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Original Research Article

Effectiveness of a Buddy System on Strength Training, Adherence, Confidence, and Perceived Health in College Females

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ABSTRACT

Introduction: College females tend to not meet the minimum resistance training guidelines. Applying behavior change theories with a buddy system may contribute to greater strength training adherence because the reason for the behavior can be explained and accountability can be developed. The purpose of this study was to explore the effects of a buddy system on promoting adherence towards resistance training in the college female population and to see whether perceived health is improved after a 6-week resistance training intervention. **Methods:** 20 University of Eau Claire college females (mean age= 19.75 ± 0.97) were split into either the buddy group or no buddy group and given a structured resistance training program. Across a 6-week intervention, participants were required to resistance train at least twice per week, self-report their confidence levels and strength training frequency through a Qualtrics survey, and answer questions pre and post intervention pertaining to perceived health through the SF-36. **Results:** Multiple two-way repeated measures ANOVA revealed a significant time-effect for confidence. Utilizing the SF-36 instrument, the Perceived Health Change score at post-test was significantly higher than that at pre-test. No significance in group or interaction effect for confidence and for the seven other SF-36 domains. Based on paired samples t-tests, there was no significant change in resistance training frequency. **Conclusions:** Utilizing a buddy during exercise may not promote confidence to exercise but resistance training alone may assist in improving one's perceived health. It would be of interest to further research on the usefulness of a buddy system in exercise and strength training promotion in different populations or over a longer time period.

KEYWORDS: ACSM, Behavior Modification Theory, Exercise, Qualtrics, Strength Program.

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Introduction

It is important to consider behavior modification when conducting intervention studies. In 2019, 75% of mental health conditions develop by age 24[1]. Amongst US adults, an estimated 48 million people have anxiety disorders while 7.2 million have had a major depressive episode. Coincidentally, those with mental illness are twice as likely to develop serious metabolic and cardiovascular diseases compared to the general population[1]. Furthermore, these statistics are even more alarming when examining the college student population. College students face many pressures, challenges, and concerns that can cause them to feel extremely overwhelmed. Many are living on their own for the first time in their lives and are trying to adapt to their schedules and workloads while managing time to sleep, hang out with friends, and do homework. This transition period from adolescence to adulthood can bring forth various mental health conditions. In one study, college students who have some mental health condition ranged between 30% and 50%, with severity in mental health disorders steadily rising[5]. These conclusions were drawn from the Hunt and Eisenberg (2010) study in which they utilized the ACHA-National College Health Assessment survey, which was given to college students[5]. Findings reported that since 2000, there was a 10-15% increase in students being diagnosed with depression[6]. To combat rising mental health, researchers have utilized various intervention strategies. But, recent research has concluded that not all health interventions are successful but using specific behavioral theories may be more beneficial in explaining the dynamics of health behaviors[2]. Among the many interventions that could be used, such as meditation[3] and therapeutic recreation[4], physical activity is one intervention to focus on. This study suggested exercise as being an effective tool in lowering stress levels[5]. They concluded that people who were physically active reported lower levels of stress, anxiety, and depression compared to their non-active counterparts. Additionally, the study suggested that vigorous exercise was the most effective tool in managing high levels of stress[5]. Despite the evidence supporting the benefits of physical activity (PA) on mental health, only 53.1% of US adults are meeting the national aerobic physical activity guidelines of 150 minutes/wk of at least moderate-intensity aerobic PA[7]. An additional piece to the guidelines includes strength training for a minimum of twice per week for six months with a focus on the usage of all seven major muscle groups[8]. Following these guidelines offers many benefits, both physiologically and psychologically[9, 10, 11]. Nevertheless in 2017, it was found that only 27.8 % of females ages 15 and older are likely to engage in strength training compared to the 72.2% of males that choose to engage in weight lifting on a daily basis[12]. Although greater than the entire female average, only 33% of college females are engaging in the 2 days per week requirements[13]. This hesitation could be correlated with certain barriers. These barriers include false

perceptions on the effects of weight training on muscle mass gain[14]. Lack of time is another commonly reported barrier in females who do not strength train along with male and female college students[15,16]. Inevitably, young women who do not strength train actually perceive more barriers than young women who are familiar with strength training[15].

In addition, it is crucial to note gender differences in behavioral patterns. One study suggested that females were more internally motivated to exercise while males were more externally motivated[17]. Therefore, intervention studies that target females should focus on self-enjoyment and motivation to be successful.

There are limited studies done on how exercising with a buddy can promote exercise adherence. The incorporation of the buddy system has shown some positive results; for instance, a 2013 study found that 91% of the participants in the buddy system group reported "very satisfactory" or "satisfactory" to sleep apnea therapy[18]. In another study, evidence also found that partaking in physical activity with a female friend resulted in higher levels of physical activity[19]. The type of physical activity was categorized into 55 broad categories as following: work, after school/spare time/hobbies, transportation, school, physical activities and sports[19].

Despite the fact that current research emphasizes the importance of both aerobic and muscle strengthening activity on health and well-being, minimal research has been conducted on the effectiveness of a buddy system with a resistance training intervention on exercise adherence and perceived health, particularly among female young adults (i.e., college students). Thus, the purpose of this study was to explore the effects of a buddy system on promoting adherence towards resistance training in the college female population and to see whether perceived health is improved after a 6-week resistance training intervention. Our hypothesis was that college females who participate in the buddy system will have better adherence towards and higher confidence in completing resistance training than those who resistance train by themselves. And, resistance training would improve perceived health in all participants.

Methods

Participants

Recruitment focused on University of Eau Claire female students (mean age= 19.75 ± 0.97) through word of mouth, email, and flyers. Inclusion criteria consisted of University of Eau Claire students not meeting the minimum strength training guidelines stated in the *2008 Physical Activity Guidelines for Americans,* which are: training the seven major muscle groups on two or more days per week[20.] The other inclusion criteria were that the participants either had or would be willing to purchase a gym membership, willing to strength train at least twice per week, willing to answer the weekly surveys, take the pre and post study

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SF-36, and had to pass the PAR-Q. Exclusion criteria was that the participants could not be male, could not have been meeting the resistance training guidelines prior to the study, were not willing to purchase a gym membership if they did not have one, were not University of Eau Claire students, and failed the PAR-Q. Once the recruitment process was completed, 20 participants passed all of the qualifications. The study protocol was approved by the Institutional Review Board, and each participant signed the informed consent form prior to participating in the study.

Experimental design

Participants were randomly assigned to either the buddy system group or no buddy system group, with ten participants being in each group. Buddy placement was completed based on gym type, given times available to resistance train, or if a participant requested to be with another participant; six out of the ten participants requested to be paired up with a friend. Initial recruitment desired all participants to be randomly assigned to a buddy but due to the lack of interest in participating, a few participants were allowed to be paired with a friend. This dilemma was kept in mind when analyzing the SF-36 since working out with someone you are familiar with may make exercising more enjoyable versus with someone you do not know. All participants participated in the 6-week intervention and were given a strength training program developed by a student researcher. Depending on group placement, participants had to strength train for at least two times per week either on their own or with their assigned buddy. Furthermore, all participants answered the Weekly Confidence and Adherence Scale on the following Monday. All participants received the same resistance training program (Figure 1). The program focused on the seven major muscle groups (chest, front of arms, back of arms, back, shoulders, core, and legs) and each muscle group had 3-4 different exercises that they could perform to increase adherence and interest. When completing the program, participants had to choose one exercise from each of the seven major muscle groups and were advised to resistance train at least two times per week. Over the 6 weeks, increases in weight were defined by the 2-for-2 rule which states that if one is able to successfully complete two or more repetitions in the last set in two consecutive workouts for any given exercise, then the load should be increased[21]. But weight lifted along was not a measured variable in the study. Furthermore, participants were told that they should rotate exercises weekly for enjoyment and improved results but, this also was not checked. Concerning resistance training, those in the buddy group were required to strength train with their paired buddy and those not in the buddy group were required to resistance train alone.

Muscle Group	Exercise *(pick one from each category each lifting session)*	Sets x Reps	Weight lifted (lb)
Chest (Pectoralis major/ minor)	• BB Bench Press • DB Bench Press • Incline DB Bench Press	3 x 12	
Legs (Hamstrings, Quadriceps)	• DB or KB Deadlift • DB or KB Goblet Squat • DB or KB Star Lunge • Front Step-Up w/ Knee Raise	3x 12	
Back (Latissimus Dorsi, Trapezius)	• TRX Inverted Row • Cable Face Pull • Lat Cable Pulldown • Seated Cable Row	3 x 8	
Front Arms (Biceps)	• DB Bicep Curl • DB Hammer Curl • EZ Bar Bicep Curl	3 x 10	
Stomach (Abdominals)	• Stir the Pot • Horizontal Cable Chop • Heel Touches • Birddog with Progressions	3 x 10	
Shoulders (Deltoids)	• DB Upright Row • DB Lateral Raises • DB Shoulder Press	3 x 8	
Back Arms (Triceps)	• DB Overhead Extension • Triceps Cable Pulldown • DB Kick Backs	3 x 8	

Notes:
- 2-for-2 rule: If you are able to complete two or more repetitions during the last set for two consecutive workouts, then increase the weight.
- Warm-up and cool-down: Spend 5-10 minutes walking or jogging on the treadmill.
- DB – Dumbbell; KB – Kettlebell; BB – Barbell.

Figure 1. Strength training program provided to all participants.

Instrumentation

Weekly Confidence and Adherence Survey (WCAS)

This survey was sent to participants via Qualtrics. Qualtrics is a university supported software developed from Qualtrics (Provo, UT). The WCAS contained 2 questions pertaining to 1) frequency of resistance training the previous week and 2) confidence level towards strength training from a scale

of 1-10. All 2 questions were fill-in-the blank and based on self-measurement.

36-Item Short Form Health Survey

The 36-Item Short Form Health Survey (SF-36) is a general survey that measures perceived health through self-measurement. The survey questions are divided into 8 categories: physical function, physical role, general health, pain, vitality, and social, emotional, and mental health[22]. This survey was given pre- and post-intervention. Usage of this particular survey was due to the various studies explaining its validity. One specific study verified the validity of the SF-36 in a cross-sectional study examining 1358 Chinese medical students and found that Cronbach's α coefficient of the entire survey was 0.791[22]. Another study utilized the SF-36 and found that the SF-36 survey reports reliable measurements of perceived health and quality of life for subjects and has favorable test-retest reliabilities[23]. This form was given at the beginning of the study and at the end of the study to compare results across the 6-weeks for all participants.

PAR-Q

A Physical Activity Readiness Questionnaire was given during the pre-assessment to validate that participants were ready to begin a resistance training program. If participants answered yes to certain questions and had no alarming medical illnesses or problems, they were able to safely participate in the study with a physician clearance. However, if participants did not pass the Par-Q, they were not allowed to participate due to heightened risk of injury.

Statistical Analyses

Study design was experimental and consisted of two groups: buddy system versus no buddy system. Dependent variables were perceived health, adherence, and confidence. Perceived health was measured pre- and post-study through the SF-36. Confidence and adherence were completed through the 6 WCAS surveys. SPSS version 19.0 was utilized for statistical analysis. Significance was set at $p < 0.05$ and a two-way factorial repeated measures ANOVA test (group x time) was the statistical approach used.

Results

During the 6 weeks, there were no participants who excluded themselves from the study. A total of 20 participants, 10 in the no buddy group and 10 in the buddy system group, were analyzed from pre-test to post-test for confidence levels, adherence to strength training, and with the SF-36. Using an alpha level of 0.05, a two-way repeated measures ANOVA indicated that Group (buddy system vs no buddy system) was not a significant predictor of confidence levels in strength training. Additionally, no significant interaction effect was examined. However, there was a significant time-effect (pretest vs. posttest) for confidence levels, such that confidence levels at posttest was significantly greater than pretest regardless of group assignments. Concerning resistance

training frequency (days per week) over the course of 6 weeks, a two-way repeated measures ANOVA indicated no group x time interaction effect or group effect. Refer to Table 1 for results of two-way repeated measures ANOVA. Utilizing the SF-36 instrument, no group or time effects were found for all of the domains of SF-36 (i.e., physical function, role functioning/physical, role functioning/emotional, energy/fatigue, emotional well-being, social functioning, pain, and general health), except for Perceived Health Change within the past year. More specifically, the Perceived Health Change score at post-test was significantly higher than that at pre-test; meaning that the participants perceived their overall health as better than it was a year ago after participating in the intervention. Refer to Table 2 for results of the two-way repeated measures ANOVAs.

Table 1. Resistance training frequency across the 6-week intervention.

				95% Confidence Interval		Time effect		Group effect		Interaction effect	
Group	Time	Mean	Standard error	Lower bound	Upper bound	*F*	*p*	*F*	*p*	*F*	*p*
Buddy	1	2.25	0.24	1.73	2.77	0.67	.570	0.05	.832	2.51	.074
	2	2.13	0.18	1.75	2.50						
	3	1.63	0.30	0.99	2.26						
	4	2.26	0.34	1.90	3.35						
	5	1.75	0.21	1.31	2.19						
	6	1.63	0.33	0.93	2.32						
No Buddy	1	1.78	0.23	1.29	2.27						
	2	2.11	0.17	1.76	2.47						
	3	2.11	0.28	1.51	2.71						
	4	1.67	0.32	0.98	2.35						
	5	2.22	0.19	1.81	2.64						
	6	1.89	0.31	1.23	2.54						

Table 2. Two-way repeated measures ANOVA measurements across the 6-week intervention.

				95% Confidence Interval		Time Effect		Group Effect		Interaction Effect	
				Lower		*F*	*p*	*F*	*p*	*F*	*p*
Training	Time	Mean	Standard Error	Bound	Upper Bound						
Confidence											
Buddy	Pre	6.20	0.62	4.89	7.51	18.15	<.001*	0.38	.546	0.05	.825
	Post	8.00	0.48	6.98	9.02						
No Buddy	Pre	5.70	0.62	4.39	7.01						
	Post	7.70	0.48	6.68	8.72						
SF-36 Physical Function											
Buddy	Pre	96.50	1.98	92.35	100.65	0.77	.39	0.39	.539	0.15	.708
	Post	95	1.98	90.85	99.15						
No Buddy	Pre	96.75	1.54	93.51	99.99						
	Post	96.50	1.54	96.26	99.74						
SF-36 Role functioning/physical											
Buddy	Pre	100.00	5.40	88.65	111.36	2.19	.156	0.40	.534	0.40	.534
	Post	87.50	6.15	74.58	100.43						
No Buddy	Pre	90.00	5.40	78.65	101.35						
	Post	85.00	6.15	72.08	97.93						

(Cont'd.)

				95% Confidence Interval		Time Effect		Group Effect		Interaction Effect	
				Lower		*F*	*p*	*F*	*p*	*F*	*p*
Training	Time	Mean	Standard Error	Bound	Upper Bound						
SF-36 Role functioning/emotional											
Buddy	Pre	66.67	12.67	40.05	93.28	0.53	.476	0.11	.745	0.11	.745
	Post	60.00	11.57	35.69	84.32						
No	Pre	66.67	12.67	40.05	93.28						
Buddy	Post	76.67	11.57	52.35	100.98						
SF-36 Energy/Fatigue											
Buddy	Pre	51.50	6.48	37.89	65.11	0.53	.476	0.11	.745	0.11	.745
	Post	56.50	6.48	42.89	70.11						
No	Pre	55.50	5.42	44.12	66.88						
Buddy	Post	58.00	5.42	46.62	69.38						
SF-36 Emotional well-being											
Buddy	Pre	65.20	7.61	49.22	81.18	1.12	.304	0.22	.643	0.22	.643
	Post	66.00	7.61	50.02	81.98						
No	Pre	67.50	4.73	57.57	77.43						
Buddy	Post	72.00	4.73	62.07	81.93						

(Cont'd.)

				95% Confidence Interval		Time Effect		Group Effect		Interaction Effect	
				Lower		*F*	*p*	*F*	*p*	*F*	*p*
Training	Time	Mean	Standard Error	Bound	Upper Bound						
SF-36 Social Functioning											
Buddy	Pre	83.75	8.63	65.63	101.87	0.32	.580	0.45	.511	0.45	.511
	Post	77.50	8.63	59.38	95.62						
No	Pre	83.31	5.47	71.83	94.79						
Buddy	Post	82.50	5.47	71.02	93.98						
SF-36 Pain											
Buddy	Pre	92.75	5.03	82.19	103.31	1.95	.180	0.18	.674	0.18	.674
	Post	84.75	5.03	74.19	95.31						
No	Pre	88.50	5.29	77.40	99.60						
Buddy	Post	76.75	5.29	65.65	87.85						
SF-36 General Health											
Buddy	Pre	67.00	3.391	59.88	74.13	0.00	1.00	0.000	1.000	0.00	1.000
	Post	72.00	3.391	64.88	79.13						
No	Pre	67.00	4.33	57.91	76.09						
Buddy	Post	72.00	4.33	62.91	81.09						

(Cont'd.)

				95% Confidence Interval		Time Effect		Group Effect		Interaction Effect	
				Lower		*F*	*p*	*F*	*p*	*F*	*p*
Training	Time	Mean	Standard Error	Bound	Upper Bound						
SF-36 Health change											
Buddy	Pre	45.00	6.48	31.38	58.62	9.59	.006*	1.76	.201	1.76	0.201
	Post	62.50	6.48	48.82	76.12						
No	Pre	70.00	4.75	60.02	79.98						
Buddy	Post	72.50	4.75	62.52	82.48						

Notes: SF-36 = The Short Form (36) Health Survey is a 36-item, patient reported survey of their perceived health. Questions are divided into 8 categories: physical function, physical role, general health, pain, vitality, and social, emotional, and mental health. * indicates a significant difference of <0.05.

Discussion

After conducting a two-way repeated measures ANOVAs on all variables utilizing a significance of $p<0.05$, no significant group differences were found for confidence levels during the intervention. But at post-test, confidence levels were higher than pre-test across all participants. For the SF-36, statistical analysis found no significance for all categories minus the Perceived Health Change. Post-test scores were considerably higher for all participants then pre-test Perceived Health Change scores. Finally, frequency of strength training maintained across the 6-week intervention and no significance was found.

Confidence and Behavior Change

Utilization of the weekly survey showed an increase in confidence for all participants, regardless of group placement. Improvement of one's confidence tends to be correlated with behavior change. One particular behavior change theory is the Health Belief Model (IBM). In a 2005 journal, the IBM model is defined as an individual's opinion of a particular risk that could occur from a health problem and the variables that influence avoidance and the decision to act on the threat[2]. To promote change, the model recommends exposing those afflicted to factors that prompt action and increase self-efficacy[2].

Our study did utilize this model with the buddy system and the weekly survey. The participants in the buddy group were able to work out with another study participant but this did not alter confidence levels between groups. For the weekly survey, all participants were required to reflect on their previous week of training, and this could have encouraged them to strength train more on the following weeks. Secondly, the given resistance training program eliminated the uncertainty of what to complete on the training day and possibly promoted confidence and self-efficacy due to the repetitive nature of the program. This allowed participants to become familiar with the movements and master them across the six weeks. Nevertheless, there was no significant difference in confidence between groups which goes against the stated hypothesis. Thus, future research is needed that incorporates a buddy system along with behavior modification theories in exercise promotion across a longer intervention period.

Perceived Health and the SF-36

The data collected showed no significance across most measured variables in the SF-36 questionnaire. This insignificance questions the appropriateness of the survey with healthier populations. One conducted study utilized the SF-36 Health Survey in brain tumor patients[24]. From the 227 patients administered, there was an internal consistency (Cronbach $\alpha \geq .728$) for all subscales minus Social Functioning (Cronbach $\alpha = .527$) and General Health

(Cronbach α = .693)[24]. Another study supports the high internal consistency of the SF-36 with scores ranging from 0.88 to 0.90 in patients with spondylarthritis[25]. Both research manuscripts support the validity of the SF-36 in clinical environments but, minimal research has been conducted with healthier populations. However, one particular study did measure quality of life in healthy Chinese medical students. Results found high validity across the seven dimensions besides the social functioning subscale at 0.631[23]. Future research should apply the SF-36 towards healthier populations so the validity can continue to be proven.

Even though the validity may be high, all of the previous studies only used the survey once and did not compare answers across a time span, unlike this study. Thus, our findings call into question the sensitivity of the SF-36 in tracking self-perceived health over time. Furthermore, the short intervention period may not have provided an adequate amount of time for one's perception of health to change. Therefore, future research should work on developing a screening tool that can be utilized in shorter interventions.

Correlation between Physical Activity and Perceived Health

Just after a short 6-week intervention, all participants had higher Perceived Health Change scores then pre-intervention despite no significance in resistance training frequency. This supports our hypothesis and is comparable to previous studies that looked at perceived health status. Findings state that physical activity levels are a strong predictor of perceived health in older women. More specifically, those that engage in higher amounts of physical activity have a more positive health outlook versus sedentary individuals[26]. This correlation is the same for active teenagers[27]. It was found that teenagers who were more physically active tended to report having good health status versus nonactive teenagers. For strength training, the results are similar. A 2016 study concluded that inactive women in the exercise groups had higher self-perceived health views and intrinsic motivation than the control group[28]. However, there is minimal research on the correlation between physical activity levels/strength training and self-perceived health in young, healthy populations. 1 in 5 of the 1,999 participants surveyed during a 2015 study interpreted their health incorrectly. Furthermore, young adults in college were more likely to wrongly perceive their health status versus those in high school. To fix this discrepancy, the study stated health education should target the specific populations[29]. Thus, with the data found from this research study and supporting evidence, giving individuals tools to promote physical activity and strength training would be beneficial (i.e. a specific program). Future research should also assess the effectiveness of strength training on perceived health in other populations.

Strengths and Limitations

This study investigated a hole in existing literature examining the successfulness of a buddy system on strength training frequency in college females and perceived health. While conducting the research study, valid tools were used that met ethical research standards. Using the InBody770 machine lessened the margin of error in body composition assessment. Providing the workout plan with a variety of exercises using all 7 muscle groups offered more flexibility and higher adherence because it kept participants interested. The program also eliminated the uncertainty of not knowing what to do in the gym and may have allowed for higher confidence levels.

For this study, there were aspects that need to be discussed on a more specific level. The sample size of 20 participants was relatively small and not diverse; a majority of the participants were Kinesiology students. Researchers would benefit by increasing the sample size and recruiting other majors. Another limitation was that this study was not a true randomized control. Some buddy groups had a pre-established relationship prior to the intervention. Furthermore, the participants in the no buddy group were told to train alone but, this was not monitored-just assumed. Environmental factors also played a part in the results. More specifically, spring break occurred during the middle of the study which created variance in the student's schedules and possibly reduced adherence. Another limitation to the study was that not all participants had a membership at the same gym. Some participants had memberships to the on-campus gyms while others had memberships to the local Anytime Fitness, YMCA, and Planet Fitness. This could have impacted the overall perceived health of participants because the atmosphere of the different gyms may vary which may make some seem less welcoming to workout at. Thus, this limitation can be eliminated by having all participants train at the same gym. Furthermore, the participants self-reported their data through an emailed survey and were not observed during their workouts. These two factors could be avoided by having student's strength train in a gym on campus, which would make it easier for observation, and utilize a physical form of self-reporting-such as an app or paper form in person. Finally, a 6-week strength training intervention may not have been long enough to induce noticeable changes in individuals' lifestyle. Perhaps a year-long strength training intervention may provide a lasting change in one's confidence and adherence to muscle-strengthening exercises.

Conclusions

The purpose of this research study was to examine the effectiveness of a buddy system on strength training adherence, confidence, and perceived health in college females. Researchers' hypothesized that participants

in the buddy system would have better adherence to resistance training than those who resistance trained alone. It was also hypothesized that resistance training would improve perceived health in all participants. Based on our knowledge, there are no past or current studies that have examined the usefulness of a buddy system on improving strength training frequency and confidence. Furthermore, after writing the research manuscript, there are no studies that have looked at the benefit of strength training on perceived health improvement with the usage of the SF-36. It is noted with the results that confidence improved, regardless of group placement. This outcome could be due to all participants receiving a free strength training program along with answering the weekly surveys, which could have reminded them to train that week. Perceived Health Change was also significant at post-test for all participants. Concerning the number of days trained, there was no significant difference in the frequency of days trained throughout the 6 weeks. However, these results suggest that just engaging in a consistent resistance training program may develop a higher perception of one's perceived health. The data found from this study provides different tactics that health and fitness professionals can utilize to increase resistance training adherence in females.

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