

Why Exercise for Cognitive and Mental Health is Especially Important in the Senior Years

Semester 2 2019



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David Lubans, Angus Leahy, Jordan Smith and Narelle Eather make the case for continuing physical activity into the senior school years...

Introduction

You may not be surprised to read that physical activity declines dramatically during adolescence (Dumith et al., 2011) and less than 10% of senior school students are sufficiently active (Schranz et al., 2014). However, you may not know that evidence suggests low levels of physical activity among senior school students may contribute to poor mental health (North, 2015; Suetani et al., 2017).

These findings are particularly relevant to schools as 43% of young Australians report at least moderate levels of psychological distress (15% report high to very high levels of distress) (Australian Bureau of Statistics, 2018), and some suggest increasing time demands and pressure to excel in senior years as a reason for sacrificing time usually spent being active.

We conclude that there is a need for effective physical activity programs that are also time efficient. This is important because, although the NSW Department of Education policy recommends that students in Year 11 and 12 are provided with weekly access to a minimum of 150 minutes of physical activity each week (New South Wales Department of Education, 2017), very few senior school students actually receive this dose.

This is partly due to the misconception that allocating more time for study skills or revision over physical activity will improve academic performance. We argue that this view is ill-informed as there is a growing body of evidence that suggests students with higher levels of physical activity and aerobic fitness perform better on standardised academic tests and measures of cognitive function (Donnelly et al., 2016; Álvarez-Bueno et al., 2017).

What might we do?

Many teachers may be experiencing the benefits of high intensity interval training (HIIT) exercise through their out-of-school lives. Such approaches to exercise at school could also benefit your students at school and would fit within existing Departmental guidelines.

HIIT is a potent and time efficient method for improving physical health and mental health (Costigan et al., 2015; Logan et al., 2014) which typically consists of short, but intense bouts of activity interspersed with brief periods of rest or light activity. The main appeal of HIIT is that it can be completed in a shorter period of time in comparison to traditional moderate intensity aerobic exercise, whilst achieving similar and in some cases superior results. In our recent systematic review and meta-analysis (Costigan et al., 2015), we demonstrated that HIIT can improve cardio-respiratory fitness and reduce body mass index (BMI) in adolescents.

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Although few studies have been conducted with adolescents, there is some evidence to suggest participation in HIIT can improve young people's cognitive and mental health (Costigan et al., 2016; Moreau et al., 2017; Leahy et al., 2019). For example, in one of our earlier studies (Costigan et al., 2016), we demonstrated that engaging in weekly HIIT sessions had a consistently positive effect on students' mood (Figure 1).

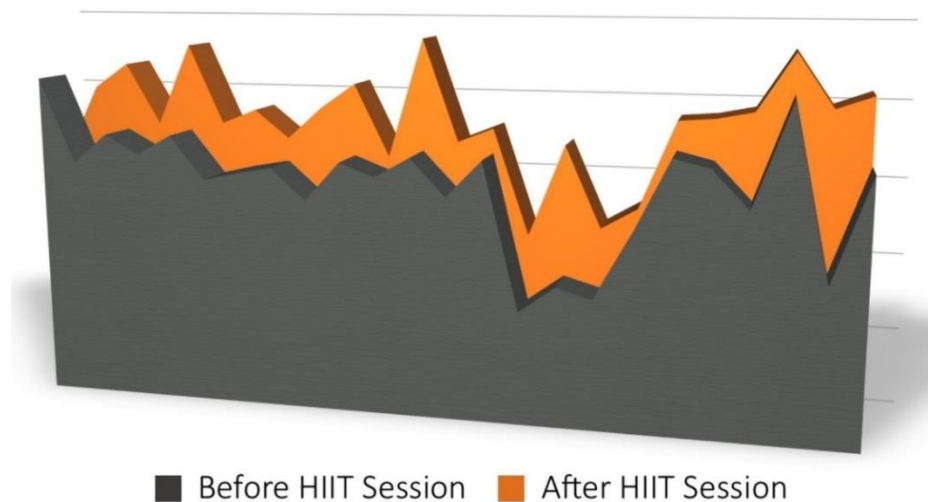


Figure 1: Mean feeling state scores reported by students before and after participating in HIIT (higher values represent better mood and the graphic represents difference in mood responses over 24 sessions)

Less than 100% effort can be good too

Many people associate HIIT with the 'all out' maximal (such as 100% of heart rate maximum) type of exercise tested by Michael Mosley in the BBC documentary 'The Truth About Exercise'. This type of activity is unlikely to be palatable for adolescents or appropriate for delivery in the school setting. Alternatively, there is emerging evidence for the efficacy of less demanding HIIT protocols (for instance, 85% of heart rate maximum) that are still relatively brief (for example, 10 minutes) (Costigan et al., 2015).

Our Burn 2 Learn program

In partnership with the NSW Department of Education School Sport Unit, we developed the Burn 2 Learn (B2L) program for senior school students. Unlike previous HIIT programs that require

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complicated equipment, facilities and expert instructors, B2L has been designed to be 'student-directed' under the supervision of secondary school teachers using minimal resources. Our team has developed a full day professional learning workshop for teachers, which is accredited with the NSW Education Standards Authority at the 'Highly Accomplished' level. We have also designed curricular materials for teachers, HIIT task (Figure 2) and technique cards and a smartphone app to enhance participation among students.

To promote variety and enjoyment, we designed 11 different styles of HIIT workouts for students to choose from: Gym, Sport, Class, Quick, Hip-Hop, Combat, Brain, Rumble, Custom, Beach and Park.

The image shows a 'Sport HIIT 2' task card from the 'Burn 2 Learn' program. It is a vertical card with a green header and a white background. The card is divided into four intervals, each with two exercises. Interval 1: 4x Sit-ups (with ball) and 10x Mountain climbers. Interval 2: 10m shuttle run - Partner pass. Interval 3: 4x Lateral jumps and 4x Push-ups (knees or toes). Interval 4: 4x Russian twists (with ball) and 10x Jumping jacks. Each interval is separated by a 'REST: 30sec' period. The card also includes logos for Newcastle University, ACU, NSW Education, and HMRI, and a list of required technique cards: O1, O6, O9, B2, G1, G5, P6.

Figure 2: Example Burn 2 Learn HIIT task card

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The B2L program was designed using self-determination theory and is focused on enhancing students' autonomous motivation for vigorous physical activity by satisfying their basic psychological needs for autonomy (feeling in control), competence (feeling capable) and relatedness (feeling connected with others) (Deci and Ryan, 1985). Teachers learn to facilitate the delivery of the B2L sessions using the SAAFE (Supportive, Active, Autonomous, Fair and Enjoyable) principles (Lubans et al., 2017) (Figure 3). Students' need for autonomy is satisfied by providing them with opportunities for choice within sessions (e.g., type of activity, music playing, and training partner) and explaining the rationale for the program in an information seminar.

The introductory seminar reinforces the importance of exercise for cognitive health and academic performance. Competence is satisfied using positive and specific feedback from teachers, an explicit focus on effort over absolute performance (via heart rate feedback) and through the provision of resources designed to support the development of exercise skills. Finally, teachers are encouraged to adopt practices that support relatedness and group cohesion during HIIT sessions (for example, encouraging supportive behaviour among students such as 'high fives' and partner work) (Owen et al., 2014).



Figure 3: SAAFE principles for Burn 2 Learn session delivery

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Positive results for teachers and students

In 2017, we conducted a pilot study to evaluate the B2L program in two high schools in the Hunter region (Leahy et al., 2019). We found that 2-3 HIIT sessions/week, each lasting ~10 minutes, increased students' fitness and improved their well-being. Overall satisfaction of the program was high among students (4.0/5) and teachers (4.0/5). Students enjoyed the practical HIIT sessions, with 'Sport HIIT', 'Class HIIT' and 'Gym HIIT' the most popular types.

Teachers also expressed high levels of satisfaction with the professional development workshop (5.0/5) and were highly confident in their ability to facilitate the delivery of the program (5.0/5). Anecdotal discussions with teachers involved in B2L also highlighted the potential impact of HIIT on students' behaviour in the classroom.

"Today we had our best B2L session where all the students got in and had a go and that translated into the classroom immediately after, where I had my best theory lesson with that class. We were doing a textbook heavy lesson and the students appeared to be more focused providing me with quality answers. Even the students who normally muck up a bit were more on task today."

(Teacher responsible for delivering B2L)

Although our pilot study results were promising, it is important to replicate our findings in a larger cohort of students before making the B2L program available to all schools in NSW. We are currently conducting a cluster randomised controlled trial evaluation of the program in 20 secondary schools in NSW (~800 Grade 11 students). In this study we will test the effects of the B2L program on students' cardiorespiratory fitness, muscular fitness, cognition and mental health. In addition, a subsample of students will: (i) provide hair samples to determine their accumulated exposure to chronic stress using cortisol testing and (ii) undergo multi-modal functional magnetic resonance imaging (fMRI) to examine changes in brain structure and function.

Next steps

A common criticism of school-based physical activity interventions is that they are rarely adopted and implemented by schools (Milat et al., 2013). With this in mind, we have designed the B2L program in partnership with the NSW Department of Education School Sport Unit and see support for ongoing provision of professional learning as essential to the success of such a statewide program.

Conclusions

Driven by pressures to perform well academically, students may choose to sacrifice physical activity for additional study time. Unfortunately, this may be having the opposite effect to that which they intended, as physical activity supports cognitive functioning and is a useful strategy for coping with stress generally.

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Further, chronic stress undermines learning and can impair performance in high stakes examinations. Consequently, the senior school years would appear to be a particularly important time for adolescents to stay physically active. Programs such as B2L have the potential to bring physical and mental health benefits for young Australians. Importantly, such programs are achievable and can be delivered within existing school structures in the interests of all of your students' health, well-being and learning.

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