034	-.145
16. I think that my weight training schedule interferes with other aspects of my life. (DM12)	.039	**.477**	.143
19. I eat sweets and carbohydrates without feeling nervous. (DT1)	-.095	.175	**.492**
20. I think about dieting. (DT2)	.073	.124	**.730**
21. I feel extremely guilty after overeating. (DT3)	-.025	.084	**.815**
22. I am terrified of gaining weight. (DT4)	-.055	-.040	**.875**
23. I exaggerate or magnify the importance of weight. (DT5)	.041	.239	**.588**
24. I am preoccupied with the desire to be thinner. (DT6)	.010	.046	**.853**
25. If I gain a pound, I worry that I will keep gaining. (DT7)	-.087	-.088	**.843**

Note. N = 360. Factor loadings and eigenvalues were obtained using a Geomin rotation. **Bold** indicates factor loadings > .40. MDL = Modified Drive for Leanness Scale item; DM = Drive for Muscularity Scale item; DT = Drive for Thinness subscale item.

Table 27

Demographic and Drive Level Differences Between Lang and Rancourt's Sample (2019) and Current Study Samples

	Lang & Rancourt, 2019			Current Study						
	N	*M*	*SD*	Sample	*N*	*M*	*SD*	*t(df) or* X^2*(df)*	*p*	*d* or *v*
Sexual Orient.	588			Survey 1	360			$X^2(3)=6.968$	.07	0.09
				Survey 2	350			$X^2(3)=11.378$	**.01**	0.11
Race	589			Survey 1	360			$X^2(5)=5.552$	.28	0.09
				Survey 2	350			$X^2(5)=10.827$	.05	0.11
Ethnicity	587			Survey 1	360			$X^2(1)=0.115$	.73	0.01
				Survey 2	350			$X^2(1)=0.762$	.38	0.03
Year College	589			Survey 1	360			$X^2(4)=12.877$	**.01**	0.12
				Survey 2	350			$X^2(4)=13.809$	**.008**	0.12
Sex	589			Survey 1	360			$X^2(2)=11.778$	**.003**	0.11
				Survey 2	350			$X^2(2)=14.392$	**.001**	0.12
Age	589	20.19	3.69	Survey 1	360	20.93	4.79	$t(947)=2.671$	**.008**	0.17
				Survey 2	350	20.61	4.09	$t(937)=1.619$	.10	0.11
BMI	564	24.74	9.20	Survey 1	359	25.02	6.02	$t(921)=0.511$	.61	0.03
				Survey 2	350	25.05	6.10	$t(912)=0.559$	.58	0.04
DLS	546	3.95	1.04	Survey 1	360	3.73	1.12	$t(904)=3.021$	**.007**	0.20
				Survey 2	349	3.83	1.21	$t(893)=1.578$	.12	0.11
EDI-DT	550	3.05	1.29	Survey 1	358	2.98	1.32	$t(906)=0.792$	.43	0.05
				Survey 2	350	2.95	1.35	$t(898)=1.113$	.27	0.08
DMS	544	2.69	1.09	Survey 1	360	2.54	0.91	$t(902)=2.160$	**.03**	0.15
				Survey 2	350	2.44	1.00	$t(892)=3.456$	**<.001**	0.24

Note. **Bold** indicates significant *p* value. *N* = sample size; *M* = mean; *SD* = standard deviation; *t* = t-test; X^2 = Chi-square; *df* = degrees of freedom; *d* = Cohen's *d*; *v* = Cramer's *v*; Orient. = orientation; BMI = body mass index; EDI-DT = Eating Disorder Inventory = Drive for Thinness subscale; DMS = Drive for Muscularity Scale; DLS = Drive for Leanness Scale.

Table 28

Goodness-of-fit Indicators for CFAs Including Items from the Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale in Women

Model	$X^2(df)$	SRMR	CFI	RMSEA
1 Original	$X^2(344)=783.609$***	.092	.856	.077
2 Dropped DM10	$X^2(318)=675.544$***	**.088**	.880	.072

Note. N = 360. *p < .05; **p < .01; ***p < .001. **Bold** indicates good fit. DM = Drive for Muscularity Scale item; SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

Table 29

Goodness-of-fit Indicators for CFAs Including Items from the Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale and in Men

Model	$X^2(df)$	SRMR	CFI	RMSEA
1 Original	$X^2(344)=822.912$***	.129	.784	.100
2 Dropped DM5, DM10, & DM12	$X^2(269)=632.862$***	.121	.824	.098

Note. N = 360. *$p < .05$; **$p < .01$; ***$p < .001$. DM = Drive for Muscularity Scale item; SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

Table 30

Goodness-of-fit Indicators for CFAs Including Items from the Modified Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale in Women

Model	$X^2(df)$	SRMR	CFI	RMSEA
1 Original	$X^2(344)=879.215^{***}$	.104	.831	.084
2 Dropped DM10 & DT7	$X^2(293)=697.893^{***}$	.093	.866	.080

Note. N = 360. $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$. DM = Drive for Muscularity Scale item; DT = Drive for Thinness subscale item; SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

Table 31

Goodness-of-fit Indicators for CFAs Including Items from the Modified Drive for Leanness Scale, Drive for Thinness Subscale, and Drive for Muscularity Scale in Men

Model	$X^2(df)$	SRMR	CFI	RMSEA
1 Original	$X^2(344)=847.265$***	.133	.775	.102
2 Dropped DM5, DM10, DM12, & DT7	$X^2(246)=584.678$***	.121	.834	.099

Note. $N = 360$. *$p < .05$; **$p < .01$; ***$p < .001$. DM = Drive for Muscularity Scale item; DT = Drive for Thinness subscale item; SRMR = Standardized Root Mean Square Residual; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

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APPENDIX A: MODIFIED DRIVE FOR LEANNESS SCALE

Modified Drive for Leanness Scale

Please rate the following six items on a scale ranging from 1 = never to 6 = always.

1	2	3	4	5	6
Never	Rarely	Sometimes	Often	Very Often	Always

1. I think my body looks best when it is well-toned.	1	2	3	4	5	6
2. When my body is hard and firm, it says I am well-disciplined.	1	2	3	4	5	6
3. My goal is to have well-toned muscles.	1	2	3	4	5	6
4. I think I would be more attractive if I looked more athletic.	1	2	3	4	5	6
5. It is important for me to have well-defined abs.	1	2	3	4	5	6
6. I think I would look better in clothes if I was well-toned.	1	2	3	4	5	6

APPENDIX B: HYPOTHESIS 2 POST-HOC ANALYSES

Post-hoc analyses were run to further understand first-order correlated factor CFA outcomes. This was done to explore the underlying factor structure of the drive scales given the difference of fit between the CFA models in this study and extant EFA work.

Drive for Leanness Scale

An EFA was conducted to investigate whether another factor structure might provide better fit. Items from the DLS, EDI-DT, and DMS were entered with a geomin rotation; up to six factor extractions were allotted. A five-factor model emerged from the initial EFA as the best fitting model based on eigen values, parallel analysis, and fit statistics (X^2 (248, N = 360) = 481.90, $p < .001$; SRMR = .03; CFI = .96; RMSEA = .05; see Table 23). Examination of item loadings suggested that DMS item 9 ("I think that I would look better if I gained 10 pounds of bulk.") cross-loaded on the drive for muscularity cognitions, drive for muscularity behaviors, and drive for leanness latent factors, while DMS item 12 ("I think that my weight training schedule interferes with other aspects of my life.") and DLS item 3 ("My goal is to have well-toned muscles.") did not load significantly onto any factor. These three items were removed and the EFA was re-estimated. This modified EFA resulted in a four-factor solution (X^2 (206, N = 360) = 455.03, $p < .001$; SRMR = .03; CFI = .95; RMSEA = .06). Examination of new item loadings suggested that DMS item 10 ("I think about taking anabolic steroids.") did not significantly load onto any factor; this item was removed and the EFA was re-estimated. This modified EFA again resulted in a four-factor solution with good model fit (X^2 (186, N = 360) = 397.05, $p < .001$; SRMR = .03; CFI = .95; RMSEA = .06). Examination of new item loadings suggested that DMS item 5 (“I try to consume as many calories as I can in a day.”) cross-loaded on the drive for muscularity cognitions and drive for leanness latent factors; this item was removed and the EFA was re-estimated. This final modified EFA again resulted in a four-factor solution with good model fit (X^2 (167, N = 360) = 336.94, p < .001; SRMR = .03; CFI = .96; RMSEA = .05). This final model had no significant cross-loadings, with all items loading significantly onto a distinct factor; this was therefore deemed to be the final model (see Table 24).

After dropping four items from the DMS and one from the DLS, this final model appeared comparable to extant psychometric findings that combined the DLS, EDI-DT, and DMS (Hartmann et al., 2016; Lang & Rancourt, 2019). All retained DLS items loaded significantly and uniquely onto one factor, all retained DMS items capturing behaviors aimed at achieving the muscular ideal loaded onto a second factor, all retained DMS items capturing cognitions regarding the muscular ideal loaded onto a third factor, and all EDI-DT items loaded onto a fourth factor; however, a discrepancy was noted. The two DMS items that were dropped due to cross-loading throughout the analytic process cross-loaded onto the drive for leanness latent factor. This is consistent with literature that suggests that drive for leanness is more closely related to drive for muscularity than drive for thinness (Lang & Rancourt, 2019). Further investigation noted that most of the items that were removed to improve model fit were from the DMS. As preliminary findings indicate that the DMS is sex variant (Lang et al., 2020), it was deemed appropriate to re-estimate the original CFAs separately by sex.

In the initial CFA including only women, the original four-factor model demonstrated comparable fit to that observed with the full mixed-sex sample (X^2 (344, N = 218) = 783.61, p < .001; SRMR = .09; CFI = .86, RMSEA = .08; see Table 28). DMS item 10 (“I think about taking anabolic steroids.”) did not load onto its respective factor; this item was removed and the CFA was re-estimated. This modified CFA resulted in comparable model fit. (X^2 (318, N = 218) = 675.54, $p < .001$; SRMR = .09; CFI = .88; RMSEA = .07). No other modifications to this model were believed to be appropriate; this was deemed the final model. Among women, the four-factor model still did not meet the previously identified thresholds for acceptable model fit.

In the initial CFA including only men, the original four-factor model demonstrated worse model fit compared to that observed with the full mixed-sex sample (X^2 (344, N = 140) = 822.91, $p < .001$; SRMR = .13; CFI = .78, RMSEA = .10; see Table 29). Three items from the DMS, items 5 ("I try to consume as many calories as I can in a day."), 10 ("I think about taking anabolic steroids."), and 12 ("I think that my weight training schedule interferes with other aspects of my life."), did not load onto their respective factors; these items were removed and the CFA was re-estimated. This modified CFA resulted in enhanced, but still inadequate, model fit (X^2 (269, N = 140) = 632.86, $p < .001$; SRMR = .12; CFI = .82; RMSEA = .10). No other modifications to this model were believed to be appropriate; this was deemed the final model. Similar to findings for the female-only sample, the four-factor model still did not meet the previously identified thresholds for acceptable model fit.

Exploratory measures confirmed that the traditional four-factor model was the most appropriate; however, exploratory analyses also revealed crossover of DMS items onto the drive for leanness latent factor, supporting the idea that the DLS is not fully distinct from the DMS. Given that all scale items were randomized within one survey for this data collection, it is possible that there were standard survey, item-position effects in extant work that resulted in the conclusion that these scales, as well as these drives, were unique.

Modified Drive for Leanness Scale

Similar to what was undertaken for the previous DLS post-hoc analyses, an EFA was conducted including the M-DLS to investigate whether another factor structure might provide better fit. Items from the M-DLS, EDI-DT, and DMS were entered with a geomin rotation; up to six factor extractions were allotted. A four-factor model emerged from the initial EFA as the best fit (X^2 (272, N = 358) = 588.04, p < .001; SRMR = .03; CFI = .94; RMSEA = .06; see Table 25). Examination of item loadings suggested that DMS item 2 ("I lift weights to build my muscle.") and M-DLS item 5 ("It is important to have well-defined abs.") cross-loaded on the drive for leanness and drive for muscularity behaviors latent factors, DMS items 7 ("If I gain a pound, I worry that I will keep gaining.") and 13 ("I think that my arms are not muscular enough.") cross-loaded on the drive for leanness and drive for muscularity cognitions latent factors, DMS item 14 ("I think that my chest is not muscular enough.") cross-loaded on the drive for leanness, drive for muscularity behaviors, and drive for muscularity – cognitions factors, DMS items 5 ("I try to consume as many calories as I can in a day.") and 9 ("I think that I would look better if I gained 10 pounds of bulk.") cross-loaded on the drive for muscularity behaviors and cognitions factors, and DMS item 15 ("I think that my legs are not muscular enough.") did not load significantly onto any factor. All of these items were removed and the EFA was re-estimated. Both a three- and four-factor solution showed acceptable fit; however, in the four-factor solution, no items loaded significantly onto the fourth latent variable. Therefore, it was determined that this modified EFA resulted in a three-factor solution (X^2 (116, N = 358) = 257.84, p < .001; SRMR = .03; CFI = .96; RMSEA = .06). This model had no significant cross-loadings, while all items loaded significantly onto a distinct factor (see Table 26).

This final model including the M-DLS differed from previous EFA analyses including the DLS in that a three-factor solution was supported. Seven items from the DMS and one from the M-DLS were dropped due to their contribution to poor model fit. In the final model, items form the DMS cognitions and behaviors subscales collapsed into one factor that was distinct from the factor representing leanness. However, in the process of data fitting, cross-loading of items onto the leanness and muscularity latent factors was noted, supporting overlap in how drives for leanness and muscularity are measured and conceptualized (Lang & Rancourt, 2019). As the final model did not reach predetermined thresholds for adequate fit, and as DMS items once again most adversely affected model fit, CFAs were re-estimate for all drive items with the sample separated by sex given previously noted DMS sex variance.

In the initial CFA including only women, the model demonstrated comparable fit to the mixed-sex model (X^2 (344, N = 218) = 879.215, p < .001; SRMR = .10; CFI = .83, RMSEA = .08; see Table 30). Neither DMS item 10 ("I think about taking anabolic steroids.") nor EDI-DT item 7 ("If I gain a pound, I worry that I will keep gaining.") loaded onto their respective factors; these items were removed and the CFA was re-estimated. This modified CFA resulted in somewhat improved, but still inadequate, model fit (X^2 (293, N = 218) = 697.89, p < .001; SRMR = .09; CFI = .87; RMSEA = .08). No other modifications to this model were believed to be appropriate; this was deemed the final model. Among women, the four-factor model still did not meet the previously identified thresholds for acceptable model fit.

In the initial CFA using only men, the model demonstrated comparable fit to the mixed-sex model (X^2 (344, N = 140) = 847.265, p < .001; SRMR = .13; CFI = .78, RMSEA = .10; see Table 31). Three DMS items, items 5 ("I try to consume as many calories as I can in a day."), 10 ("I think about taking anabolic steroids.") and 12 ("I think that my weight training schedule interferes with other aspects of my life."), as well as EDI-DT item 7 ("If I gain a pound, I worry that I will keep gaining."), did not load onto their respective factors. These items were removed and the CFA was re-estimated. This modified CFA resulted in somewhat enhanced, but still inadequate, model fit (X^2 (246, N = 140) = 584.68, $p < .001$; SRMR = .12; CFI = .83; RMSEA = .10). No other modifications to this model were believed to be appropriate; this was deemed the final model. Similar to findings for the female-only sample, the four-factor model did not meet the previously identified thresholds for acceptable model fit.

Exploratory analyses suggested that a three-factor solution was a better fit and identified a number of items that cross-loaded on drive for leanness and muscularity latent factors. Given that item wording was modified in the M-DLS to be more similar to the DMS and EDI-DT, it is possible that there were wording effects in extant work that used the DLS that concluded that the original drive scales, as well as the underlying drive constructs themselves, were unique.

Summary

Item cross-loading primarily occurred with items from the DMS crossing-over onto the latent drive for leanness factors, supporting past findings that drives for leanness and muscularity are more closely related than these same constructs are with drive for thinness. In all, 10% of the items from the DLS and DMS cross-loaded, while 33% of the items from the M-DLS and DMS cross-loaded between the leanness and muscularity latent factors or loaded onto the wrong latent factor, lending more evidence to the idea that wording effects have impacted past drive work. While these findings provide some evidence for a lack of complete psychometric distinction between these drive scales, there was more distinctiveness than commonality. Nonetheless, potential lack of distinction between drives for leanness and muscularity on a factor level should be further investigated.

In terms of the investigation into whether sex variance in drive measures played a role in less than adequate model fit, this hypothesis was not supported. CFAs run by sex evidenced comparably less than adequate model fit as those models run with full mixed-sex samples. Even though results do not support sex as a factor that differentially impacted model fit in the current sample, sex invariance of the drive scales and models including them are still important to investigate given that sex has been shown to impact drive item interpretation (Lang et al., 2020) and drive level endorsement (Gray & Ginsberg, 2007; Lang & Rancourt, 2019) in extant work.