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ORIGINAL RESEARCH

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Translating an evidence-based exercise and behavioral health intervention to public school therapeutic classrooms

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ABSTRACT

Background: Exercise is associated with improvements in mood in typically-developing children, and may be particularly beneficial to children with behavioral health disorders (BHDs). However, there is evidence that traditional physical education (PE) fails to adequately engage children with social, emotional, and behavioral challenges, and adaptive PE is offered and implemented inconsistently across school districts. Given that few targeted school-based exercise interventions exist for children with BHDs, the aims of this pilot study were: 1) to detail the translation of an existing evidence-based exercise and behavioral health program developed for children with BHDs to a public school district, 2) evaluate feasibility and engagement, and 3) conduct a preliminary exploration of whether participation improved student mood.
Methods: Translational planning was conducted by a school committee including school counselors, classroom teachers, and special education administrators. The decision was made to install cybercycles directly in therapeutic classrooms; students could elect to ride during breaks from class. Data were compiled from therapeutic classrooms in one elementary (ES) and one high school (HS) (N = 15 students, ages 9–17). Over 4 weeks, students were asked to self-identify mood using a simple pictorial instrument before and after riding. Logistic regression was used to compare odds of positive affect after riding *versus* before; results were stratified by school level.
Results: Eight ES students (100%) and 7 HS students (35%) elected to ride; average number of rides was 7.1 per student. ES students had 1.28 times the odds of reporting positive affect after riding as compared to before [95% confidence interval (CI): 0.58–2.80]. HS students had 2.76 times the odds of positive affect after riding (95% CI: 1.07–7.11).
Conclusion: It appears feasible to integrate cybercycles into therapeutic classrooms and increase student physical activity without disrupting learning. Student elective participation in cybercycling was robust; although it decreased with age, improvements to mood were highest among adolescents who elected to ride.

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Introduction

Both unplanned physical activity and planned exercise have been shown to have positive effects on mood in children and adolescents [1,2]. Active children have been shown to have more stable positive affect and lower rates of depression [3]. However, most children in the United States do not meet physical activity or fitness recommendations [4]. Meanwhile, children and adolescents with behavioral health disorders (BHDs) such anxiety, depression, attention deficit/hyperactivity disorder (ADHD), bipolar disorder, and autism may be less physically active and fit than their counterparts without such diagnoses [5–7]. This may be one cause of the observed mental and physical health disparities experienced by populations with moderate to severe BHDs. Exercise, particularly aerobic exposures, has been shown

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to have positive effects on a variety of important cognitive, behavior, and affective outcomes in children with BHDs [6]. Yet little translational research exists regarding effective physical activity engagement promotion among youth with BHDs, particularly in school-settings, nor is there much evidence regarding the effects of normal bouts of physical activity in real-world settings on mood state in children with such disorders.

Promising interventions do exist, but have had limited adaptation to large, public school systems and populations with challenging constellations of symptoms and behaviors. A recent review of physical activity interventions for children with BHDs found that while some interventions have proven effectiveness among children with single diagnoses, all require intensive staffing to ensure student engagement, and the vast majority have not been tested in real-world settings with children who have complex, co-morbid diagnoses [8]. Only two studies were identified as having been employed in school settings serving children with complex BHDs [9,10], and only one of these interventions was designed specifically for children with BHDs and evaluated as implemented as a pragmatic randomized trial by existing school staff within existing school scheduling and programing [11]. This approach utilized cybercycling as an engaging aerobic exercise modality. It was implemented at a private, therapeutic day school through a randomized controlled trial; a full description and results published elsewhere [10]. The program utilized a structured aerobic exercise curriculum that was integrated into school PE programing twice per week, and was evaluated over one school year. Researchers found that the programing was implemented by school staff with high fidelity and engaged all enrolled children (N = 103) [12].Most importantly, participation in the programing was associated with significant improvements in self-regulation and classroom behavior, particularly among children with ADHD [10]. Mood was not explicitly addressed as an outcome of the study, but interviews with students and staff indicated that mood improvements may have been an important mediator of classroom behavior improvements [10]. However, despite the effectiveness of this approach, few schools may have the infrastructure or PE class time to implement the PE curriculum, particularly in middle and high schools. It is also important to note that children with BHDs may be less likely to fully engage in PE programing for a variety of reasons including oppositional and defiant behaviors, anxiety, and lack of athletic self-efficacy. Also, despite legal protections, the availability, quality, and accessibility of adaptive PE programing varies greatly among schools in practice [13].

The Marblehead Public School system began to consider adapting the "Manville Moves" cybercycling programing for students in 2016. The goal was to translate the existing cybercycle programing to increase physical activity engagement among children enrolled in their Therapeutic Intervention Designed for Educational Success program, but with many of the constraints outlined above. These constraints included large PE classes and a lack of budget and facilities in which to install enough cybercyles to meet PE needs. Thus, the district chose the novel approach of integrating the cybercycles directly into therapeutic classrooms beginning in January 2017.

The purpose of this mixed-methods study was to 1) detail the translation of an existing evidence-based exercise and behavioral health program developed for children with BHDs to a public school district; 2) evaluate feasibility and engagement; and 3) conduct a preliminary exploration of whether riding improved student mood. If successful, this approach could be studies further, with the goal of developing a relatively cost-effective tool to increase physical activity, improve student classroom engagement, and eventually help reduce academic and health disparities among children with behavioral challenges.

Methods

The study was conceived and conducted as a collaboration between the Marblehead Public Schools and Merrimack College researchers investigating physical activity and youth behavioral health. All study protocols were approved by the Merrimack College Institutional Review Board.

Translation

Prior to translation, Marblehead Public Schools assembled an evaluation and implementation team, including the district's Special Education Director, Psychologist, therapeutic classroom teachers and aides. Important considerations included 1) cost of equipment; 2) PE class sizes, existing curricula, and student engagement; 3) potential for therapeutic classroom benefits such as use of the bikes as a therapeutic modality, opportunities for team building, as well problems such as noise and student distraction; 4) staffing limitations; and 5)

Figure 1. Cybercycling interface in virtual reality mode (left) and exergaming mode (right).

evaluation approaches. After an assessment process that included a review of classroom facilities and PE programing, the team decided to pilot the cybercycles by integrating them directly into the therapeutic classrooms.

Program description

Students were allowed to ride the bikes during classroom activity breaks, as a self-selected therapeutic modality to pro-actively prevent behavioral problems, and as a situationally dependent behavioral treatment modality. Student riding was tracked on progress boards in each classroom with small prizes such as stickers and T-shirts for achieving riding benchmarks of 1, 5, 10, and 20 miles. Competition was discouraged, but classes could set "team" goals for riding if they elected. Classroom staff were encouraged to participate on classroom "teams" as well. Students were not allowed to change clothing for riding, but were provided a fan and towels.

Equipment

The project utilized Espresso HD cybercycles (Interactive Fitness Corp., Santa Clara, CA). These bikes feature multiple virtual–reality courses and video games with engaging graphics (Fig. 1). Riders must shift, steer and peddle just as they would a real bike, and courses and games presented a range of difficulty from easy, flat 1-mile courses to very difficult courses of over 20 miles.The high school bikes were adult-sized, while the elementary school bike was child-sized. All bikes were adjustable, and staff was trained to fit them to riders. Students were assigned unique numerical login codes; once they logged in, the bikes recorded their riding data and uploaded it to individual rider dashboards that students could access via the bike and classroom tablets and computers.

Participants, sites, and staffing

Cybercycles were installed in three therapeutic classrooms serving children with documented behavioral health challenges: one elementary school classroom and two high school classrooms (Fig. 2). All children were previously cleared for physical activity through school enrollment documentation. Like all school physical activity programs, a passive parental opt-out procedure was utilized for consent. All participation was elective; student assent was given verbally prior to every ride. The elementary school classroom served a total of eight students, ages 9–12, while the high school classrooms served a total 20 students, ages 14–18. When students elected to ride, they were overseen by a classroom aide in the elementary school, or teacher in the high school.

The bike at the elementary school was installed in a small therapy room directly connected to the classroom with a door that could be closed during riding. The high school bikes were installed directly into therapeutic classrooms. All bikes were outfitted with antiseptic wipes, a fan, and towels for student use. Students in the high school, but not the elementary school, were allowed to listen to music using headphones while they rode.

Data were collected for evaluation purposes over a 4 week period in the spring of 2017. Students had access to the bikes for approximately 4 weeks prior to the start of data collection, and continued to have access to the bikes after data collection was completed.

Measures

Demographics

Individual student demographics were not collected other than age, since the sample size was so

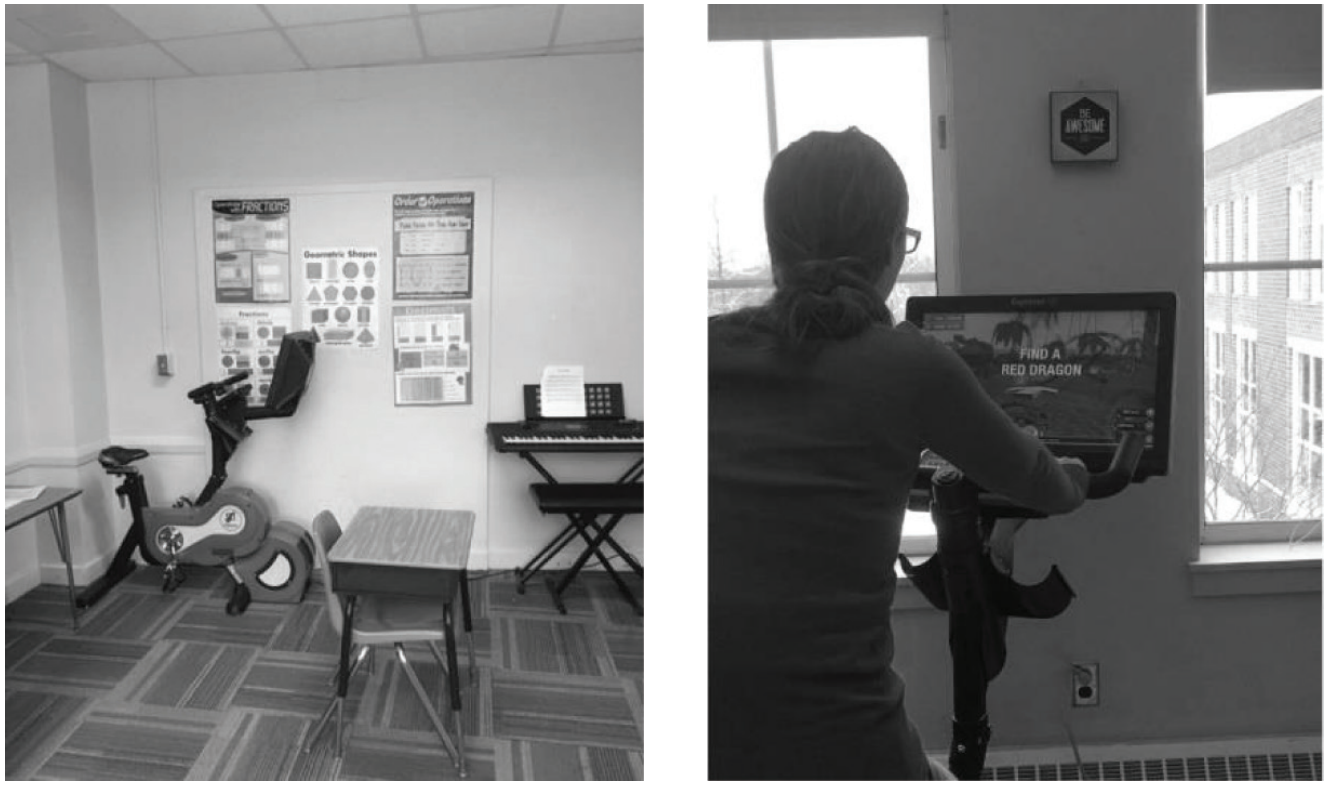

Figure 2. Child (left) and adult (right) sized cybercycles integrated into therapeutic classrooms.

small that sex and racial/ethnic categories could lead to individual student identification.

Engagement

The cybercycles collected real-time data on student rides via their unique login codes. This data included date and time of ride. While the bikes collect this data for each ride, only the data collected during the 4 week evaluation period was used for this study.

Feasibility

School staff—including teachers, aides, and psychologists—was informally interviewed regarding overall perceptions of the programing approach. Debriefings were held during programing meetings. Themes were identified during notes review by Merrimack College faculty, and then validated with school staff.

Mood

Students self-identified mood using a pictorial instrument (five positive affect and five negative affect options) before and after each ride during the 4-week study period. Positive mood choices were calm, focused, happy, and energized. Negative mood choices were bored, mad, sad, anxious, and restless. This instrument was chosen because of pre-existing use in the classroom; while not validated, children were familiar with the choices and comfortable using it without staff supervision. The instrument was offered to the student by a staff member before and after riding, but the student placed it in an envelope without identifying information after completion. Forms were labeled "pre" or "post" riding, but did not include any other information about the student or the ride.

Statistical analyses

Descriptive statistics were used to evaluate student engagement with the cybercycles and overall exercise using them, as well as overall affect reports pre- and post-riding. Logistic regression was used to compare odds of positive affect after riding versus before riding; results were stratified by school level. All analyses were conducted in STATA 13.

Results

A total of N = 15 students, aged 9–17, utilized the bikes over the 4 weeks. Students were predominantly white and male. Engagement and mood reporting results are shown in Table 1.

Logistic regression analysis found that students in the elementary school had 1.28 times the odds of reporting positive affect after riding as

Table 1. Engagement and mood reporting results.

	Total	Elementary school	High school
Total students (*N*)	28	8	20
Participating (%)	54%	100%	35%
Average rides per student	7.1	7.4	6.7
Pre-ride mood (Positive %)	44.3%	61%	23%
Post-ride mood (Positive %)	58.1%	67%	46%

compared to before, but this improvement was not statistically significant [95% confidence interval (CI): 0.58–2.80]. Students in the high school had 2.76 times the odds of reporting positive affect after riding *versus* before; this improvement was statistically significant (95% CI: 1.07–7.11). Five informal interviews were conducted with school staff, and two programmatic follow-up meetings were held. The staff interviewed included the high school psychologist, one high school classroom teacher, both elementary school classroom teachers, and one elementary school classroom aid. Overall perceptions were positive and staff expressed the belief that the program was both feasible and sustainable. However, they also expressed that engagement and effects on student behaviors and mood might have been greater if riding opportunities had been more structured, or if barriers to student riding were better addressed. Qualitative themes are summarized in Table 2, and expanded upon below.

Staff reported that the bikes were universally utilized by elementary students, but many students were motivated by incentives, not intrinsically. Elementary school teachers reported that student feedback indicated children preferred to use the bikes in video game mode (versus virtual reality course mode), and that some students expressed disappointment that there was only one bike and so they could not ride together. They also reported that students found the mood measure helpful in seeing how riding might improve their affect, even when those changes were subtle.

The high school teacher who was interviewed noted very strong self-selection bias in her population of students. Those who already enjoyed physical activity or understood its benefits for their mood were those mostly likely to take part. She found that the bike as placed in the main classroom was quiet and did not present a disruption to student work. However, student feedback indicated that the potential physical and appearance effects of riding—becoming sweaty, hot, or "stinky" for example—were major barriers to choosing to ride. Some students addressed this by keeping intensity low, while others only engaged on days when they were already prepared for physical activity exposures in other classes such as shop or PE. The high school teacher reported that clothing was a particularly barrier for girls in the classroom, who frequently felt that they could not comfortably ride in their school attire.

Discussion

This study examined the translation of an existing PE curriculum utilizing cybercycles to engage children with complex BHDs in exercise into public school, therapeutic classroom settings. Cybercycles were integrated directly into three therapeutic classrooms serving a total of 28 students, including eight elementary school students and 20 high school students. Staff reported that the bikes were not disruptive and that they were useful as a therapeutic modality for students. Staff perceptions were that the programing approach of integrating cybercycles

Table 2. Perceived benefits and barriers of integrated classroom cybercycling.

	Elementary school	High school
Staff		
Perceived barriers	• Riding primarily motivated by incentives • Unstructured riding meant more staff burden	• Elective nature of program meant only students already inclined to be active participated regularly
Perceived benefits	• Students enjoyed physical activity breaks.	• Bikes were quiet • Students could take part without disrupting scheduling or requiring additional staffing
Students		
Perceived barriers	• Single bike (no riding with friends)	• Clothing for riding • Hygiene concerns
Perceived benefits	• Video game mode • Ability to see how riding improves mood in real time	• Convenience improved ability to take movement breaks

directly in the classroom was both feasible and sustainable. However, they noted that several limitations were present, including the inability of students to ride together, a lack of intrinsic motivation for many students which might lead to declining, or even stopping use over time, and the fact that students might not be wearing appropriate clothing for riding, particularly at the high school level.

Using an elective riding structure with small incentives, the program demonstrated excellent engagement among elementary school students, and moderate engagement among high school students. All students chose to engage in riding at the elementary school level, while high school student participation appeared to be strongly driven by previously existing exercise enjoyment.

This may be why mood improvements, while present among both groups, were less pronounced among the elementary school participants, since some might be participating reluctantly, enticed by incentives. For high school students, who identified several barriers to riding including clothing choices and hygiene issues, participation appeared more limited to students who already enjoy exercise. Those students, in turn, may be more likely to feel/recognize mood improvements after exercise engagement. This is an important finding. Programing such as this is meant to engage all students in an entertaining exercise modality regardless of athletic self-efficacy; however, the engagement sustainability of such elective programing among students who are not already exercise-motivated appears questionable. While incentives appear to address this issue with elementary school students, they seem less effective among high school students, and not all school districts will have the resources to implement them. One advantage of the PE cybercycling curricula, as it was originally developed, was that it provided a structured, class-wide riding expectation, nearly eliminating the problem of self-selection into riding. However, unlike therapeutic schools with small, adaptive PE classes, in order to implement such curricula, the Marblehead Public School district would need to purchase 20 cybercycles per school; impossible with an average cost per bike of between $2,000 and $5,000 depending on the model.

This evaluation has important limitations; evaluation measures were clearly limited in an effort to reduce burden to school staff and students. The mood measure is brief and not validated for use in this population; however, students used it consistently and reported that it helped them recognize the mood benefits of riding when they were present. In fact, even with such a blunt measure and very small sample size, we found a significant improvement in mood among the high school participants after engaging in riding. Given these findings, an effort should be made to validate this instrument for regular use in this population. Despite these limitations, this pilot study provides important information regarding the translation of a successful exercise intervention from a therapeutic day school setting to a public school therapeutic classroom setting.

It is important to note that this was a well-resourced school district with small therapeutic class sizes, excellent classroom facilities, and significant staffing resources. Future research should center on exploring other engaging exercise technologies and programing that utilize the features of the cybercycles that appeal to children and adolescents with a variety of BHDs—accessibility, ease of use, gaming, excellent graphics, and progress tracking—that are more cost-effective and suitable for upscaling. Cybercycles should also be further evaluated as therapeutic modalities in integrated classroom and clinical settings where their cost is more feasible. This pilot study found that it was feasible to integrate cybercycles directly into public school special education, therapeutic classrooms. Staff reported that academic content time was not affected, and the use of the bikes was not disruptive. Student engagement with exercise was moderate to high, and students reported improvements to mood after riding; however, participation was likely driven by incentives provided through a classroom "challenge," and might significantly decrease over time. Participation also appeared to decrease with age and degree of agency, but improvements to mood were highest among adolescents who elect to ride. Cybercycles—while currently too expensive for widespread use in large public school PE classes—show promise as an integrated therapeutic tool in classrooms.

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Conflict of interest

The authors report no conflict of interest.

References

[1] Basso JC, Suzuki WA. The effects of acute exercise on mood, cognition, neurophysiology, and neurochemical pathways: a review. Brain Plast 2017; 2(2):127–52.

[2] Fox KR. The influence of physical activity on mental well-being. Public Health Nutr 1999; 2(3a):411–8.

[3] Dunton GF, Huh J, Leventhal AM, Riggs N, Hedeker D, Spruijt-Metz D, et al. Momentary assessment of affect, physical feeling states, and physical activity in children. Health Psychol 2014; 33(3):255.

[4] Dentro KN, Beals K, Crouter SE, Eisenmann JC, McKenzie TL, Pate RR, et al. Results from the United States' 2014 report card on physical activity for children and youth. J Phys Act Health 2014; 11(s1):S105–12.

[5] Srinivasan SM, Pescatello LS, Bhat AN. Current perspectives on physical activity and exercise recommendations for children and adolescents with autism spectrum disorders. Phys Ther 2014; 94(6):875.

[6] Rimmer JH, Rowland JL, Yamaki K. Obesity and secondary conditions in adolescents with disabilities: addressing the needs of an underserved population. J Adolesc Health 2007; 41(3):224–9.

[7] Mangerud WL, Bjerkeset O, Lydersen S, Indredavik MS. Physical activity in adolescents with psychiatric disorders and in the general population. Child Adolesc Psychiatry Ment Health 2014; 8(1):2.

[8] Ash T, Bowling A, Davison K, Garcia J. Physical activity interventions for children with social, emotional, and behavioral disabilities—a systematic review. J Develop Behav Pediatr 2017; 38(6):431–45.

[9] Bustamante EE, Davis CL, Frazier SL, Rusch D, Fogg LF, Atkins MS, et al. Randomized controlled trial of exercise for ADHD and disruptive behavior disorders. Med Sci Sports Exerc 2016; 48(7):1397–407.

[10] Bowling A, Slavet J, Miller DP, Haneuse S, Beardslee W, Davison K. Cybercycling effects on classroom behavior in children With behavioral health disorders: an RCT. Pediatrics 2017; 139:e20161985.

[11] Davison K, Bowling A, Garcia J, Wood B, Hermesch R, Prince J, et al. A cybercycling intervention to improve behavioral regulation and classroom functioning among children with behavioral health disorders: pragmatic randomized trial design for Manville Moves. Contemp Clin Trials 2016; 49:40–6.

[12] Bowling AB, Slavet JD, Garcia JM, Wood BJ, Miller DP, Hermesch RM, et al. Implementation fidelity of a cybercycling curriculum among children with behavioral health disorders. Trans J Am Coll Sports Med 2016; 1(9):82–9; doi:10.1249/tjx.0000000000000008

[13] Lorenzi DG. A case study of two schools' inclusion practices in elementary physical education. West Virginia University, 2008. Publisher location is Morgantown, West Virginia.