

## ORIGINAL RESEARCH

# College Student Physical Activity: A Systematic Review

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## ABSTRACT

The purpose of this review was to systematically review the published research on the effect of physical activity (PA) interventions on PA behavior among university students. A PA intervention was defined as participants engaging in PA and measuring changes in PA from pre- to post-intervention. Studies were eligible for inclusion if they were (1) published in peer-reviewed English-language journals, (2) included undergraduate university students, (3) implemented a PA intervention, and (4) assessed PA via self-report or direct measures. Fourteen studies met the inclusion criteria and were analyzed in this review. PA interventions were more effective than other techniques or control settings in improving PA behavior in university student participants. The review discusses sample characteristics, study design, PA behavior measurement, PA intervention implementation, and the theoretical frameworks of the studies, along with limitations of the research and suggestions for future researchers.

**Keywords:** university; physical activity; exercise; interventions; behavior change

## INTRODUCTION

There are a wide variety of difficulties that high school students experience as they transition to college. The progression to higher education is associated with social independence, financial burdens, academic difficulties, and novel peer influence, many of which have a negative impact on overall health and well-being (Britt et al., 2017; Ruthig et al., 2011; Wilhite, Ashenhurst, Marino, & Fromme, 2017). Students exhibit increases in weight gain and alcohol intake, poor nutritional choices such as excessive snacking, fast food intake, and skipped meals, inadequate sleep, and higher substance abuse as they progress to college (de Vos et al., 2015; Feng et al., 2014; Gropper et al., 2012; Wilhite et al., 2017). Many of these difficulties in behavioral self-regulation have a negative impact on overall well-being. For example, university students have higher levels of obesity and chronic diseases, such as heart disease, stroke, and Type 2 diabetes than previous generations of students (Barsell et al., 2018; Clarke, Norris, & Schiller, 2017). The current generation of university students also exhibits a greater prevalence of social isolation, stress, anxiety, depression, suicide ideation, and suicide attempts than past students (Twenge, 2017; Twenge et al., 2018). Furthermore, college students report a higher prevalence of mental illnesses such as anxiety, depression, and stress, along with higher smoking prevalence and binge drinking, when compared to their non-college counterparts (Carter et al., 2010; Kovess-Masfety et al., 2016; Sidani et al., 2019). While students experience poorer physical, emotional, social, and mental well-being throughout college, engaging in daily PA has been found to improve all aspects of overall health (Institute of Medicine, 2013). Understanding regular physical activity habits are necessary to then provide programming to counteract many of the unhealthy behaviors of college students.

Regular PA behavior, or meeting the recommended 150 minutes of moderate-to-vigorous aerobic activity and two days of muscle and bone-strengthening activities per week, is associated with the prevention and amelioration of symptoms of stress, anxiety, and depression in university students (Asmundson et al., 2013; Bailey, Hetrick, Rosenbaum, & Purcell, 2017; VanKim & Nelson, 2013). Furthermore, sufficient PA behavior promotes cognitive functioning, quality of life, and academic achievement (Kelly et al., 2014; Pedersen & Saltin, 2015; Pedišić et al., 2014; Wald, Muennig, O'Connell, & Garber, 2014). Although there are a wide variety of cross-sectional, randomized control trials (RCTs), and reviews that have examined the benefit of regular PA, most of these studies have combined university students with adult populations or specifically focused on children (Asmundson et al., 2014; Biddle & Asare, 2011; Rebar et al., 2015; Rhodes et

al., 2017; Rosenbaum, Tiedemann, Sherrington, Curtis, & Ward, 2014). As discussed earlier, undergraduate students are in a life stage of transition, which is different from that of children, adolescents, adults, and older adults. Most PA research has investigated the potential impact of interventions on clinical samples as well, rather than nonclinical samples (Josefsson, Lindwall, & Archer, 2013; Rosenbaum et al., 2014).

A review of PA research within the past 10 years has not been conducted with the current generation of university students (Bailey et al., 2017; Henley, Sealy, Hopp, & Brown, 2016; Park, 2014; Pedišić et al., 2014; VanKim & Nelson, 2013). The purpose of this review was to synthesize the published research on the effect of PA interventions on PA behavior among undergraduate university students.

## METHODS

This systematic review protocol was prepared in accordance with the Preferred Items for Systematic Reviews and Meta-Analysis Protocols (PRISMA-P) 2015 statement and was reported using the PRISMA statement as guidance (Moher, et al., 2015).

### Eligibility Criteria

A systematic review of peer-reviewed literature published from 2010 to July 2020 was conducted. Studies were only included from 2010 to explicitly examine one generation of undergraduate students and to include the most recent interventional research. Generation Alpha includes students born in 2010 and afterward (McCrinkle & Fell, 2019). Studies were eligible for inclusion if they were 1) published in peer-reviewed English-language journals, 2) included undergraduate university students, 3) implemented a PA intervention, and 4) assessed PA via self-report or direct measures. Studies included original research articles, qualitative studies, and did not have to include a control group.

### Information Source

Literature was gathered from the following databases: (1) PubMed, (2) Psych Info, (3) Sport Discus, and (4) Google Scholar. These databases were chosen due to their coverage of physical health, school wellness, and education domains (Booth, Papaioannou, & Sutton, 2012).

### Search Strategy

The systematic search was conducted on the four electronic databases to identify all relevant studies published after 2010 that examined the impact of university PA interventions on PA behavior. The search strategy (see Table 1) included search terms that were created using similar review parameters definitions and guiding definitions (Keating et al., 2005; Irwin, 2004). The search terms fell into two content categories (university PA or exercise). PA and or exercise search terms were first applied to narrow the search process specifically to find articles that assessed undergraduate university PA or exercise intervention work. Additionally, physical health terms (e.g., BMI) were subsequently added to narrow the search to address specific outcomes related to undergraduate university PA interventions. One term per content category was entered per search field until all combinations of terms across the categories were exhausted.

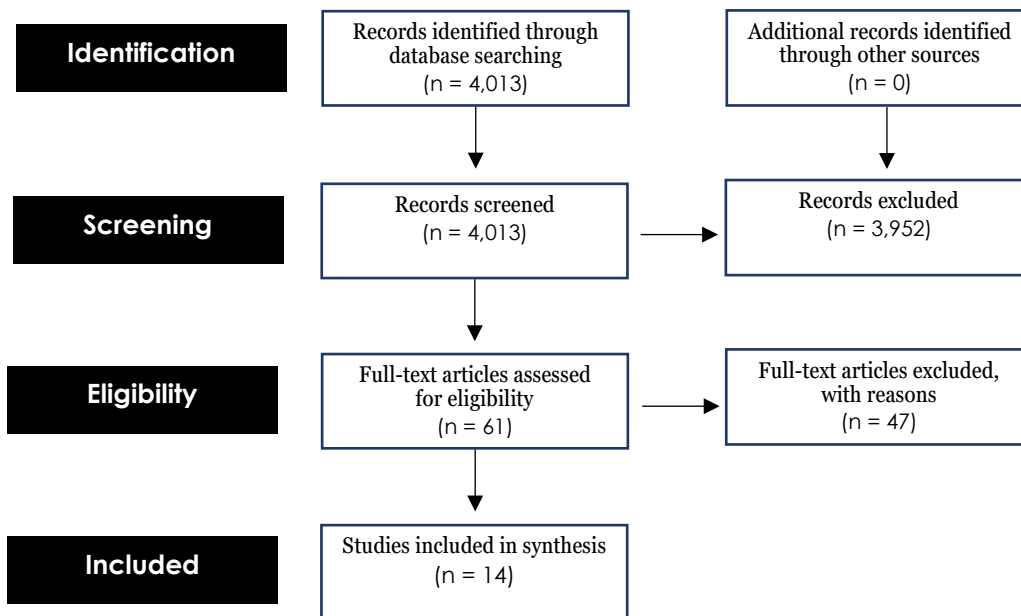
**Table 1. Search Terms by Content Categories**

University Terms (Category 1)	Activity Terms (Category 2)	Physical/Mental Health Terms (Category 3)
<ul style="list-style-type: none"> <li>• university</li> <li>• college</li> </ul>	<ul style="list-style-type: none"> <li>• physical activity</li> <li>• exercise</li> </ul>	<ul style="list-style-type: none"> <li>• well-being</li> <li>• physical health                             <ul style="list-style-type: none"> <li>• fitness</li> <li>• BMI</li> <li>• program</li> </ul> </li> <li>• intervention</li> <li>• course</li> </ul>
+		+
<p><b>Note. Example searches: (1) university + physical activity + physical health; (2) college + exercise + program</b></p>		

### Study Selection, Data Collection, and Extraction

Figure 1 presents the flow chart for the selection of the included studies. To determine the eligibility of the studies, the research team screened titles, abstracts, and full-text articles in a sequential manner to determine potential relevance using the inclusion criteria of university PA interventions. After screening and review, all potentially relevant full manuscripts were retrieved and screened for inclusion ( $n = 60$ ). Once the list of potentially relevant studies was compiled, titles, abstracts, and full-text articles were reviewed to determine if the articles met the aforementioned inclusion criteria. At this stage, articles were excluded if they 1) were not published in English, 2) did not implement a PA intervention, 3) did not measure PA with self-report or direct measures, or 4) did not limit recruitment to undergraduate university students. Any article called into question was deliberated by two reviewers (e.g., did the article meet inclusion criteria) until

agreement was met. After a thorough evaluation, all relevant articles ( $n = 14$ ) were obtained and were organized by number and type of undergraduate university PA program in a Microsoft® Excel spreadsheet (Microsoft Corporation, Redmond, VA).



**Figure 1. Identification of Included Studies**

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med*, 6(7): e1000097. doi:10.1371/journal.pmed1000097

Note: For more information, visit [www.prisma-statement.org](http://www.prisma-statement.org)

## Data Synthesis

A narrative synthesis with tabular presentation was used to analyze and present the data. Study results were tabulated into six sections by: (1) sample characteristics, (2) theoretical framework, (3) research design, (4) measurement of PA, (5) intervention duration and adherence, and (6) PA intervention outcomes. A narrative synthesis of these results is included as well. Data collection, extraction, and synthesis was conducted by all four authors, ensuring reliability and validity of the included studies.

## RESULTS

A total of fourteen studies met the search criteria of a university-based, PA intervention that measured change in PA. Table 2 provides an overview of the reviewed studies that encompass references, sample characteristics, theoretical frameworks, interventions, measurement of PA, intervention duration adherence, and PA intervention outcomes.

### Participant Characteristics

All of the included research studies included undergraduate university student participants. The total number of participants in the fourteen studies was 1,451 and the mean number of participants was 104. The smallest sample size was 5 (McFadden et al., 2017) and the largest sample size was 408 (Quintiliani et al., 2010). Only nine of the fourteen studies reported the age of participants, and the average age was 20.07 years (Brown et al., 2014; Mackey et al., 2014; McFadden et al., 2017; Melton et al., 2016; Myers et al., 2011; Pfeffer & Strobach, 2018; Sharp et al., 2016; Weinstock et al., 2014; Weinstock et al., 2016). On average, 25.21% of participants were male and 74.79% of participants were female. Furthermore, only seven of the fourteen studies reported participant race (Mackey et al., 2015; Melton et al., 2016; Myers et al., 2011; Quintiliani et al., 2010; Sharp et al., 2016; Ulla Diez et al., 2012; Weinstock et al., 2014). Across these studies, an average of 29.05% of participants were African-American, 45.58% were White, 16.67% were Hispanic, and 10.86% of participants reported as Other.

## Intervention Components

The fourteen PA interventions were conducted over various durations ( $M = 8.47$  weeks, Median = 8 weeks, Range = 1-24 weeks). Three of the interventions were relatively short in duration ( $\leq 1$  month) and included 1 week ( $n = 2$ , Pfeffer & Strobach, 2019; Ulla Diez et al., 2012) and 4 weeks ( $n = 3$ , Quintiliani et al., 2010). Five of the interventions were moderate in duration (1-2 months) and included 6 weeks ( $n = 2$ , Melton et al., 2016; Wadsworth & Hallam, 2010) and eight weeks ( $n = 3$ , McFadden et al., 2017; Weinstock et al., 2014; Weinstock et al., 2016). The remaining six interventions were long in duration ( $\geq 2$  months) and included ten weeks ( $n =$  Topp et al., 2011), 11 weeks (Myers et al., 2011), 12 weeks ( $n = 1$ , Sharp et al., 2016), 16 weeks ( $n = 1$ , Annesi et al., 2017), 20 weeks ( $n = 1$ , Brown et al., 2014), and 24 weeks ( $n = 1$ , Mackey et al., 2014). The shorter-duration interventions (100%) all reported significant increases in PA for the treatment group compared to the control groups. Three of the moderate duration interventions (60%) resulted in improved PA levels (McFadden et al., 2017; Wadsworth et al., 2010; Weinstock et al., 2016). Only two of the longer duration interventions (33%) reported significant improvements for the treatment group when compared to the control group (Annesi et al., 2017; Brown et al., 2014).

Eight of the included studies reported follow-up data ranging from 1-month (Brown et al., 2014; McFadden et al., 2017; Quintiliani et al., 2010), 2-months (Melton et al., 2016), 3-months (Sharp & Caperchione, 2016; Ulla Diez et al., 2012), and 6-months (Mackey et al., 2015; Weinstock et al., 2016). Only five of the eight interventions reported sustained improvements in PA at follow-up (McFadden et al., 2017; Quintiliani et al., 2010; Sharp et al., 2016; Ulla Diez et al., 2012; Weinstock et al., 2016).

Twelve studies reported intervention adherence (Brown et al., 2014; Mackey et al., 2015; McFadden et al., 2017; Melton et al., 2016; Pfeffer & Strobach, 2019; Quintiliani et al., 2010; Sharp et al., 2016; Topp et al., 2011; Ulla Diez et al., 2012; Wadsworth & Hallam, 2010; Weinstock et al., 2014; Weinstock et al., 2016). Intervention adherence refers to the degree to which participants completed the entirety of the intervention. The weighted average adherence across studies was 69.4%. The study with the fewest participants ( $n = 5$ ) had the highest adherence (100%) and was a single-subject design (McFadden et al., 2017). The study with the lowest adherence (19%) was a 24-week RCT (Mackey et al., 2014).

Twelve out of the fourteen included studies used a theoretical framework to guide the research study. The studies used the social cognitive theory ( $n = 5$ ), transtheoretical model of behavior change ( $n = 3$ ), behaviorism ( $n = 2$ ), self-determination theory ( $n = 1$ ), self-regulation theory ( $n = 1$ ), health action process approach ( $n = 1$ ), and two studies did not use a theoretical framework. Overall, there was not a profound difference in PA outcomes between the theory-based and non-theory-based interventions.

The included studies employed a variety of cognitive and behavioral intervention strategies to encourage PA behavior. For example, nine of the studies used cognitive-behavioral techniques, such as journaling, counseling, motivational seminars, and motivational interviewing (Brown et al., 2014; McFadden et al., 2017; Pfeffer & Strobach, 2019; Ruissen et al., 2018; Topp et al., 2011; Ulla Diez et al., 2012; Wadsworth & Hallam, 2010; Weinstock et al., 2014; Weinstock et al., 2016). Four of the studies used technology such as websites, mobile applications, text messages, or emails as an intervention (Mackey et al., 2014; Melton et al., 2016; Quintiliani et al., 2010; Sharp et al., 2016). One of the studies simply employed pedometers as a means of measuring PA (Myers et al., 2011), and the last allocated participants to PA classes or regular classes as the intervention (Annesi et al., 2017).

## Assessment of Physical Activity

Most of the included studies collected PA data via self-report measures only ( $n = 9$ ; Annesi et al., 2017; Brown et al., 2014; Pfeffer & Strobach, 2019; Quintiliani et al., 2010; Sharp et al., 2016; Topp et al., 2011; Ulla Diez et al., 2012; Wadsworth & Hallam, 2010). Five of the studies collected PA data through accelerometers and self-report measures (Mackey et al., 2014; McFadden et al., 2017; Melton et al., 2016; Weinstock et al., 2014; Weinstock et al., 2016). The remaining studies collected PA data through pedometers ( $n = 2$ , Myers et al., 2011; Topp et al., 2011). All of the self-report questionnaires had been validated previously, including the Stanford 7-Day Recall ( $n = 1$ , Pfeffer & Strobach, 2019), Godin Leisure-Time Questionnaire ( $n = 2$ , McFadden et al., 2017; Sharp et al., 2016), the International Physical Activity Questionnaire ( $n = 3$ , Brown et al., 2014; Topp et al., 2011; Wadsworth & Hallam, 2010), Compendium of Physical Activities ( $n = 2$ , Weinstock et al., 2014; Weinstock et al., 2016), Healthy Promoting Lifestyle Behavior-II ( $n = 1$ , Ulla Diez et al., 2012), and the US Behavioral Risk Factor Surveillance Survey ( $n = 1$ , Quintiliani et al., 2010). It is important to note that self-report PA data is not as accurate as direct report data. Future studies should aim to assess PA from direct and indirect measures. Future meta-analyses could compare the results of direct and indirect PA measures as well.

## Research Design and Effectiveness

All of the fourteen studies implemented and assessed the effectiveness of a PA intervention with university undergraduate students. Nine of the 14 studies that met inclusion criteria were randomized control trials (Mackey et al., 2015; Melton et al., 2016; Pfeffer & Strobach, 2019; Quintiliani et al., 2010; Sharp et al., 2016; Ulla Diez et al., 2012; Wadsworth & Hallam, 2010; Weinstock et al., 2014; Weinstock et al., 2016). Five of the nine RCTs reported significant improvements in PA for the treatment group when compared to the control group (Pfeffer & Strobach, 2019; Ulla Diez et al., 2012; Wadsworth & Hallam, 2010; Weinstock et al., 2014; Quintiliani et al., 2010). Three of the RCTs reported no significant difference between treatment and control groups (Melton et al., 2016; Sharp et al., 2016; Weinstock et al., 2016), while the remaining study reported low and unmeasurable PA across both groups (Mackey et al., 2014). Three studies were single-group design (McFadden et al., 2017; Myers et al., 2011; Topp et al., 2011). Two of the single-group design studies reported significant improvements in PA from baseline to post-intervention (McFadden et al., 2017; Topp et al., 2011). The remaining study was a two-group design without randomization (Brown et al., 2014). Participants in the intervention group reported significantly greater increases in PA when compared to the control group (Brown et al., 2014). Overall, 12 out of the 14 studies (85.71%) significantly improved PA behavior in college undergraduate students.

## DISCUSSION

A number of research articles have highlighted a decline in PA participation among college students and show a relationship to various factors, including social independence, financial burdens, academic difficulties, novel peer influence, and boredom (Britt et al., 2017; Ruthig et al., 2011; Westgate & Wilson, 2018; Wilhite, Ashenhurst, Marino, & Fromme, 2017). The purpose of this review was, therefore, to systematically review the published research on the effect of PA interventions on PA behavior among college students. The findings from the 14 studies indicated an overall positive impact of PA interventions on PA behavior in undergraduate university students. The current review provided information about participant characteristics, intervention components, research design, and effectiveness to better inform future research.

Eleven of the 14 research studies were effective at improving PA in college students. Nine of the included studies were RCTs, which is the preferred design for PA intervention research (Rothwell, 2005). Five of the nine RCTs reported statistically significant improvements in PA for the treatment group when compared to the control group. This is consistent with previous reviews indicating a significant effect of RCTs on PA behavior with young adults (Murray et al., 2017) adults (Borek et al., 2018), and older adults (Shvedko et al., 2018). However, this was the first systematic review conducted with undergraduate students in the past ten years. Although the interventions included in this review revealed statistically significant results when comparing treatment to control, none of the studies used the exact same intervention or duration, which is needed to determine if the intervention alone is effective at improving PA behavior.

All 14 of the included studies reported gender information (74.79% female), but only seven of the 14 studies reported participant race (29.05% African-American, 45.58% White, 16.67% Hispanic). A lack of diversity for participant gender and race, as well as inconsistent reporting of such demographic information, is a limitation of the included studies. The high prevalence of female participants is consistent with previous PA reviews (Borek et al., 2018; Owen et al., 2017; Plotnikoff et al., 2015). With males typically reporting greater intrinsic motivation to engage in PA than females (Lauderdale et al., 2015; Wilson et al., 2019), it is necessary to tailor PA interventions to the motivation, desires, and needs of each gender. All of the studies included only two gender categories (i.e., male and female). It has been found that university students who identify as non-binary engage in less PA (Jones et al., 2017). PA interventions should provide adequate demographic options regarding gender and tailored programming to ensure safe and inclusive environments. Additionally, many of the studies that met the inclusion criteria for this study recruited homogeneous samples. It has been previously reported that White individuals report greater aerobic and strength training PA than Hispanic or African American individuals (Belcher et al., 2010; Wilson et al., 2019). Therefore, it is important to recruit college-student samples to determine differences in preference, enjoyment, engagement, and effectiveness of PA interventions.

The interventions that met inclusion criteria varied in duration from one to twenty-four weeks. Furthermore, each of the included interventions employed different cognitive or behavioral techniques to target PA behavior. It is necessary to explicitly describe intervention techniques in detail to enable valid and reliable evaluation of PA behavior change and adherence (Gourlan et al., 2016). This could help future researchers understand how certain intervention techniques may relate to intervention duration and adherence. It is important to note that intervention effectiveness in terms of increasing PA was greater in shorter interventions than longer interventions. This could have been due to intervention adherence as a product of the shorter interventions, or the effectiveness of the intervention strategies used in shorter interventions. However, future meta-analyses are needed to examine differences across intervention types in more depth. Given that university students are on semester schedules, it could be beneficial to use shorter interventions (i.e., 1 month), but repeat such interventions each semester to improve adherence. PA intervention adherence (M = 76.47%) was much similar to a review of PA interventions with children (M = 89.5%, Howie & Staker, 2016), clinical adults (M = 73.7%, Vancampfort et al., 2016), and chronically ill adults (M = 77%, Bullard et al., 2019). It is necessary to evaluate tailored PA interventions on university campuses to determine both effectiveness and long-term adherence across different durations and demographic categories.

Twelve of the 14 included studies used a theoretical framework to guide the interventions. A meta-analysis found that interventions guided by a single-theory had a greater effect on PA than interventions guided by multiple theories (Gourlan et al., 2016). However, there were no significant differences in theory-based and non-theory-based interventions on PA behavior in this review. It is evident that further analysis is needed to determine whether theory-based interventions are actually more effective than interventions not guided by theory. Another review found that longer duration interventions and those with poor methodological rigor negatively impacted the effect of PA theory-based interventions (Bernard et al., 2016). Further research is needed to compare the efficacy of PA interventions across various time points as well as the fidelity of the interventions to the theory-based constructs. Overall, this review indicated the effectiveness of various interventions targeting PA behavior in college students. However, there were some limitations. Only 14 studies met the inclusion criteria for this study, and this is the only review within the past decade. Continued interventional research with university populations is needed to further understand such effects. The quality of the studies is another limitation. Each of the studies used a different research design, constructs, and duration. Furthermore, there was variability across each study regarding gender and race. Lastly, assessment of PA was a limitation in that self-report measures were used more frequently than direct measures of PA. Lastly, studies that were not published or were published in a language other than English were excluded, potentially excluding relevant findings.

## CONCLUSION

Continued research specifically targeting university-student samples is necessary to determine differences in PA behavior across grade, gender, and race classification at the university level. Most research studies and reviews combine university-age samples with adult samples when implementing and evaluating PA interventions. However, university students are in a distinct life stage, and determining effective interventions across race, gender, and grade could increase PA adherence and improvements in mental, emotional, and social health. PA interventions with a larger sample size including historically black colleges and universities would provide a better representation of the effectiveness of interventions. Overall, PA interventions appear to be promising for improving PA behavior for undergraduate students. This systematic review indicates the necessity for university-specific PA interventions that measure long-term PA behavioral outcomes.

**Table 2. Characteristics of Included Studies**

Study	Sample characteristics	Theoretical Framework	Intervention	Measurement of PA	Intervention Duration & Adherence	PA Intervention Outcomes
<i>Pfeffer, I., &amp; Strobach, T., 2019</i>	N = 107 college students; $M_{age} = 22.73$ years, 67.29% female, 32.71% male 2-group RCT	Health Action Process Approach (Schwarzer, 1992)	Tx group: 7-day PA planning diary/education. Control group: read scientific text for 15 mins	Stanford 7-Day PA Recall	Duration: 1 week Adherence: 95.69%	Intervention resulted in greater increase in PA for the treatment group compared to the control group.
<i>McFadden, T., Fortier, M. S., &amp; Guérin, E., 2017</i>	N = 5 female undergraduate students, $M_{age} = 19.60$ years, 100% female, 100% mildly to severely depressed Single-Subject Design	Self-Determination Theory (Deci & Ryan, 1985)	Participants received 90-minute physical activity counseling, weekly, for eight weeks.	Accelerometers, GLTEQ, PHQ for depression	Duration: 8 weeks Adherence: 100%	Large increases in PA and decreases in depression (based on Cohen's D) for all 5 participants
<i>Brown, D. M. Y., Bray, S. R., Beatty, K. R., &amp; Kwan, M. Y. W., 2014</i>	N = 174 undergraduate students, $M_{age} = 17.97$ ; 58% female, 42% male RM, Two-Group Design	Social Cognitive Theory (Bandura, 1998)	Tx Group: HAL community with seminars for MI, CBT, and PA behavior change. Control Group: normal residence hall activities.	GPAQ 7-item Social Cognitive Theory PA measure	Duration: 20 weeks Adherence: 36%	HAL Tx group reported greater MVPA than the control group.
<i>Wadsworth, D. D., &amp; Hallam, J. S., 2010</i>	91 sedentary college females, 100% female 2-group RCT w/ pre/post	Social Cognitive Theory (Baron & Kenny, 1986)	Tx group: 6 weekly PA emails, access to an e-counselor, and website. Control group: pre/post questionnaires only.	IPAQ Exercise SES	Duration: 6 weeks Adherence: 86.81%	Intervention group increased frequency of MVPA at 6 weeks, but not 6 months
<i>Melton, B. F., Buman, M. P., Vogel, R. L., Harris, B. S., &amp; Bigham, L. E., 2016</i>	N = 69 undergraduates, 100% female, $M_{age} = 19.7$ years, 100% African-American 2-group RCT	None	Tx Group: Jawbone UP platform w/ mobile application Control Group: MyFitness Pal self-monitoring	Actigraph Activity Step Count Monitor and Total Counts	Duration: 6-weeks Adherence: 72.5%	No significant difference in steps between the Tx and Control groups in African American females.
<i>Ulla Díez, S. M., Fortis, A. P., &amp; Franco, S. F., 2012</i>	N = 73 freshman Mexican students, 74% female, 26% male 2-group RCT	Social Learning Theory (Bandura & Walters, 1977)	Tx group: 7-session (2.5 hours/session) behavior change program. Control group: nothing	Health Promoting Lifestyle Profile II	Duration: 9 days Adherence: 71.5%	Tx group reported greater PA, health responsibility, and stress management.
<i>Weinstock, J., Capizzi, J., Weber, S. M., Pescatello, L. S., &amp; Petry, N. M., 2014</i>	N = 31 sedentary hazardous drinking students, $M_{age} = 20.55$ years; 35.35% male, 64.65% female; 90.25% White, 9.75% Other 2-group RCT	Contingency Management (Stitzer & Petry, 2006)	MET Group: 50-minute exercise planning session MET + Contingency Management Group: 50-minute exercise planning session and 8 weeks of CM.	Drinking behavior Accelerometer Time Line Follow Back via Compendium of Physical Activities	Duration: 8 weeks Adherence: 93.55%	The MET + CM condition showed an increased self-reported frequency of exercise in comparison to the MET alone condition. No significant group difference in accelerometry-based PA.
<i>Mackey, E., Schweitzer, A., Hurtado, M. E., Hathway, J., DiPietro, L., Lei, K. Y., &amp; Klein, C. J., 2015</i>	N = 47 African-American college students; $M_{age} = 19.2$ years, 76% female, 24% male 2-group RCT	Social Cognitive Theory (Bandura, 1998)	Tx group: online Alive! Nutrition and PA, goal-setting, SCT, and self-efficacy. Control group: access to website but no guided goal-setting.	Accelerometer	Duration: 24 weeks Adherence: 19%	Accelerometer adherence was low (30%). Leisure and MVPA behavior was very low and couldn't be compared between groups.

**Table 2. Characteristics of Included Studies continues...**

Study	Sample characteristics	Theoretical Framework	Intervention	Measurement of PA	Intervention Duration & Adherence	PA Intervention Outcomes
Weinstock, J., Petry, N. M., Pescatello, L. S., & Henderson, C. E., 2016	N = 70; M <sub>age</sub> = 20, 88.5% male, 11.5% female 2-group RCT	Contingency Management (Petry et al., 2011)	Group 1 received motivational interviewing plus weekly exercise contracting (MI + EC); Group 2 received motivational interviewing and weekly contingency management for exercise (MI + CM).	Timeline Follow Back via Compendium of Physical Activities	Duration: 8 weeks Adherence: 94% at 2 months	Both groups increased PA frequency  MI + CM exercised more than MI + EC  Exercise frequency decreased at follow-up in both groups
Myers, D. L., Romero, Z., Anzaldúa, N., & Trinidad, M. L., 2011	N = 68 Hispanic undergraduate students, M <sub>age</sub> = 22.43, 8% male, 92% female Single group, pre/post	Transtheoretical Model (Prochaska et al., 2002)	Participants wore pedometers for 9 weeks and self-reported weekly steps.	Pedometer Exercise Self-Efficacy	Duration: 9-weeks Adherence: NA	Participants achieved 10,000 step threshold 7/8 weeks. Only two weeks were significantly greater than baseline.
Quintiliani, Campbell, Bowling, Steck, Haines, & DeVellis, 2010	N = 408 college students, 100% female, 81.3% White, 18.7 other 3-group RCT	Transtheoretical Model (Prochaska et al., 2002) & Health Belief Model (Rosenstock et al., 1988)	3 PA groups 1) received messages tailored to topic of choice, 2) received messages tailored to expert-tailored topic, 3) non-tailored messages.	US Behavioral Risk Factor Surveillance Survey; Stages of change, self-efficacy	Duration: 1 month Adherence: 68.6%	Sig. increases in self-efficacy & goal commitment at immediate follow-up and VPA at 1-month follow-up in expert-determined group compared to comparison group.
Annesi, Porter, Hill, & Goldfine, 2017	N = 84, 69% female, 31% male 2-group design (non-RCT)	None	Tx Group: enrolled in university PA class at least 2x/week, Control group: not enrolled in PA	Self-report PA	Duration: 16 weeks Attrition: NA	The Tx group reported sig. greater increase in PA when compared to Control group
Sharp, P., & Caperchione, C., 2016	N = 184 first-year college students, M <sub>age</sub> = 18 years; 65% White, 11% Chinese, 9% South Asian, 15% other; 53% male, 47% female 2-group RCT	Social Cognitive Theory (Bandura, 1998)	Tx Group: Wore pedometer, monthly PA logs, and monthly emails. Control Group: received no intervention but were promised a pedometer post-intervention.	HRQoL GLTEQ GHQ	Duration: 12 weeks Adherence: 74.5%	Both Tx and Control groups experienced improvements in self-reported, moderate PA. No group differences for PA.

## REFERENCES

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