Canadian Psychology / Psychologie canadienne
2012, Vol. 53, No. 4, 291–300

0708-5591/12/$12.00 DOI: 10.1037/a0030215

A Meta-Analysis of the Influence of Gender on Self-Determination Theory's Motivational Regulations for Physical Activity

Eva Guérin, and Elena Bales
University of Ottawa

Shane Sweet
Queens University

Michelle Fortier
University of Ottawa

Self-determination theory (SDT) is a motivation metatheory that has received significant empirical support across several contexts of human behaviour. The motivational regulations as espoused by SDT refer to differing degrees of self-determination that individuals can demonstrate toward their behaviour. In particular, the regulations have received strong empirical support as predictors of exercise. However, literature in this domain has revealed inconsistent findings with respect to gender on levels of motivational regulations. The purpose of this meta-analysis was to examine differences between men and women on SDT's motivational regulations for exercise using studies that employed the Behavioural Regulations in Exercise Questionnaire (E. Mullan, D. Markland, & D. K. Ingledew, 1997, A graded conceptualisation of self-determination in the regulation of exercise behaviour: Development of a measure using confirmatory factor analytic procedures. *Personality and Individual Differences, Vol. 23,* pp. 745–752.). A total of 27 studies contributed total effect sizes (Hedge's *g*) of gender differences, which were computed independently for each of the regulations, as well as for a composite self-determination score. Overall, results from random-effects models revealed near-zero effect sizes, thus representing negligible differences between men and women on each of the regulations. The findings with respect to SDT's fundamental principles of universality across genders are carefully interpreted in light of existing research of gender invariance and with suggestions for future work.

Keywords: meta-analysis, gender, motivation, self-determination theory, exercise

Supplemental materials: http://dx.doi.org/10.1037/a0030215.supp

Motivation has been identified as one of the most important and consistent predictors of exercise (Lewis & Sutton, 2011; Pan et al., 2009). Of interest, several studies to date have found that men and women differ with respect to their motivation for exercise (Hamilton, Cox, & White, 2012; Kilpatrick, Hebert, & Bartholomew, 2005). However, this literature remains rather grey since other studies have not revealed significant gender differences (Hall, Rodgers, Wilson, & Norman, 2010; Lutz, Lochbaum, & Turnbow, 2003). Hence, the overall purpose of the present meta-analysis was to examine gender differences in exercise motivation in order to resolve these inconsistencies.

Exercise Motivation

A fair amount of early research on exercise motivation was conducted using the participation motives approach that arose in the 70s (Weiss & Ferrer-Caja, 2002). Motives, defined simply as the reasons why individuals engage in exercise (Markland & Ingledew, 2007), have been shown to differ between genders. For instance, experts agree that concerns of self-presentation, such as weight, body shape, and tone, as well as general appearance, are more commonly reported motives for exercise in women (DiBartolo & Shaffer, 2002; Tiggeman & Williamson, 2000). Likewise, Kilpatrick et al. (2005) found that several motives for exercise, namely challenge, competition, social recognition and strength/endurance, reached greater levels in men (Kilpatrick et al., 2005). However, no theoretical reasoning or implications were associated with these findings.

Indeed, a major criticism of the participation-motives literature is its largely atheoretical nature and "surface-level" analysis of motivation (Hagger & Chatzisarantis, 2008; Weiss & Ferrer-Caja, 2002). Instead, experts contend that a well-grounded theoretical framework of motivation is highly valuable in order to understand the underpinnings of this construct and to optimise its use in predicting health behaviours such as exercise (Michie et al., 2005). One theory that has received considerable empirical support is Deci and Ryan's (1985) self-determination theory (SDT; Teixeira, Carraca, Markland, Silva, & Ryan, 2012).

Self-Determination Theory

Self-determination theory is a metatheory that rests on the principle that individuals have innate tendencies to develop their sense of self through proactive and engaged behavioural function-

Eva Guérin and Michelle S. Fortier, School of Human Kinetics, University of Ottawa, Ottawa, Ontario, Canada; Elena Bales, School of Psychology, University of Ottawa; Shane Sweet, School of Kinesiology and Health Studies, Queens University, Kingston, Ontario, Canada.

The authors would like to extend their gratitude to Elena Bales, who contacted the authors in this meta-analysis to obtain the necessary data.

Correspondence concerning this article should be addressed to Eva Guérin, School of Human Kinetics, University of Ottawa, 125 University Pr, Ottawa, ON, K1N 6N5. E-mail: eguer016@uottawa.ca

ing (Deci & Ryan, 1985). One of the fundamental assumptions of SDT is the universality of its psychological constructs and processes (e.g., motivational regulations) across cultures, developmental periods, and most notably for this study, gender (Ryan & Deci, 2000, 2002). In regard to these universal processes, it is postulated in SDT that there is a continuum of three main types of motivation: amotivation, extrinsic motivation, and intrinsic motivation (Deci & Ryan, 2002). Amotivation indicates an absence of motivation whereas intrinsic motivation is defined by enjoyment of an activity, for example exercise, and by the satisfaction of performing it for its own sake. In between these two extremities rests a gradient of extrinsic motivational regulations, which, with an increasing degree of self-determination, become positioned closer to intrinsic motivation (Deci & Ryan, 2002).

The least self-determined of the regulations is external regulation, which reflects engaging in a behaviour because one is motivated by external rewards or to avoid punishment (Deci & Ryan, 2002). The first level at which individuals begin to internalize a behaviour such as exercise is introjected regulation, which involves partaking in the activity to avoid feelings of shame or guilt. Adjacent is identified regulation, which arises when an individual begins to value the benefits of exercise and assigns it personal importance (Deci & Ryan, 2002). The most self-determined of the external styles of motivation is integrated regulation, whereby a behaviour such as exercise becomes assimilated in an individual's identity and sense of self (Deci & Ryan, 2002; Ryan & Deci, 2003).

The proliferation of research examining motivational regulations and their relationship with exercise can be credited to the development of self-report instruments that have allowed researchers to quantify the continuum of motivation. Overall, studies have consistently shown that self-determined motivation is associated with exercise adoption and maintenance, especially intrinsic and identified forms of motivation (Teixeira et al., 2012); external regulation and amotivation have consistently shown either no association or negative associations in this regard (Lewis & Sutton, 2011; Roberts & Treasure, 2012). In contrast, the association between introjected regulation and exercise is equivocal, with some studies indicating a facilitative influence for introjection and others the opposite influence (Edmunds, Ntoumanis, & Duda, 2006; Silva et al., 2008).

While the above cross-gender synopsis describes a universal sequence linking the regulations with exercise, there have been inconsistent findings across men and women in terms of levels of the individual regulations. On the one hand, a number of studies have found that men and women show similar patterns of motivational regulations (Duncan, Hall, Wilson, & Jenny, 2010; Gillison, Standage, & Skevington, 2006; Lutz et al., 2003). On the other hand, several studies have found differences across gender in the extent to which exercise regulations are expressed (Daley & Duda, 2006; Gillison, Osborn, Standage, & Skevington, 2009). For example, several authors have found that women endorse introjection for exercise more strongly than men (Duncan et al., 2010; Wilson, Rodgers, Fraser, & Murray, 2004). These findings are consistent with formerly cited research on exercise motives, which have been theoretically linked to SDT's motivational regulations (i.e., appearance motives and controlled regulations; Markland & Ingledew, 2007). Although these gender differences in levels of motivation are not explicitly espoused in SDT, they tie in well with research in the sports domain that is grounded in gender-based frameworks. For instance, gender-roles orientations that arise within surrounding social environments have been shown to differentially influence sport motivation for men and women (Clément-Guillotin, Chalabaev, & Fontayne, 2012). Given the importance of the social context in SDT, it is not surprising that gender differences in motivational regulations for sport have also been found (e.g., Gillet & Rosnet, 2008). Perpetuation of these discrepancies in the exercise domain would not run contrary to SDT, and this is worthy of investigation.

In light of this empirical evidence, the purpose of this investigation was to conduct a meta-analysis to examine gender-based mean differences in SDT's motivational regulations for exercise. Meta-analyses using concepts from SDT in the exercise domain are in their infancy, particularly with regard to targeting the motivational regulations specifically (Chatzisarantis, Hagger, Biddle, Smith, & Wang, 2003; Teixeira et al., 2012). To our knowledge, no meta-analysis has ever been conducted to examine whether there are discrepancies between how men and women score on any of SDT's fundamental concepts. There are empirical and theoretical implications for this study. Namely, the findings have the potential to provide clarity on which regulation(s), if any, researchers can expect to find differences between men and women. This could bestow greater justification for either merging or segregating scores for men and women in auxiliary analyses and in intervention applications. The findings could spawn innovative theoretical enquiries to better understand different facets of the universality hypothesis.

Method

Selection of Studies

In order to maintain psychometric consistency and to reduce heterogeneity of the results, this meta-analytic investigation drew from studies that specifically employed the original Behavioural Regulations in Exercise Questionnaire (BREQ; Mullan, Markland, & Ingledew, 1997) and the revised BREQ-2 (with amotivation subscale; Markland & Tobin, 2004) as measures of motivation. Both versions have been deemed psychometrically sound, making them popular choices among motivation researchers (Markland & Tobin, 2010; Fortier, Duda, Guérin, & Teixeira, 2012). The BREQs have been applied successfully in conceptual research (e.g., Duncan et al., 2010) as well as in large-scale intervention studies (e.g., Fortier et al., 2011).

The search was conducted using *Scopus, Web of Science,* and *Google Scholar* databases to find relevant empirical studies between 2001 and 2009 in which SDT's motivational regulations toward exercise were measured using either the BREQ or the BREQ 2 (Markland & Tobin, 2004; Mullan et al., 1997). The keywords that were used in this search were: BREQ, BREQ-2, motivation, exercise, physical activity, self-determ*, SDT, regulation*, men, women, and gender. We also conducted a search of this instrument's reputable BREQ website (http://pages.bangor.ac.uk/~pes004/exercise_motivation/scales.htm) to locate other pertinent studies. After deleting duplicate studies, a total of 134 studies remained.

From the original pool of 134 studies, we applied a series of exclusionary steps to achieve a greater specificity of research and a target population. Studies with the following types of participants were excluded from further analyses: clinical samples (e.g., cardiac rehabilitation patients), samples of subjects under the age of 18, and samples that were comprised exclusively of men or women. In addition, we eliminated any studies that did not employ the BREQ or BREQ-2 as a measurement tool, as well as those studies that were solely theoretical or contained no original empirical data (such as other meta-analyses).

The studies were sorted and deleted on the basis of each criterion; the taxonomy of studies can be found in Figure 1. For articles that did not present separate means and standard deviations of the regulations for men and women, we contacted the authors directly, requesting that they send (a) the gender-based effect sizes for their respective studies or (b) the raw data by gender so that we could calculate the effect sizes in the manner described below. The final 27 studies included in this meta-analysis appear in Table 1. For any longitudinal or intervention studies with time-lagged measures of motivation, only baseline values were employed in order to avoid contamination from intervention components or from the effects of participating in a research study over time.

Coding of Studies

Several pieces of information were coded for each study, such as the number of men and women participants, the mean age of participants, and the version of the BREQ scale used to measure motivation. The studies were coded by two of the authors of this paper. The BREQ is a 15-item self-report questionnaire comprised of four subscales that measure external, introjected, identified, and intrinsic regulations of exercise behaviour; the BREQ-2 contains an additional subscale (four items) assessing amotivation (Markland & Tobin, 2004). Neither instrument contains items assessing integrated regulation. Although some authors have recently included additional items assessing this style of motivation

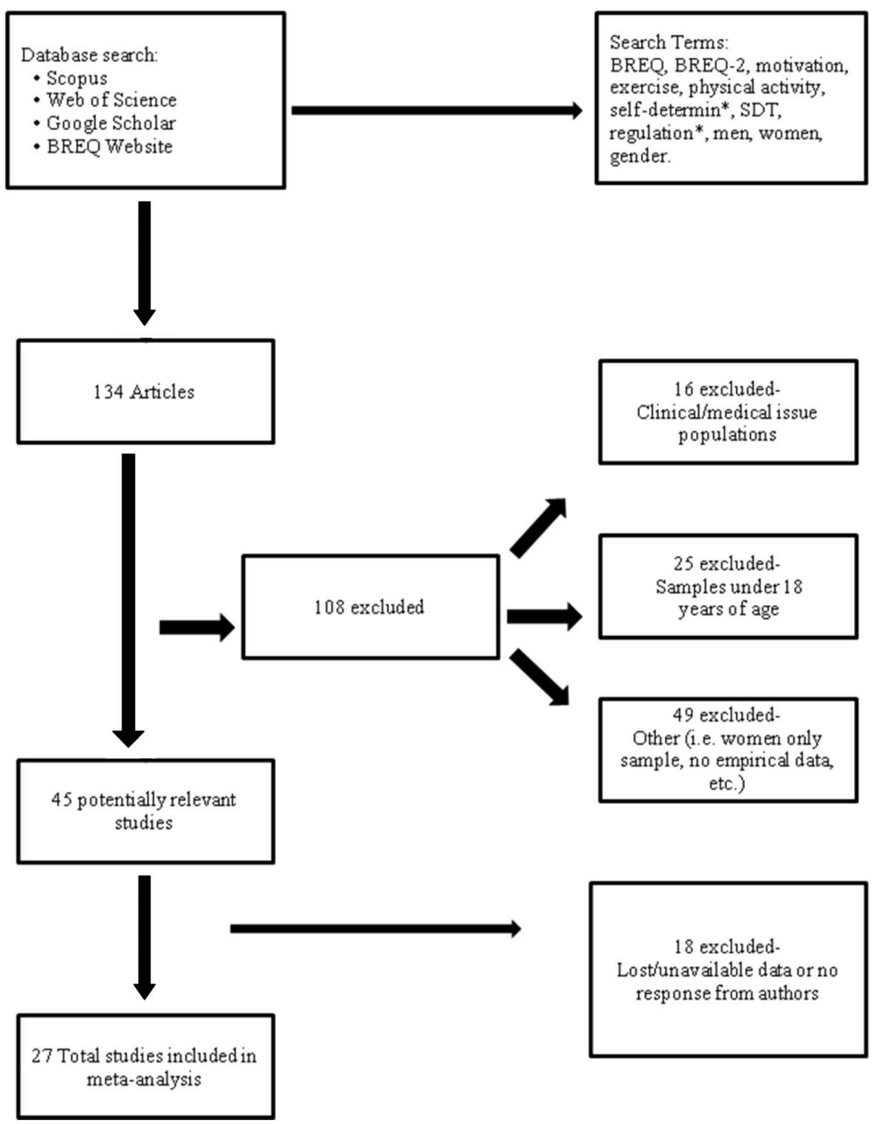

Figure 1. Meta-analysis flow chart of study selection.

Table 1
Descriptive Information of Studies Included in the Meta-Analysis

Studies	Sample size	Mean age	Scale	Recruitment context/participants[a]	Location	Study design
Brunet & Sabiston (2009)	161 M 220 F	18.69	BREQ-2	Students (various)	Canada	Associational (cross-sectional)
Fossmo (2006)	85 M 59 F	21.34	BREQ	Other (competitive athletes)	Norway	Associational (cross-sectional)
Ingledew & Markland (2008)	128 M 120 F	40.36	BREQ-2	Other (office workers)	UK	Associational (cross-sectional)
Ingledew, Markland, & Ferguson (2009)	119 M 131 F	19.48	BREQ-2	University students (residences)	UK	Associational (cross-sectional)
Ingledew, Markland, & Sheppard (2004)	90 M 92 F	36.46	BREQ	Sport/exercise center	UK	Associational (cross-sectional)
Lacroix, Saini, & Goris (2009)	30 M 28 F	33	BREQ-2	Other (office workers)	Netherlands	Associational (cross-sectional)
Markland & Tobin (2004)	59 M 136 F	56.33 M 54.24 F	BREQ-2	Other (exercise referral scheme participants)	UK	Associational (cross-sectional)
Moreno, Gimeno, & Camacho (2007)	263 M 298 F	31.82	BREQ-2	Sport/exercise centers	Spain	Associational (cross-sectional)
Moreno, Conte Marin, Borges Silva, Gonzales-Cutre Coll (2008)	264 M 215 F	29.07	BREQ-2	Combination (sport-exercise centers, students)	Mexico	Associational (cross-sectional)
Moreno, Lopez de San Roman et al. (2008)	238 M 156 F	21.64	BREQ-2	Sport/exercise centers	Spain	Associational (cross-sectional)
Moreno et al. (2009) Sample 1	127 M 184 F	33	BREQ-2	Sport/exercise centers (aquatic sports)	Spain	Associational (cross-sectional)
Moreno et al. (2009) Sample 2	261 M 207 F	28.89	BREQ-2	Sport/exercise centers (land sports)	Spain	Associational (cross-sectional)
Muyor, Aguila, Sicilia, & Orta (2009)	402 M 325 F	NA	BREQ-2 (Spanish)	Sport/exercise center	Spain	Associational (cross-sectional)
Navarro et al. (2008)	144 M 258 F	34.91	BREQ-2 (Spanish)	Sport/exercise centers	Spain	Associational (cross-sectional)
Palmeira, Teixeira, Silva & Markland (2007)	269 M 430 F[b]	27.3	BREQ-2 (Portugese)	Combination (sport-exercise centers, students)	Portugal	Associational (cross-sectional)
Petherick & Markland (2008)	124 M 248 F	42.1	BREQ-2	Sport/exercise centers	UK	Associational (cross-sectional)
Rose, Markland & Parfitt (2001)	113 M[b] 174 F[b]	35.8	BREQ	Other (Office workers, university staff)	UK	Associational (cross-sectional)
Rose, Parfitt, & Williams (2005)	83 M 101 F	33.99 M 28.85 F	BREQ	Combination (teachers, sport-exercise centers, students)	UK	Associational (cross-sectional)
Sebire, Standage, & Vansteenkist (2008)	137 M 175 F	34.44	BREQ	Combination (university graduate students, university staff)	UK	Associational (cross-sectional)
Sebire, Standage, & Vansteenkist (2009)	118 M 292 F	41.39	BREQ	Other (office/ government workers)	UK	Associational (cross-sectional)

Table 1 (*continued*)

Studies	Sample size	Mean age	Scale	Recruitment context/participants[a]	Location	Study design
Thogersen-Ntoumani & Ntoumanis (2006)	121 M 246 F	38.7	BREQ	Sport/exercise centers	UK	Associational (cross-sectional)
Thogersen-Ntoumani & Ntoumanis (2007)	25 M 110 F	33.94	BREQ	Other (exercise instructors)	UK	Associational (cross-sectional)
Vlachopoulos & Karageorghis (2005)	205 M 311 F	33.08	BREQ	Sport/exercise centers	UK	Associational (cross-sectional)
Wilson & Rogers (2008)	31 M 250 F[b]	31.79 M 26.15 F	BREQ	Students and staff in university aerobics class, Canada	Canada	Associational (cross-sectional)
Wilson, Rodgers, & Fraser (2002)	52 M 284 F	33.63 M 28.43 F	BREQ	Combination (university staff and students in exercise classes)	Canada	Associational (cross-sectional)
Wilson, Rodgers, Fraser, & Murray (2004)	98 M 178 F	20.37 M 20.75 F	BREQ-2	University students (classrooms)	Canada	Associational (cross-sectional)
Wilson, Rodgers, Loitz, & Scime (2006)	61 M 146 F	19.54 M 19.18 F	BREQ	University students	Canada	Associational (cross-sectional)

Note. The reference list for all studies included in this meta-analysis is available in a supplemental file; Age is given as a combined mean for men and women unless available separately.
[a] Recruitment context/participants, location, and study design were coded for descriptive purposes. Location was coded as the country in which the study was conducted (if this information was not available in the article, the country of the first-author's institutional affiliation was used). [b] mean *n* when different sample sizes were reported for the individual behavioral regulations; M = males and F = females.

(Barbeau, Sweet, & Fortier, 2010; Wilson, Rodgers, Loitz, & Scime, 2006), this subscale was not included in the present article, as the number of studies having done so was marginal at the time the analyses were conducted (i.e., one study identified). Items on the BREQ and BREQ-2 are scored on a five-point Likert scale and mean scores are created for each subscale. In addition, the Relative Autonomy Index (RAI), which refers to a weighted summed score of all regulations, can also be computed (Markland & Tobin, 2004). In this meta-analysis, the RAI was used when the scores had been computed in the original studies.

Data Evaluation and Analyses

An effect size is defined as the standardized mean difference between two populations. For the purposes of this meta-analysis, effect sizes were computed that referred to the differences between men and women on the RAI and on measures of each of the different motivational regulations: amotivation, external, introjected, and integrated regulations, and intrinsic motivation. We calculated the effect sizes of gender differences using Hedge's g (Borenstein, Hedges, Higgins, & Rothstein, 2009); whenever possible, the effect sizes were calculated for each of the regulations and the RAI by dividing the mean score difference for males and females by a pooled standard deviation. All effect sizes are presented such that positive effect-size values indicate that men on average scored higher than women on the different regulations.

The effect sizes were first calculated for each individual study and also separately by regulation type (and RAI). Despite stringent inclusion criteria, the studies varied in their research purposes and implementation and therefore we assumed that there would be significant variability between them in terms of methodology, culture, sample characteristics, BREQ version employed, and exercise context. Because fixed-effect models assume that all included studies are functionally identical, and thus the results have limited generalizability beyond the narrowly defined populations, we opted for the random-effects models (Borenstein, Hedges, Higgins, & Rothstein, 2010). The advantage of using a random-effects model lies in the assumption that there is a distribution of true effect sizes among the studies, and in the fact that such models take into consideration two sources of sampling error: within studies and between studies (Borenstein, Hedges, & Rothstein, 2007; Field, 2001).

To compute the overall mean effect sizes using a random-effects model, we employed the Comprehensive Meta-Analysis (CMA) software (Biostat, Version 2, Englewood, NJ). To obtain the overall effect sizes (g total, or Hedge's g total), and consistent with random-effects analyses, each study was weighted by the inverse of two sources of variance (i.e., within and between studies; Borenstein et al., 2009). For each of the regulations and the RAI, the approximate confidence interval for g total was provided and interpreted as the probability that the overall effect size is equal to zero (Hedges & Olkin, 1985). We also computed a random-effects Q statistic for each of the regulation analyses, which provided an indication of the homogeneity of variance across studies (Huedo-Medina, Sanchez-Meca, Marin-Martinez, & Botella, 2006). The Q statistic is evaluated using the χ^2 distribution with $k - 1$ degrees of freedom (k = number of studies). A significant Q statistic indicates that there are elements of diversity between studies in terms of design, participants, or other, greater than what would be expected by chance, and that could be influencing the magnitude of an effect size. When such methodological heterogeneity is found, it is best to test for moderator variables in an attempt to explain this heterogeneity.

In interpreting the results of a meta-analysis, it also is important to consider the likelihood of publication bias, which refers to the selective publication of only those studies with significant findings (Ahmed, Sutton, & Riley, 2012). In the present paper, the likelihood of this bias was determined by computing the "fail-safe *N*" through the CMA program. The fail-safe *N* refers to the required number of unpublished studies that would be needed to reduce the overall effect size to nonsignificant levels (Orwin, 1983). The risk of publication bias is lower when this number is elevated. Lastly, for each motivational outcome variable, we also obtained a forest plot with 95% confidence intervals. A forest plot provides a visual display of the amount of heterogeneity that is present in contributing studies, and it indicates the relative weight, based on sample size, of each effect size to the total (Akobeng, 2005).

Results

Characteristics of the final 27 studies included in this meta-analysis appear in Table 1. Overall statistical values obtained for the distinct motivational regulations and the RAI can be found in Table 2. Fourteen studies contributed to the total effect size for amotivation (BREQ-2). Although six of the studies showed effect sizes favouring higher scores in women, the total effect size for the difference in amotivation between men and women was nonsignificant ($g = .046$, 95% CI: −0.04 to 0.13; see Figure 2 for forest plots). The overall effect-size distribution in the random model appeared to be homogeneous, as indicated by a statistically nonsignificant Q value, $Q(13) = 13.37$, $p > .25$.

A total of 26 individual effect sizes contributed to the analyses of the external and introjected regulations. The overall effect size representing gender differences on external regulation was nonsignificant ($g = -.001$, 95% CI: −0.045 to 0.042). As can be seen from the forest plots in Figure 2, there seemed to be an even split between studies that reported higher external regulation scores in men and those that reported higher scores in women. Although 15 of the studies indicated that women had higher scores for introjected regulation, the total effect size revealed that, overall, levels in men did not differ significantly from those displayed by women ($g = -.049$, 95% CI: −0.117 to 0.019). The amount of heterogeneity in the distributions of studies for the analyses of external and introjected regulations was not significant, external: $Q(25) = 23.48$, $p > .05$; introjected: $Q(25) = 23.53$, $p > .05$.

The total effect size of gender differences for identified regulation across the 26 studies was nonsignificant ($g = -.059$, 95% CI: −0.145–0.027). As can be seen from the forest plot, 15 of the individual effect sizes for introjected regulation indicated higher scores in women, despite greater variance in the size of these effects than in the remaining 11 studies. Similarly, 26 studies contributed to the overall analysis for intrinsic motivation and revealed no overall disparities between men and women ($g = -.003$, 95% CI: −0.097 to 0.091). Nonsignificant Q values for identified regulation, $Q(25) = 22.87$, $p > .05$, and for intrinsic motivation, $Q(25) = 22.78$, $p > .05$, indicated a homogenous distribution of studies in each overall analysis. Finally, few of the total studies that were selected for this meta-analysis had computed RAI scores. Therefore the overall effect size for the difference between men and women on the RAI could only be computed on a total of five studies. The overall effect size was nonsignificant ($g = 0.104$, 95% CI: −0.066 to 0.274), and the distribution of contributing effect sizes was homogeneous, $Q(4) = 4.35$, $p > .05$. Given that all overall effects were already nonsignificant, there was no need to consider the fail-safe *N*s that might provide the required number of unpublished studies with null findings.

No moderator analyses were conducted for any of the regulations or for RAI because none of these effects were found to be heterogeneous.

Discussion

The purpose of this meta-analysis was to examine gender differences in SDT's motivational regulations for exercise, as measured by the BREQ and BREQ-2. To our knowledge, few meta-analytic investigations have focused solely on assessing the magnitude of gender differences on mean levels of major theoretical determinants of exercise, and none have centered on SDT's motivational regulations. This type of summative evidence is particularly warranted given recent statistics showing gender disparities in levels of exercise (Colley et al., 2011). Our findings from 27 studies revealed that scores for men and women were not significantly different from one another for any of the five regulations or for the composite RAI. All total effect sizes were nearly zero and thus any differences between males and females could be considered negligible. This serves to clarify some of the inconsistencies between genders that have risen over time in this literature.

From an empirical standpoint, the absence of any mean-level differences between men and women on the motivational regulations is somewhat surprising, as several studies have shown differences between genders in levels of intrinsic motivation, as well as identified and introjected regulations (Daley & Duda, 2006; Brunet & Sabiston, 2009). The findings also run contrary to gender disparities that have surfaced in the sports literature (Clément-

Table 2
Meta-Analysis Statistical Output for Each Motivational Regulation and RAI

	n	*z* (*p*)	Hedge's *g* (weighted)	Heterogeneity *Q* (*df*)
Amotivation	14	1.039 (.30)	.046	13.37 (13)
External regulation	26	−0.057 (0.96)	−.001	23.48 (25)
Introjected regulation	26	−1.420 (0.16)	−.049	23.53 (25)
Identified regulation	26	−1.345 (0.18)	−.059	22.87 (25)
Intrinsic motivation	26	−0.064 (0.95)	−.003	22.78 (25)
RAI	5	1.199 (0.231)	0.104	4.35 (4)

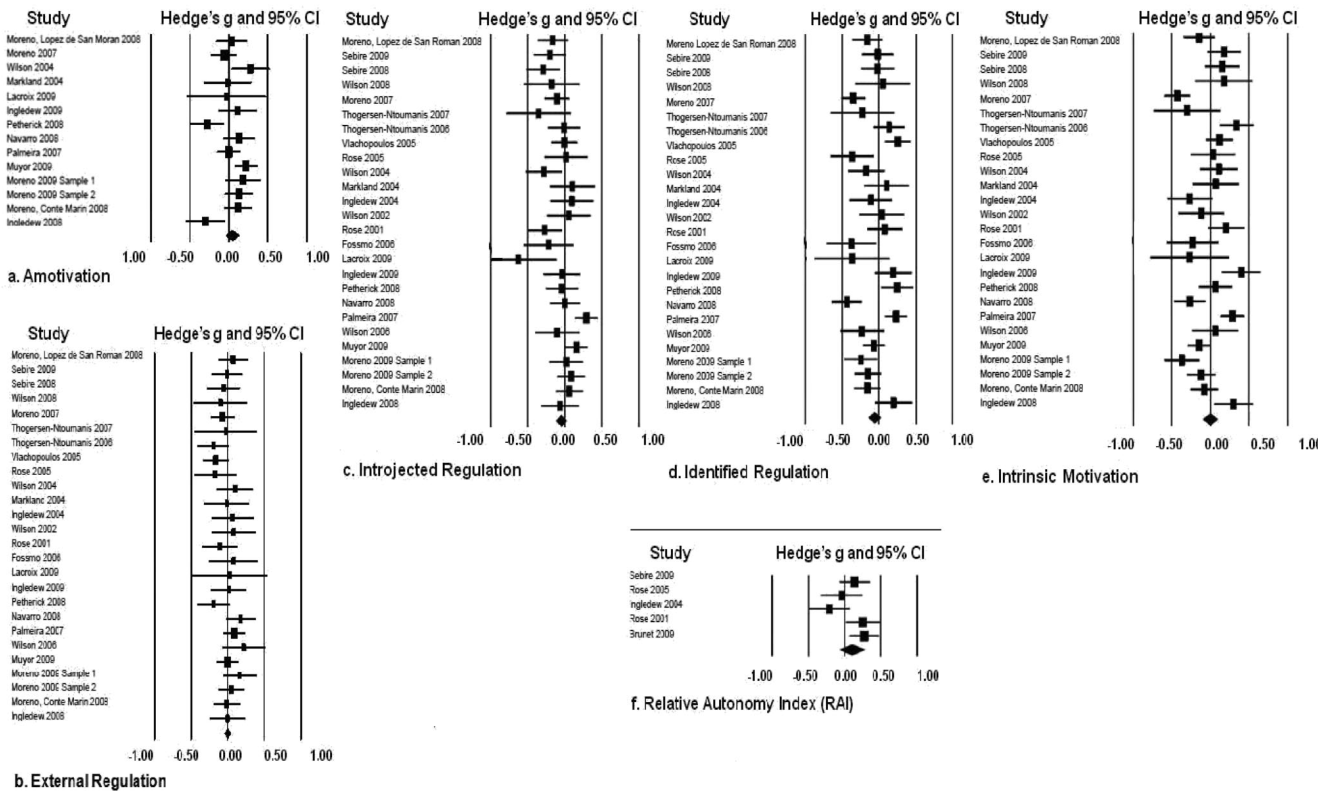

Figure 2. Forest plots for the individual effect sizes (Hedge's *g*) and overall effects (last lines) for (a) amotivation, (b) external regulation, (c) introjected regulation, (d) identified regulation, (e) intrinsic motivation, and (f) relative autonomy index (RAI); first author and date refer to the relevant studies.

Guillotin et al., 2012; Gillet & Rosnet, 2008). However, our results are in line with opposing findings demonstrating that men and women share consistent levels of motivational styles (Hall et al., 2010). From the participation-motives perspective, our findings do not take away the notion that certain reasons for exercise, such as appearance and competition, can be more salient for either gender. However, there appears to be uniformity across men and women in the overall internalization of these reasons into one's sense of self (Markland & Ingledew, 2007).

This relates to SDT's tenant of universality, from which Ryan and Deci (2002) claim that it is the *meaning* of the constructs as well as the basic theoretical processes that should not differ by gender. Researchers have conducted robust assessments of the universality principle, for instance, by testing the gender invariance of specific measurement instruments and showing that theoretical constructs are similarly perceived and defined by men and women (e.g., Vlachopoulos, 2008). In the exercise context, certain empirical models have been shown to be invariant, thus supporting the universality of motivational mechanisms/sequences across men and women, rather than any consistency in mean levels of the respective constructs per se (Gillison et al., 2006). Some authors have maintained gender invariance with respect to overarching SDT-based models while simultaneously speculating about mean-level differences between men and women on latent theoretical constructs (Brunet & Sabiston, 2009). But our summary of studies showed no discrepancies overall in mean levels of the regulations, which raises theoretical implications regarding the universality of motivational processes and of motivational quality, at least in the exercise context. Further testing is required through future meta-analyses, including broadening these enquiries to different contexts such as sport, as well as other facets such as cultural universality.

However, it is also important to take into account that gender discrepancies (or similarities) might not simply arise in terms of overall mean levels on the regulations. Rather, they may evolve further along the line at an associational level from motivational source (regulations) to outcome (e.g., exercise frequency), although this was not assessed in the present study. Therefore future quantitative reviews will also need to examine cross-study gender differences in the strength and direction of regulations–exercise relationships (e.g., Duncan et al., 2010). This could lead to additional interpretations of SDT's universality hypothesis and important implications for exercise interventions.

In terms of the limitations of this meta-analysis, only those studies that employed the popular BREQ and BREQ-2 were included. Although this provided a homogeneous assessment of motivation, it limited the ability to capture measurement-based variability and to generalise the findings to other instruments. In addition, studies supplementing the BREQ with a subscale for integrated regulation were scarce at the time the data was compiled. Although this regulation is now being assessed more frequently in the exercise literature (Wilson, Sabiston, Mack, &

Blanchard, 2012), to our knowledge, levels of this regulation have seldom been compared across gender.

Eliminating clinical populations from this meta-analysis meant that there were few intervention studies, and hence a scarcity of longitudinal studies ($n = 2$; baseline data examined). Hence, no conclusions can be drawn regarding the consistency of gender uniformity of motivational regulations over time. This will need to be examined in future studies. Moreover, this meta-analysis was primarily comprised of studies in which participants were recruited from sport/exercise centers, thereby ensuring that the individuals in these samples were mostly active (with exceptions; Markland & Tobin, 2004). Therefore, the lack of gender differences in levels of SDT's motivational regulations cannot be generalised to more sedentary individuals, including those undergoing exercise interventions. This is a noteworthy remark, considering that individuals in different stages of exercise behaviour change tend to endorse dissimilar levels of the motivational regulations (Fortier, Sweet, et al., 2012; Thøgersen-Ntoumani & Ntoumanis, 2006).

In sum, future meta-analyses of this kind will need to show consideration of the broadening of inclusion criteria, so that, for the allowance of greater generalisation of gender similarities (or differences) in motivation to the wider population, a greater number of studies can be included. From an applied standpoint, the results of our study suggest that programs that aim to motivate individuals to achieve greater levels of exercise might not require significant gender tailoring with respect to targeting the motivational regulations specifically. Theoretically, our findings carry implications in terms of the consistency of basic SDT constructs (i.e., regulations) across gender and in the exercise context, which supplements existing knowledge of the universality of motivational processes within SDT.

Résumé

La théorie de l'autodétermination (TAD) est une métathéorie de la motivation qui a bénéficié d'un important appui empirique dans divers domaines du comportement humain. La régulation de la motivation, selon la TAD, fait référence à divers degrés d'autodétermination dont peuvent témoigner les individus dans leur comportement. En particulier, la régulation a reçu un grand soutien empirique à titre de facteur prédicteur de l'exercice. Toutefois, la littérature sur ce domaine révèle des résultats contradictoires quant aux genres et aux niveaux de régulation de la motivation. Cette méta-analyse avait pour but d'examiner les différences entre les hommes et les femmes quant à la régulation de la motivation pour l'exercice, en se servant d'études ayant utilisé le Behavioural Regulations in Exercise Questionnaire (E. Mullan, D. Markland & D. K. Ingledew, 1997. A graded conceptualisation of self-determination in the regulation of exercise behaviour: Development of a measure using confirmatory factor analytic procedures. *Personality and Individual Differences, 23,* pp. 745–752). Au moyen de 27 études, on a pu établir l'ampleur de l'effet (le *g* de Hedges) des différences selon le sexe, qui a été calculée séparément pour chaque régulation, puis utilisée pour obtenir un résultat combiné pour l'autodétermination. Dans l'ensemble, les résultats des modèles à effets aléatoires révèlent une ampleur de l'effet presque nulle, ce qui représente des différences négligeables entre les hommes et les femmes pour chaque type de régulation. Les résultats relatifs aux principes fondamentaux d'universalité entre les sexes selon la TAD sont soigneusement interprétés à la lumière de la recherche actuelle sur l'invariance d'après les genres et des suggestions de recherches ultérieures sont proposées.

Mots-clés : méta-analyse, genre, motivation, théorie de l'autodétermination, exercice.

References

Ahmed, I., Sutton, A. J., & Riley, R. D. (2012). Assessment of publication bias, selection bias, and unavailable data in meta-analyses using individual participant data: A database survey. *BMJ: British Medical Journal, 344,* d7762. doi:10.1136/bmj.d7762

Akobeng, A. K. (2005). Understanding randomized controlled trials. *Archives of Disease in Childhood, 90,* 840–844. doi:10.1136/adc.2004.058222

Barbeau, A., Sweet, S. N., & Fortier, M. S. (2009). A path-analytic model of self-determination theory in a physical activity context. *Journal of Applied Biobehavioral Research, 14,* 103–118. doi:10.1111/j.1751-9861.2009.00043.x

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. West Sussex, UK: John Wiley & Sons. doi:10.1002/9780470743386

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2010). A basic introduction to fixed-effect and random-effects models for meta-analysis. *Research Synthesis Methods, 1,* 97–111. doi:10.1002/jrsm.12

Borenstein, M., Hedges, L. V., & Rothstein, H. R. (2007). *Meta-analysis: Fixed effect vs. random effects*. Retrieved from http://www.sciencedownload.net/demodownload/Fixed%20effect%20vs.%20random%20effects.pdf

Brunet, J., & Sabiston, C. M. (2009). Social physique anxiety and physical activity: A self-determination theory perspective. *Psychology of Sport and Exercise, 10,* 329–335. doi:10.1016/j.psychsport.2008.11.002

Chatzisarantis, N. L. D., Hagger, M. S., Biddle, S., Smith, B., & Wang, J. C. K. (2003). A meta-analysis of perceived locus of causality in exercise, sport, and physical education contexts. *Journal of Sport and Exercise Psychology, 25,* 284–306.

Clément-Guillotin, C., Chalabaev, A., & Fontayne, P. (2012). Is sport still a masculine domain? A psychological glance. *International Journal of Sport Psychology, 43,* 67–78.

Colley, R. C., Garriguet, D., Janssen, I., Craig, C. L., Clarke, J., & Tremblay, M. (2011). Physical activity of Canadian adults: Accelerometer results from the 2007 to 2009 Canadian Health Measures Survey. Ottawa, ON, Canada: Statistics Canada (Catalogue No. 82–003-XPE). Retrieved from http://www.statcan.gc.ca/pub/82-003-x/2011001/article/11396-eng.pdf

Daley, A. J., & Duda, J. L. (2006). Self-determination, stage of readiness to change for exercise, and frequency of physical activity in young people. *European Journal of Sport Science, 6,* 231–243. doi:10.1080/17461390601012637

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behaviour*. New York, NY: Plenum.

Deci, E. L., & Ryan, R. M. (2002). *Handbook of self-determination research*. Rochester, NY: University of Rochester Press.

DiBartolo, P. M., & Shaffer, C. (2002). A comparison of female college athletes and nonathletes: Eating disorder symptomatology and psychological well being. *Journal of Sport & Exercise Psychology, 24,* 33–42.

Duncan, L. R., Hall, C. R., Wilson, P. M., & Jenny, O. (2010). Exercise motivation: A cross-sectional analysis examining its relationships with frequency, intensity, and duration of exercise. *International Journal of*

Behavioral Nutrition and Physical Activity, 7, 7. doi:10.1186/1479-5868-7-7

Edmunds, J., Ntoumanis, N., & Duda, J. L. (2006). A test of self-determination theory in the exercise domain. *Journal of Applied Social Psychology, 36,* 2240–2265. doi:10.1111/j.0021-9029.2006.00102.x

Field, A. P. (2001). Meta-analysis of correlation coefficients: A Monto Carlo comparison of fixed- and random-effects methods. *Psychological Methods, 6,* 161–180. doi:10.1037/1082-989X.6.2.161

Fortier, M. S., Duda, J., Guerin, E., & Teixeira, P. (2012). Promoting physical activity: Development and testing of self-determination theory-based interventions. *The International Journal for Behavioral Nutrition and Physical Activity, 9,* 20. doi:10.1186/1479-5868-9-20

Fortier, M. S., Sweet, S. N., Tulloch, H., Blanchard, C. M., Sigal, R. J., Kenny, G. P., & Reid, R. D. (2012). Self-determination and exercise stages of change: Results from the Diabetes Aerobic and Resistance Trial. *Journal of Health Psychology, 17,* 87–99. doi:10.1177/1359105311408948

Fortier, M. S., Wiseman, E., Sweet, S. N., O'Sullivan, T., Blanchard, C. M., Sigal, R. J., & Hogg, W. (2011). A moderated mediation of physical activity motivation in the context of the Physical Activity Counseling randomized control trial. *Psychology of Sport and Exercise, 12,* 71–78. doi:10.1016/j.psychsport.2010.08.001

Gillet, N., & Rosnet, E. (2008). Basic need satisfaction and motivation in sport. *Athletic Insight: The Online Journal of Sport Psychology, 10*(3). Retrieved from http://www.athleticinsight.com/Vol10Iss3/BasicNeed.htm

Gillison, F., Osborn, M., Standage, M., & Skevington, S. (2009). Exploring the experience of introjected regulation for exercise across gender in adolescence. *Psychology of Sport and Exercise, 10,* 309–319. doi:10.1016/j.psychsport.2008.10.004

Gillison, F. B., Standage, M., & Skevington, S. M. (2006). Relationship among adolescents' weight perceptions, exercise goals, exercise motivation, quality of life and leisure-time exercise behaviour: A self-determination theory approach. *Health Education Research, 21,* 836–847. doi:10.1093/her/cyl139

Hagger, M., & Chatzisarantis, N. (2008). Self-determination theory and the psychology of exercise. *International Review of Sport and Exercise Psychology, 1,* 79–103. doi:10.1080/17509840701827437

Hall, C. R., Rodgers, W. M., Wilson, P. M., & Norman, P. (2010). Imagery use and self-determined motivations in a community sample of exercisers and non-exercisers. *Journal of Applied Social Psychology, 40,* 135–152. doi:10.1111/j.1559-1816.2009.00566.x

Hamilton, K., Cox, S., & White, K. M. (2012). Testing a model of physical activity among mothers and fathers of young children: Integrating self-determined motivation, planning, and the theory of planned behavior. *Journal of Sport & Exercise Psychology, 34,* 124–145.

Hedges, L. V., & Olkin, I. (1985). *Statistical methods for meta-analysis*. Orlando, FL: Academic Press.

Huedo-Medina, T. B., Sanchez-Meca, J., Marin-Martinez, F., & Botella, J. (2006). Assessing heterogeneity in meta-analysis: I^2 or Q statistic? *Psychological Methods, 11,* 193–206. doi:10.1037/1082-989X.11.2.193

Kilpatrick, M., Hebert, E., & Bartholomew, J. (2005). College students' motivation for physical activity: Differentiating men's and women's motives for sport participation and exercise. *Journal of American College Health, 54,* 87–94. doi:10.3200/JACH.54.2.87-94

Lewis, M., & Sutton, A. (2011). Understanding exercise behavior: Examining the interaction of exercise motivation and personality in predicting exercise frequency. *Journal of Sport Behavior, 34,* 82–97.

Lutz, R., Lochbaum, M., & Turnbow, K. (2003). The role of relative autonomy in post-exercise affect responding. *Journal of Sport Behavior, 26,* 137–154.

Markland, D., & Ingledew, D. K. (2007). Exercise participation motives. In M. S. Hagger, & N. L. D. Chatzisarantis, (Eds.), *Intrinsic motivation and self-determination in exercise and sport* (pp. 23–34, 302–305). Windsor, ON, Canada: Human Kinetics.

Markland, D., & Tobin, V. (2004). A modification to the Behavioural Regulation in Exercise Questionnaire to include an assessment of amotivation. *Journal of Sport & Exercise Psychology, 26,* 191–196.

Markland, D., & Tobin, V. (2010). Need support and behavioural regulations for exercise among exercise referral scheme clients: The mediating role of psychological need satisfaction. *Psychology of Sport and Exercise, 11,* 91–99. doi:10.1016/j.psychsport.2009.07.001

Michie, S., Johnston, M., Abraham, C., Lawton, R., Parker, D., & Walker, A. (2005). Making psychological theory useful for implementing evidence based practice: A consensus approach. *Quality and Safety in Health Care, 14,* 26–33. doi:10.1136/qshc.2004.011155

Mullan, E., Markland, D., & Ingledew, D. K. (1997). A graded conceptualisation of self-determination in the regulation of exercise behaviour: Development of a measure using confirmatory factor analytic procedures. *Personality and Individual Differences, 23,* 745–752. doi:10.1016/S0191-8869(97)00107-4

Orwin, R. G. (1983). A fail-safe N for effect sizes. *Journal of Educational Statistics, 8,* 157–159. doi:10.2307/1164923

Pan, S. Y., Cameron, C., DesMeules, M., Morrison, H., Craig, C. L., & Jiang, X. H. (2009). Individual, social, environmental, and physical environmental correlates with physical activity among Canadians: A cross-sectional study. *BMC Public Health, 9,* 21–33. doi:10.1186/1471-2458-9-21

Roberts, G., & Treasure, D. (Eds.). (2012) *Advances in motivation in sport and exercise* (3rd ed.). Windsor, ON, Ccanada: Human Kinetics.

Ryan, R. M., & Deci, E. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55,* 68–78. doi:10.1037/0003-066X.55.1.68

Ryan, R. M., & Deci, E. L. (2002). Overview of Self-Determination Theory: An organismic dialectical perspective. In E. L. Deci, & R. M. Ryan, *Handbook of self-determination research* (pp. 3–36). Rochester, NY: University of Rochester Press.

Ryan, R. M., & Deci, E. L. (2003). On assimilating identities to the self: A self-determination theory perspective on internalization and integrity within cultures. In M. R. Leary, & J. P. Tangney (Eds.), *Handbook of self and identity* (pp. 253–274). New York, NY: Guilford Press.

Silva, M. N., Markland, D., Minderico, C. S., Vieira, P. N., Castro, M. M., Coutinho, S. R., . . . Teixeira, P. J. (2008). A randomized controlled trial to evaluate self-determination theory for exercise adherence and weight control: Rationale and intervention description. *BMC Public Health, 8,* 234. doi:10.1186/1471-2458-8-234

Teixeira, P. J., Carraca, E. V., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity, 9,* 78. doi:10.1186/1479-5868-9-78

Thøgersen-Ntoumani, C., & Ntoumanis, N. (2006). The role of self-determined motivation to the understanding of exercise-related behaviours, cognitions and physical self-evaluations. *Journal of Sports Sciences, 24,* 393–404. doi:10.1080/02640410500131670

Tiggemann, M., & Williamson, S. (2000). The effect of exercise on body satisfaction and self-esteem as a function of gender and age. *Sex Roles, 43,* 119–127. doi:10.1023/A:1007095830095

Vlachopoulos, S. P. (2008). The basic psychological needs in exercise scale: Measurement invariance over gender. *Structural Equation Modeling, 15,* 114–135. doi:10.1080/10705510701758398

Weiss, M. R., & Ferrer-Caja, E. (2002). Motivational orientations and sport behavior. In T. Horn (Ed.), *Advances in sport psychology* (2nd ed., pp. 101–170). Champaign, IL: Human Kinetics.

Wilson, P. M., Rodgers, W. M., Fraser, S. N., & Murray, T. C. (2004). Relationships between exercise regulations and motivational consequences in university students. *Research Quarterly for Exercise and Sport, 75,* 81–92.

Wilson, P. M., Rodgers, W. M., Loitz, C. C., & Scime, G. (2006). "It's who I am. . .really!" The importance of integrated regulation in exercise contexts. *Journal of Applied Biobehavioral Research, 11,* 79–104. doi:10.1111/j.1751-9861.2006.tb00021.x

Wilson, P. M., Sabiston, C. M., Mack, D. E., & Blanchard, C. M. (2012). On the nature and function of scoring protocols used in exercise motivation research: An empirical study of the Behavioural Regulation in Exercise Questionnaire. *Psychology of Sport and Exercise, 13,* 614–622. doi:10.1016/j.psychsport.2012.03.009

Received May 14, 2012
Revision received August 24, 2012
Accepted August 27, 2012 ■