

Associations Between Behavior Regulation, Competence, Physical Activity, and Health for Adolescent Females

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Background: This study investigated the association between the different types of behavior regulation and competence on sport and physical activity (PA) and perceived health, and the influence of school year level (ie, year 7 and year 11) and setting (ie, metropolitan and rural) on these relationships. **Methods:** A cross sectional self-complete survey was conducted. Competence was measured using the 5-item perceived competence subscale of the 21-item Athletic Identity Questionnaire (AIQ); behavior regulation was measured using a modified version of the Behavior Regulation in Exercise Questionnaire (BREQ-2); PA was measured using an item to assess if adolescents are meeting recommended levels of PA; and perceived health was measured using the Short Form 1 (SF-1). **Results:** This study included 732 participants, 71.2% from metropolitan schools, and 66.8% in year 7. Self-determined behavior regulation and competence were positively associated with PA and health. Intrinsic motivation was more strongly related to older adolescents' PA than it was for younger adolescents. Behavior regulators and competence were more strongly associated with health than PA. **Conclusions:** The findings of this study suggest that strategies that enhance intrinsic motivation and PA competence may improve the health of adolescent females; enhancing these may lead to greater health regardless of level of PA.

Keywords: self-determination theory, exercise, adolescence

Regular participation in physical activity (PA) is imperative for good physical and mental health.¹ PA can increase one's capacity for learning, promote social well-being and introduce skills such as teamwork, self-discipline and leadership.^{1,2} Level of participation in PA during adolescence is also associated with level of PA in adulthood.³

Low levels of PA, particularly during adolescence, are contributing to poor health, including the incidence of overweight and obesity. A marked decline in PA participation occurs with age for adolescents, specifically for females.^{4,5} Evidence suggests a 50% drop off from sport and PA for young women aged 10–14 years.⁶ This may be because of the significant life transitions that take place for adolescent females from the ages 12–15 years, which include moving from primary to secondary school,⁷ and 16–19 years, which include increasing pressure to study⁸ and transition to independent living.

Decline in PA with age has also been observed specifically in rural adolescents.⁹ However, the determinants of participation in PA for rural living people, and therefore

reasons for the disparity in PA, are largely unexplored¹⁰ and require investigation.

Understanding reasons for the decline in PA during adolescence is essential. Behavioral theories such as self-determination theory (SDT) can assist our understanding of factors that are associated with level of participation and outcomes of PA.

SDT is a well-established theory for understanding engagement in and maintenance of a variety of behaviors, including PA, as well as predicting cognitive and affective outcomes (eg, well-being and quality of life).^{11,12} SDT incorporates a multilayered motivation perspective for understanding behavioral processes and includes 3 major types of motivation—*intrinsic motivation*, *extrinsic motivation*, and *amotivation*.^{12,13}

Intrinsic motivation represents the highest level of self-determination and occurs when an individual is inherently interested or enjoys the activity itself, irrespective of the outcomes. SDT differentiates between 3 types of extrinsic motivation: *identified regulation*, *introjected regulation* and *external regulation*.¹ The most self-determined form of extrinsic motivation is *identified regulation*, followed by *introjected* and *extrinsic regulation*. *Amotivation* is the third 'type' of motivation and refers to having no intention to engage in the behavior, or a lack of motivation.^{12,13}

SDT proposes that self-determined motivation (ie, *intrinsic motivation* and *integrated regulation*) leads to

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positive behavioral, cognitive, and psychological (eg, well-being) outcomes.^{14,15} For adolescents, self-determined forms of behavioral regulation have a positive impact on level of PA.^{16,17} In a study of British adolescents, self-determined motivation positively predicted quality of life and PA behavior¹⁶. In the context of physical education, several studies have shown that positive outcomes result from self-determined regulation.^{18,19}

According to SDT, competence is 1 of the 3 basic psychological needs fundamental to self-determined regulation and positive psychological outcomes.²⁰ Competence is particularly important to child and adolescent PA; research on these groups has suggested the importance of perceived competence in increasing PA participation^{21,22}.

Females' perceived competence in PA declines during early adolescence.²³ This may be due to contextual factors as well as biological factors such as puberty.²⁴ Physical changes associated with puberty, including increases in body fatness, may result directly in poorer performance or in self-consciousness that leads to poorer performance and hence to decreased perceived competence.²⁴

There is evidence supporting the positive influence of self-determined behavior regulation on quality of life for adolescents.¹⁶ However, the influence of behavior regulation and competence on perceived health has largely been unexplored. Furthermore, whether behavior regulation and competence influence perceived health regardless of level of PA has not been examined and represents an important area of investigation in determining key determinants of adolescent health.

This study aimed to investigate differences in motivation, competence, PA and perceptions of health for females who are from 2 stages of adolescence (year 7, aged 12–13 years; and year 11, aged 16–17 years) and 2 different settings (rural and metropolitan). Specifically, the study research questions were 1) what are the associations between behavior regulation (intrinsic motivation, identified regulation, introjected and external regulation amotivation), competence and level of PA, and do these relationships vary by year level and setting; 2) what are the associations between behavior regulation (intrinsic motivation, identified regulation, introjected and external regulation, amotivation), competence, level of PA, and health, and do these associations vary by year level and setting; and 3) do behavior regulation or competence uniquely contribute to positive health above the contribution of PA to perceived health?

Methods

Participants

A cluster randomization process was used to select schools for this study. Schools in metropolitan and rural areas of Victoria, Australia, were randomly selected to take part. The postcodes of schools were used to assign a value of the Australian Bureau of Statistics (ABS) SEIFA

(Socioeconomic Indices for Areas) disadvantage/advantage index to each²⁵ and the distribution of schools was checked to ensure they were representative of the broader SIEFA indices in Victoria. A total of 17 schools in metropolitan and 14 schools in rural areas participated in the study. Ethical approval was gained from the University Human Research Ethics Committees, the Victorian Department of Education and the Victorian Catholic Education Office.

A pilot test was conducted, involving 71 participants in a convenience sample of 3 schools. Minor changes were made to the content of the questionnaire and the order of questions was revised.

The physical education coordinator or research officer invited female students in years 7 and 11) to participate in the study. Plain language information statements and parental and participant consent forms were handed out to students; those who returned both completed consent forms completed the baseline survey questionnaire. The questionnaire was completed by most students during school class time.

Measurements

PA Participation. PA participation was self-assessed using a single item asking the respondent to indicate the number of days (0–7) out of the past 7 that they had engaged in PA for a total of 1 or more hours per day.²⁶ The item ranged from 'no days' (0) to 7 days (7). This item was based on Active Australia's sufficient PA recommendations.²⁶ This question has been found to be reliable and has acceptable validity when compared with accelerometer data for adolescents.²⁷ Studies of adults have also shown that single-item questions are acceptable measures of physical activity when compared with accelerometry measures²⁸ and against questions or surveys consisting of multiple items or PA diaries.²⁹

Perceived Health. Perceived health was measured using the single item from the SF-1^{30–32}; 'In general, would you say your health is,' with responses on a 5-point scale ranging from 'excellent,' 'very good,' 'good,' 'fair,' to 'poor.' This provides an assessment of general health. Single items measuring perception of health have been used in studies of adolescents³³ and have found to be associated with psychosocial functioning and other dimensions of adolescent health.³³

PA Competence. Competence was assessed using the 5-item perceived competence subscale of the 21-item Athletic Identity Questionnaire (AIQ).³⁴ For consistency with other aspects of the questionnaire, we used a 5-point Likert-type scale ('strongly disagree' to 'strongly agree'), and the terms "sport" and "PA" were used to align with the focus of this research. In our sample, the scale had acceptable reliability (Cronbach's alpha = .78).

PA Behavior Regulation. A modified version of The Behavior Regulation in Exercise Questionnaire (BREQ-2),³⁵ was included to measure amotivation and external, introjected, identified, and intrinsic forms of behavior

regulation. In common with other measures of behavioral regulation in different contexts, the BREQ-2 does not include an integrated regulation subscale. The BREQ has previously been used with adolescents (11–15 years).¹⁹

We used a 5-point Likert scale from ‘strongly agree’ to ‘strongly disagree’ as these responses were suitable for the study participants, who had varying levels of participation in PA. This response scale also provided consistency with other aspects of the questionnaire. The Cronbach’s alpha for each of the factors were in acceptable ranges, thus demonstrating reliability. Cronbach’s alpha for each of the factors was as follows: External regulation (.81), Introjected regulation (.71), Identified regulation (.72), Intrinsic regulation (.87), and Amotivation (.84).

Sociodemographics. The sociodemographic data that were used in the analysis were year at school (year 7 or 11), setting (metropolitan or rural), and socioeconomic index for areas (SEIFA²⁵). SEIFA disadvantage/advantage index values were assigned according to the participant’s home postcode, with higher scores indicating higher socioeconomic status.

Statistical Analyses

Data screening was undertaken before the data analyses.³⁶ All analyses were conducted on the cases with complete data for the particular analysis. To check for multicollinearity, correlations between the independent variables and tolerance values were checked, and all were within acceptable ranges. Scatterplots, casewise diagnostics (for cases with standardized residual values greater in magnitude than 3.0) and Cook’s Distances were examined for outliers. Results from these analyses suggested outliers did not affect the models.

First, relationships between SEIFA index, year level and setting and the dependent variables (PA and health) were assessed using correlation coefficients and *t* tests, as appropriate. The influence of those sociodemographic factors that accounted for significant variation in PA and health were controlled for in the regression analyses.

To test research question 1, hierarchical multiple regression analyses, incorporating interaction components (cross products of year level or setting with intrinsic motivation, identified regulation, introjected regulation, external regulation, amotivation, and competence) were used in the main analyses of the data. Thus, moderating effects,³⁷ as well as main effects, on PA were examined.

To test research question 2 and 3, hierarchical multiple regression analyses, incorporating interaction components (cross products of year level or setting with intrinsic motivation, identified regulation, introjected regulation, external regulation, amotivation, and competence) were used in the main analyses of the data. Thus moderating effects as well as main effects of participation in PA on health were examined.

In the regression analyses, behavior regulators and competence scores were centered to reduce the risk of multicollinearity, and the categorical variables of setting and year level were dummy coded (metropolitan = 0, rural

= 1; year 7 = 0, year 11 = 1, respectively) before creating the interaction terms. Centering of scores requires conversion of the scores to deviation scores so that each score has a mean of 0.⁴² Possible interaction effects were explored by plotting selected groups at ± 1 SD from the mean.³⁸ The *F* test representing the stepwise change in variance explained as a result of the addition of the product terms was used as the determinant of significant moderator effects. When the interaction effects were nonsignificant the first-order effects became unconditional effects. The data were analyzed using SPSS’s (Version 18).

Results

Demographic Information

A total of 732 participants completed the questionnaire. Of these 71.2% (*n* = 521) were from metropolitan schools and the remaining 28.8% (*n* = 211) were from rural schools. Year 7 respondents accounted for 66.8% (*n* = 489) of the sample and 33.2% (*n* = 243) were from year 11. Response rates were as follows: Metropolitan: Year 7 23.7% (368 of 1550 distributed), Year 11 13.0% (155 of 1189 distributed); Nonmetropolitan: Year 7 25.7% (123 of 479 distributed), Year 11 16.8% (88 of 523 distributed).

The age range of participants was 11–20 years (mean = 13.6, *SD* = 1.96, *n* = 701). Most participants were aged 11–13 (*n* = 464, 66.2%) and were in year 7; the remaining 33.8% (*n* = 237) were aged 16–20 and were in year 11. The SEIFA index ranged from 817–1141 (mean = 1011; *SD* = 63), which indicated that the sample was representative of socioeconomic areas (SEIFA is centered around a value of 1000) with 5th and 95th percentiles around 800 and 1200 respectively.

Descriptive statistics of the study variables can be seen in Table 1. On average, participants were physically active for 60 minutes or more on 3 days of the week and reported average levels of health. The mean scores of competence and behavior regulation shows that participants had higher levels of competence and self-determined type motivations (intrinsic motivation, identified regulation) than non-self-determined motivations (introjected regulation, external regulation and amotivation).

Associations Between Behavior Regulation, Competence, and PA

Preliminary analysis showed that SEIFA (*r* = .12, *P* = .002, *n* = 672), setting (*t* 715 = –2.68, *P* = .002) and year level (*t* 715 = 2.36, *P* = .019) were significantly associated with PA. To control for these factors, they were entered into the regression analysis in the first block.

In the hierarchical analysis year level, setting and SEIFA were entered in step 1, explaining 5% of the variance in PA (*P* < .001). After entry of the behavior regulation factors and competence in Step 2, the total variance explained by the model as a whole was 24% (*P* < .001). The behavior regulators and competence explained an additional 19% (*P* < .001) (see also Table 2).

Table 1 Means and Standard Deviations of Study Measures

Measure	n	Mean	SD	Item range
PA number of days	717	3.23	1.85	0–7 ⁺
Competence	725	3.86	.72	1–5 ⁺⁺
Intrinsic motivation	727	3.83	.95	1–5 ⁺⁺
Identified regulation	727	3.67	.86	1–5 ⁺⁺
Introjected regulation	725	2.84	1.09	1–5 ⁺⁺
External regulation	725	2.03	.87	1–5 ⁺⁺
Amotivation	726	1.50	.72	1–5 ⁺⁺
Self-reported health	702	3.67	.89	1–5 ⁺⁺⁺

+ 0–7 days.

++ 1 = strongly disagree to 5 = strongly agree.

+++ 1 = poor to 5 = excellent.

Table 2 Regression of Physical Activity on Behavior Regulation and Competence, Including the Interaction of These Predictor Variables

Variables entered	β final ^c	R^2	Sig	95% CI for b^d	
				Lower	Upper
Step 1		.05	<.001		
SEIFA	.11		.02	.001	.005
Setting ^a	.12		<.001	.180	.755
Year level ^b	–.10		.01	–.644	–.111
Step 2		.24	<.001		
Competence	.30		<.001	0.494	1.04
Intrinsic	.04		.56	–0.175	0.323
Identified	.09		.22	–0.108	0.478
Introjected	.07		.20	–0.064	0.307
External	–.11		.055	–0.457	0.004
Amotivation	–.01		.90	–0.289	0.254
Step 3		.26	<.001		
Region $\times$ competence	–.06		.21	–0.774	0.172
Region $\times$ intrinsic	.05		.41	–0.259	0.628
Region $\times$ identified	–.00		.96	–0.508	0.482
Region $\times$ introjected	–.03		.51	–0.441	0.219
Region $\times$ external	.02		.64	–0.293	0.477
Region $\times$ amotivation	–.04		.38	–0.737	0.279
Year $\times$ competence	–.09		.08	–0.843	0.045
Year $\times$ intrinsic	.15		.02	0.088	0.922
Year $\times$ identified	.07		.32	–0.243	0.747
Year $\times$ introjected	–.04		.42	–0.443	0.186
Year $\times$ external	.03		.53	–0.241	0.471
Year $\times$ amotivation	–.02		.67	–0.555	0.358
(constant)	–2.94				

^a Setting coded as: Metropolitan = 0; Rural = 1.

^b Year level coded as: year 7 = 0; Year 11 = 1.

^c Standardized coefficient (Beta).

^d Confidence interval for unstandardized coefficient.

The interaction terms between year level and the behavior regulators and competence, and setting and behavior regulators and competence were entered in Step 3 and the total variance explained by the model as a whole was 26% ($P < .001$). The interaction terms explained an additional 3% of variance ($P = .03$).

In the final model, SEIFA ($\beta = .11, P = .002$), setting ($\beta = .12, P = .001$), year level ($\beta = -.10, P = .01$), competence ($\beta = .30, P < .001$), and interaction of year level and intrinsic motivation ($\beta = .15, P = .02$) were significant. In terms of sociodemographic characteristics, the influence of setting was such that adolescent females from rural areas had higher levels of PA than females from metropolitan settings. The relationship between SEIFA scores and PA suggested that females from higher SES have higher levels of PA. Finally, the relationship between year level and PA indicated that females from the lower year level reported more PA. External regulation ($\beta = -.11, P = .055$) approached significance, the direction of this association indicated that higher levels of external regulation were associated with lower levels of participation in PA.

A graph of the interaction effect of intrinsic motivation and year level on level of PA assisted in the interpretation of this finding. Figure 1 shows that intrinsic motivation has a relationship with PA for year 11 students but not for students in year 7.

Associations Between Behavior Regulation, Competence, PA, and Health

Preliminary analysis showed that SEIFA ($r = .10, P = .01, n = 672$) and year level ($t_{700} = 4.80, P < .001$) were significantly associated with health; however setting was not significant ($P = .40$). SEIFA and year level were included in the regression analysis in the first block.

Year level and SEIFA were entered in step 1, explaining 4% of the variance in health ($P < .001$). After entry of the behavior regulation factors, competence and PA in Step 2, the total variance explained by the model as a whole was 25% ($P < .001$; see Table 3). The behavior regulators, competence and PA explained an additional 21%.

The interaction terms between year level or setting and the behavior regulators and competence, which were entered in Step 3, did not explain significant additional variance ($P = .27$). Thus, the influence of behavior regulators and competence did not vary by setting or year level. In the final model, year level ($\beta = -.15, P < .001$), external regulation ($\beta = -.14, P = .001$), intrinsic motivation ($\beta = .18, P < .001$), competence ($\beta = .25, P < .001$) were significant predictors of health. Year level beta value suggested that females from year 7 reported more positive health. The negative beta value of external regulation suggested that the more females' PA is externally regulated, the less positive their perceived health. PA was not significant in the final model, suggesting that external regulation, intrinsic motivation and competence are stronger predictors of health than PA.

Discussion

This study supported the positive influence of self-determined behavior regulation and the negative influence of external behavior regulation on level of PA and health for adolescent females. The influence of behavior regulators on PA and health, in the main, were not moderated by year level or setting. The exception was that year level interacted with intrinsic motivation to influence PA such that intrinsic motivation was related to PA for older adolescents but not for younger adolescents. We also found

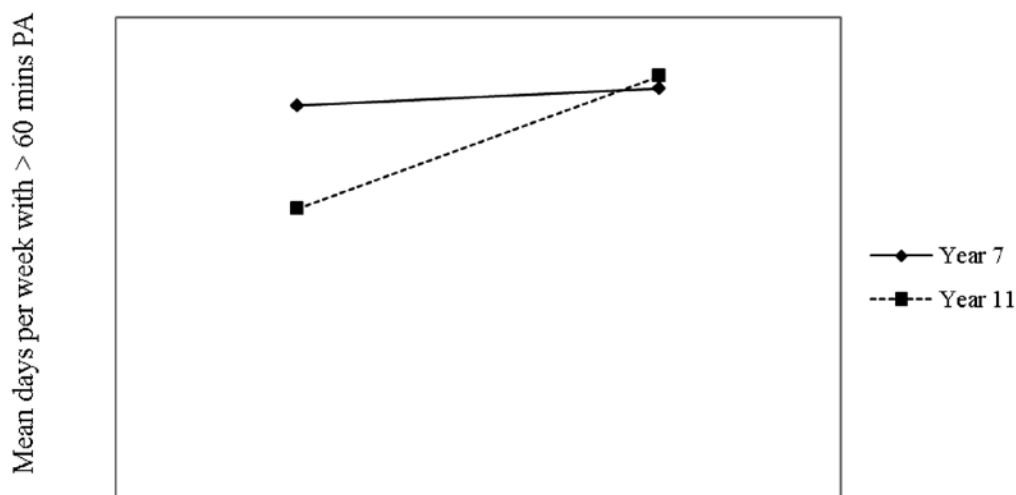


Figure 1 — Moderating effect of year level on influence of intrinsic motivation on participation in PA.

Table 3 Regression of Self-Reported Health on Behavior Regulation, Competence, and Physical Activity, Including the Interaction of These Predictor Variables

Variables entered	β Final ^{a,c}	R^2	Sig	95% CI for b^d	
				Lower	Upper
Step 1		.04	<.001		
SEIFA	.05		.11	0.00	.002
Year level ^b	-.15		<.001	-0.415	-0.162
Step 2		.25	<.001		
Competence	.25		<.001	0.211	0.412
Intrinsic	.18		<.001	0.078	0.262
Identified	.07		.22	-0.039	0.174
Introjected	-.06		.18	-0.115	0.022
External	-.14		.001	-0.221	-0.059
Amotivation	.07		.09	-0.012	0.188
PA	.06		.12	-0.007	0.065
Step 3		.27	<.001		
(constant)	1.05				

^a Values for step 1 and 2 are β values after Step 2 (Step 3 not significant).

^b Year level coded as: year 7 = 0; year 11 = 1.

^c Standardized coefficient (Beta).

^d Confidence interval for unstandardized coefficient.

that behavior regulators were the dominant influence on the health of adolescent females and this influence was greater than the influence of PA. This finding suggests the potential importance of contextual factors of PA in maintaining the participation of females in PA and also influencing their health.

Our study adds to the body of knowledge on the determinants of participation in PA for adolescents by uniquely examining the influence of the specific types of behavior regulation on PA. Consistent with previous research and the tenets of SDT, we found that external regulation was negatively associated with participation in PA.¹⁸ However, other behavior regulators did not predict participation in PA. Year level and intrinsic motivation interacted to influence PA. To our knowledge no other studies have examined the interaction between year level and intrinsic motivation on PA. Our finding suggests that intrinsic motivation had a significant influence on participation in PA for older adolescents but not for younger adolescents.. This could be explained by the changing nature of participation as younger adolescence moved into older adolescence. Younger adolescents tend to participate in physical activities that are more structured and organized by other parties, such as school and parents.^{8,39} Conversely,, as adolescents get older they become more responsible for organizing their own participation, and if they are not intrinsically motivated they might not go to the additional effort involved in self managing participation.

Out of all of the factors we examined, competence had the strongest association with PA. This finding is consistent with previous research which has shown the importance of competence to participation PA for adolescents.⁴⁰ In our study, competence was significant after accounting for differences in year level, setting and socioeconomic status.

Younger females had higher levels of participation in PA than older females^{5,6} and females from rural areas were more physically active than those from metropolitan areas. Research on metropolitan/rural differences in participation in PA in children and adolescents in the United States has found mixed results, with some finding that rural adolescents are more active,⁴¹ others finding that metropolitan adolescents are more active⁴² and others finding no difference in level of PA.⁴³

We found that intrinsic motivation and competence positively influenced perceived health, whereas external regulation was a negative influence. Intrinsic motivation and competence were stronger predictors of health than PA. The influences of identified and introjected regulation were not significant and there was no moderating effect of year level or setting.

Based on SDT, Vallerand's⁴⁴ hierarchical model suggests that a variety of positive consequences of self-determined motivation within a specific context (eg, PA) may explain related consequences outside of that context (eg, health). Our findings support that self-determined motivation in PA is generalizable to other contexts.

Self-efficacy, self-esteem, self-confidence and negative attributional style have often been proposed as potential moderator variables of stress and depression.^{45,46} Such factors presumably facilitate effective coping and inhibit maladaptive response to stressful life events. Our findings suggest that competence in PA might also have a positive influence on health and wellbeing. This area of inquiry is worthy of further research to determine the influence of competence in PA on the physical and mental health of adolescents.

The study provided an understanding of the role of behavior regulation and competence in participation in PA and health for adolescent females. There are some limitations, however, that need to be considered when interpreting the findings of the research. Participation in PA and health were measured using single items, however these items were based on previously validated assessments of PA and health. The second limitation of the study involved the selection of the study participants. The recruitment of students was conducted during school hours and relied on voluntary participation. As a result, and notwithstanding the use of incentives and the specific encouragement of both active and inactive students to participate, students who were frequently absent may not have had an opportunity to be selected and those with more interest in physical activity are more likely to have volunteered. Finally, the current study reports cross-sectional data and therefore cannot infer causality.

Overall, our study supported the potential importance of competence and self-determined forms of behavior regulation in PA to increase the participation in PA and positive health of adolescents. Furthermore, external regulation may have negative consequences for participation in PA and health. We found that competence, intrinsic motivation and external regulation were more strongly associated with health for adolescent females than participation in PA. Our findings also suggest that it is important that intrinsic motivation and competence are gained in early life, as it is these aspects of participation which might facilitate continued participation in PA for females. However, due to limitations relating to the cross sectional nature of the data and the single item measures of PA and health, these relationships require further investigation in longitudinal studies with more robust measures of PA and health. Our findings have implications for those responsible for school health and physical education curriculum, parents and those involved in the development of community sport.

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Notes

- ¹ Some proponents of SDT also define a forth form of extrinsic motivation but this was not measured in this study. This form of regulation is called integrated regulation and is considered the most self-determined.

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