

**Literature Review:
Measuring the positive impact of
school based activities on
adolescent anxiety, depression and
cortisol expression.**

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Literature Review

Mental Health Globally

It is estimated that a total of 792 million people were living with a mental health disorder globally in 2017 (Dattani & Roser 2021). Equating to approximately one in ten people or 10.7% of the world's population. Although diverse and complex, the most common types of mental health disorders typically include forms of anxiety, depression, bipolar, eating disorders and schizophrenia. Factors that contribute to the overall mental health of an individual is multifaceted and may be impacted directly by their genetics (Hyman, 2014; McCammon & Sive, 2015), gender (Afifi, 2007; Rosenfield & Mouzon, 2013), ethnicity (Samaan, 2000; U.S. Department of Health and Human Services, 2001; Villatoro et al., 2018) and/or by environmental factors such as diet (O'Neil et al., 2014; Parletta et al., 2019), substance use (Wu et al., 2003; Baingana et al., 2015) and socio-economic status (Eibner et al., 2004). Thus, deriving the core causes of declines in mental health is challenging and typically the result of many personal and social elements influencing an individual's life.

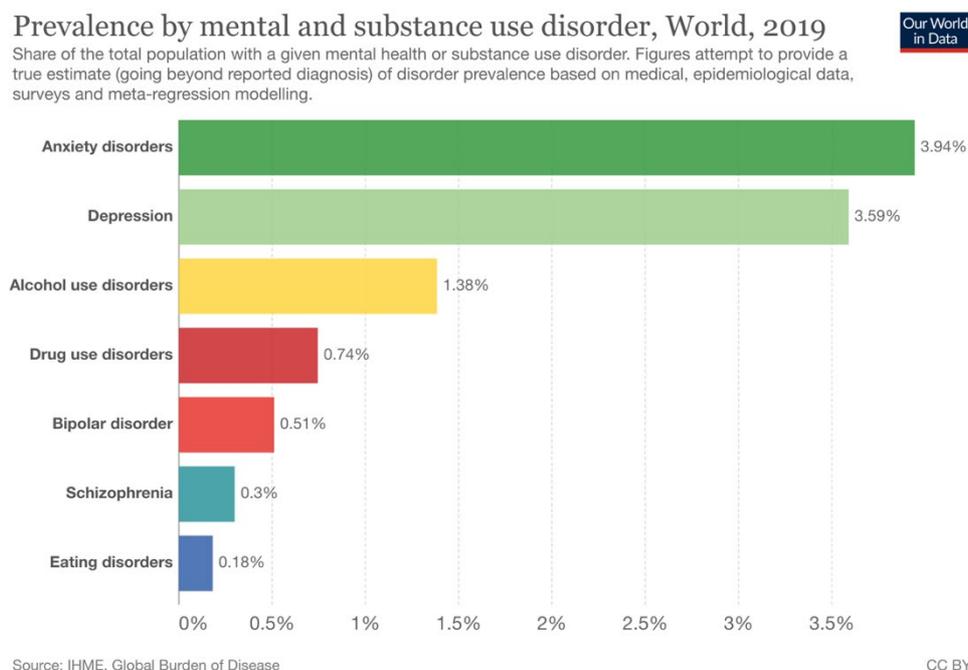


Figure 1. Prevalence of mental and substance use disorder, World, 2019. Source: IHME, Global Burden of Disease.

To tackle the growing mental health crises globally, the World Health Organisation established the Comprehensive Mental Health Action plan 2013-2020. The plan outlined four major objectives;

1. More effective leadership and governance for mental health.
2. The provision of comprehensive, integrated mental health and social care services in community-based settings.
3. Implementation of strategies for promotion and prevention.

4. Strengthened information systems, evidence and research.

In 2019, the WHO extended the CMHA plan from 2013 - 2030 with further updates in 2021. Given the scale and number of individuals suffering worldwide, implementation of the WHO CMHA objectives has become imperative for governments aiming to improve global health (Saxena et al., 2015). The two most common mental health disorders globally are forms of anxiety and depression, of which females are overrepresented in both groups, compared with males. The literature supporting strong gender differences between females and males in levels anxiety and depression is well established (Weissman & Klerman, 1997; Bebbington, 1996). Such differences are even more pronounced during adolescence (Lewinsohn et al., 1998; Salk et al., 2017). Studies suggest adolescent females are more likely to develop decreased feelings of self-worth and self-competence than males of the same age (Hill & Pallin, 1998; Ohannessian et al., 1999; Craft et al., 2003).

Factors influencing mental health challenges

Proposed factors which contribute to the observed sex differences in levels of anxiety and depression include childhood experience, social/cultural behaviour and biological differences. Females are more likely to experience childhood trauma and have increased reactivity to some types of trauma than males (Freedman et al., 2002; Dube et al., 2005). Females are more likely to discuss troubling behaviour and seek support from others, compared with males who are more likely to take personal action or develop avoidant coping mechanisms (Taylor et al., 2000; Carter, 2011; Gluck et al., 2014). In addition to this, there is evidence that sex chromosomes (XX in females and XY in males) in mammals can lead to differences in behaviours such as levels of aggression (Maxson, 1992). Importantly, females are exposed to substantial fluctuations in oestrogen levels compared to males (Altemus et al., 2014) which has been linked to increased rates of depression (Angold et al., 1998). Remarkably, mammalian studies have suggested that maternal and paternal stress, even prior to conception, can produce neurobiological and behavioural differences in male and female offspring (Dietz et al., 2011; Zaiden et al., 2013). Female infants are more likely to exhibit fearful and reactive behaviours if their mothers had elevated levels of depression and cortisol during pregnancy, and elevated milk cortisol levels during lactations (Buss et al., 2012; Grey et al., 2013; Sandman et al., 2013) than male offspring. Interestingly, emotional stress during the first trimester has a larger negative impact on male offspring behaviour than female offspring, while later trimesters have a larger negative impact on future behaviour in infant and adolescent females (Huttenen et al., 1999; Van denBerg et al., 2008; de Bruijn et al., 2009). The term intergenerational transmission is sometimes used to describe the process in which characteristics are transmitted from parent to child. Some studies have shown stress can leave 'imprints' on germ cells (sperm and eggs) and therefore affect multiple generations, referred to as transgenerational transmission.

Assessing anxiety and depression

Given the immediate and potential future impact of mental health disorders on society, assessment and treatment of the two most common types, anxiety and depression, has received high levels of attention. One of the most common tools for assessing levels of

anxiety and depression both medically and academically has been through the use of psychometric testing. Two of the most popular tests include the General Anxiety Disorder-7 (GAD-7) questionnaire and the Patient Healthcare Questionnaire-9 (PHQ-9) (Löwe et al., 2004; Spitzer et al., 2006). Many studies have reported high levels of reliability, sensitivity and validity for GAD-7 and PHQ-9, confirming their dependability as screening tools for anxiety and depression respectively (Adewuya et al., 2006; Löwe et al., 2008; Sidebottom et al., 2012; Wild et al., 2014; Williams, 2014; Mossman et al., 2017; Johnson et al., 2019; Urtasun, 2019). Each questionnaire uses a Likert scale, participants rank their response to questions related to how often they have had certain negative feelings in the previous 2-week period (0 - Not at all, 1- Several Days, 2 - More than Half the days, 3 - Nearly Every Day). Participants can then be attributed levels of severity based on how low or high they scored. Most practitioners regard a score of ≥ 10 in either test as an indication of clinical levels of anxiety or depression. The use of such screening tools will likely become more commonplace to quickly assess clinical levels of anxiety and depression post COVID-19 (Sartorão et al., 2020; Stocker et al., 2021; Shevlin et al., 2022). Indeed, some recent publications suggest the unpredictability, stress, misinformation and social isolation in response to COVID-19 has led to a further increase in mental morbidity (Zandifar & Badrfam, 2020).

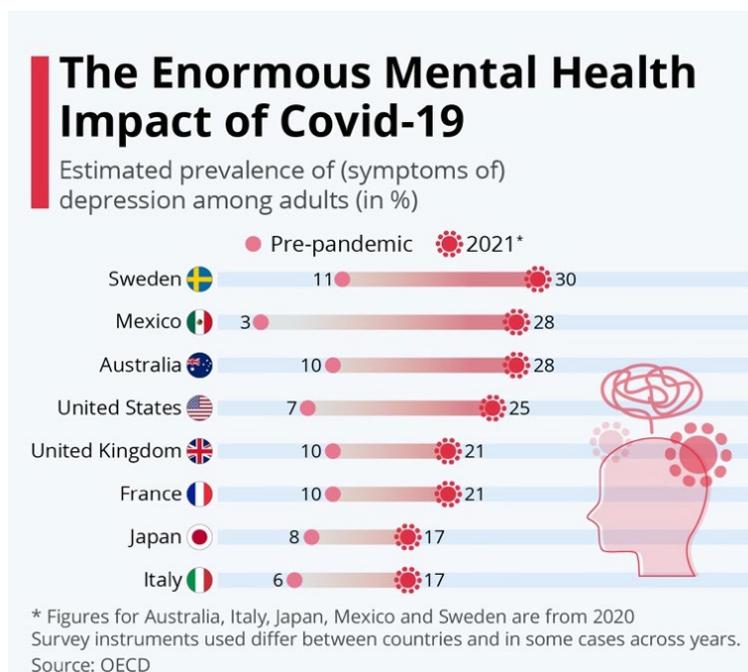


Figure 2. OECD estimates on prevalence of depression levels post-COVID 19

Some authors have suggested the advent of a true mental health crisis given how many people have been affected by COVID-19 both economically and physically (Dong & Bouey, 2020; Proto & Quintana-Domeque, 2021). For adolescents who are considered the most vulnerable and susceptible demographic for developing mental health issues, the negative consequences will likely be more pronounced.

Mental health challenges and adolescence

Prevention, diagnoses and treatment of mental health disorders in adolescents (14 - 20 years old) therefore is emerging as a primary focus of concern to limit the prevalence of

mental health and substance misuse in adults (Patton et al., 2016; Colizzi et al., 2020). This critical developmental stage offers unique opportunities and challenges for engaging young people in mental health interventions. If a young person does receive appropriate support, information and guidance during this phase of their life, it may significantly impact chances of future employment, level of education and economic status as an adult (Patel et al., 2007). Improving the quality of a young person's mental health not only advances their own life moving forward, but the lives of their own families, their communities and ultimately society (Knapp et al., 2002, 2011; McCrone et al., 2005). Importantly, it may give them the tools to pass on to their own children, which may help reduce the chance of intergenerational or transgenerational transmission.

It is well known that brain development during adolescence and early adulthood is heavily dependent of external experiences (Bosson & Niesink, 2010; Blakemore, 2012). This simultaneously presents difficult challenges to overcome and incredible opportunities to seize. During normal development, the adolescent brain undergoes structural change, although different structures mature at different rates. Perhaps the most important 'mismatch' of brain region maturation in adolescents relates to the early development of subcortical regions followed by later development of prefrontal regions (Blakemore, 2012; Tottenham & Galván, 2016). The subcortical regions contain structures important to risk-taking and sensation seeking, such as the amygdala. The prefrontal regions such as the prefrontal cortex are important in impulse and cognitive control. This phenomena is often referred to as the 'developmental mismatch' in adolescents (Somerville et al., 2010; Mills et al., 2014). The 'developmental mismatch' has been used to try and explain common behaviours exhibited in adolescents and young adults such as increased risk taking, pleasure seeking and heightened emotional reactivity (Whittle et al., 2008; Burnett et al., 2012; Mills et al., 2014).

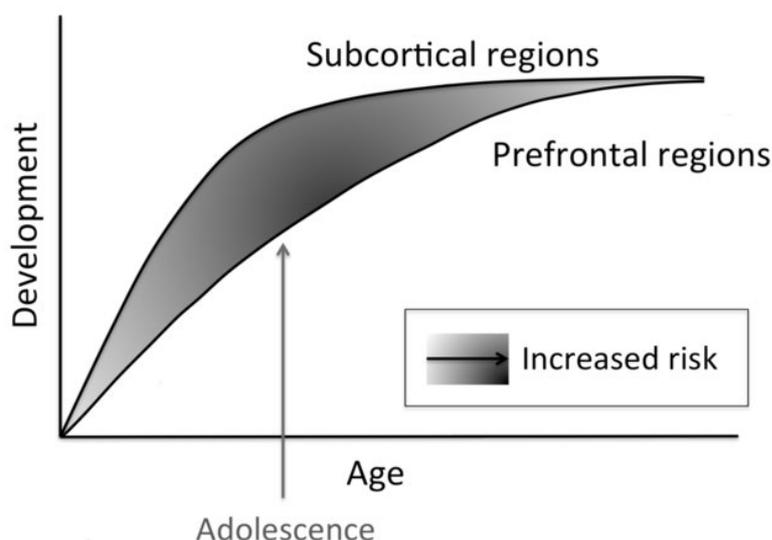


Figure 3. Developmental mismatch model from Somerville et al., (2010)

This mismatch appears normal in neurotypical individuals however, given the receptiveness of the brain to environmental stimuli during this critical stage, substance

use such as excessive alcohol consumption or other drug use can have long lasting consequences on brain structure and therefore function (Lisdahl, 2013; Lees et al., 2020).

Although the human brain appears to be more responsive and adaptive during development (early childhood to young adult), new evidence has emerged demonstrating that human brains appear to respond and adapt throughout the entire lifespan of an individual (Pauwels et al., 2018). This adaptability of the brain is often referred to as neuroplasticity. Given the plasticity of the brain during adolescence there is a real opportunity to enhance development by providing enriching environments for adolescents to learn and grow (Guyer et al., 2018). This is perhaps even more important in adolescents who have experienced high levels of stress and childhood trauma.

Brain adaptability and stress response

During early development, exposure to chronic or acute high stress events can trigger a cascade of neurobiological effects in mammalian brains (Teicher et al., 2002). It can change the molecular structure of the stress-response system, diminish inhibition of the amygdala causing increased fear and anxiety behaviours, and importantly disrupt feedback mechanisms in the production of hormones such as cortisol. Cortisol, often referred to as the stress hormone, plays a number of critical roles in normal bodily functions from regulating metabolism, inflammation and immune function (Oakley & Cidlowski, 2013).

There is a common misconception that only high levels of cortisol are inherently bad for humans, in fact, extremely high levels of cortisol (hypercortisolism) and extremely low levels of cortisol (hypocortisolism) are both detrimental to human health. For example, chronic hypercortisolism can lead to diseases such as Cushing syndrome and hypocortisolism can lead to Addison disease. Therefore, one would expect healthy individuals to exhibit 'goldilocks' levels of cortisol, not too high and not too low. Although Cushing syndrome and Addison disease represent the extreme ranges of cortisol imbalance, levels above and below expected norms can provide a window into potentially disrupted neurochemical pathways, which may help explain associated behavioural traits. For example, studies have found lower baseline levels of cortisol in individuals who have attempted suicide, and the families of individuals who have attempted suicide (Keilp et al., 2016). Some forms of depression and suicidal ideation therefore appear to be linked to reduced frontal lobe activity and dysregulation of cortisol rhythms (McGirr et al., 2010). Using cortisol as a stress biomarker can be an important element in the mosaic of available assessment tools used to determine adolescent mental health.

There are multiple methods employed to assess cortisol levels such as blood, urine, saliva and hair sampling. Traditionally, blood sampling has been a popular method of choice. Recently however, studies have suggested a number of shortcomings in this technique. Primarily, the act of taking blood from the vein can induce a stress response in participants, resulting in false positive results. Secondly, levels of cortisol in the blood represents total cortisol, not free biologically active cortisol (cortisol that is actually used by the body), again masking the true concentration of functioning cortisol (Bozovic et al., 2013). Urine sampling can be complex, requiring collection at appropriate times over a 24-hour period and again, does not necessary represent free biologically active cortisol (Bozovic et al., 2013). Saliva sampling on the other hand, confers many advantages. Saliva

sampling is non-invasive, safe, simple and does not require special training to administer. Saliva sampling requires participants to place absorbent cotton swabs under their tongue for a short period of time (1-2minutes) and can be conducted in 'normal' environmental conditions, thus limiting the chance of a stress response, reducing the chance of false positive results. Cortisol found in saliva has also passed through membranes of the salivary gland, representing biologically active cortisol levels opposed to total cortisol levels found in the blood (Bozovic et al., 2013). Hair sampling presents similar advantages to saliva sampling, however is more useful when investigating chronic stress levels (Khoury et al., 2019; Enge et al., 2020). One disadvantage of hair sampling, as a relatively new approach, is the limited amount of supporting literature currently available.

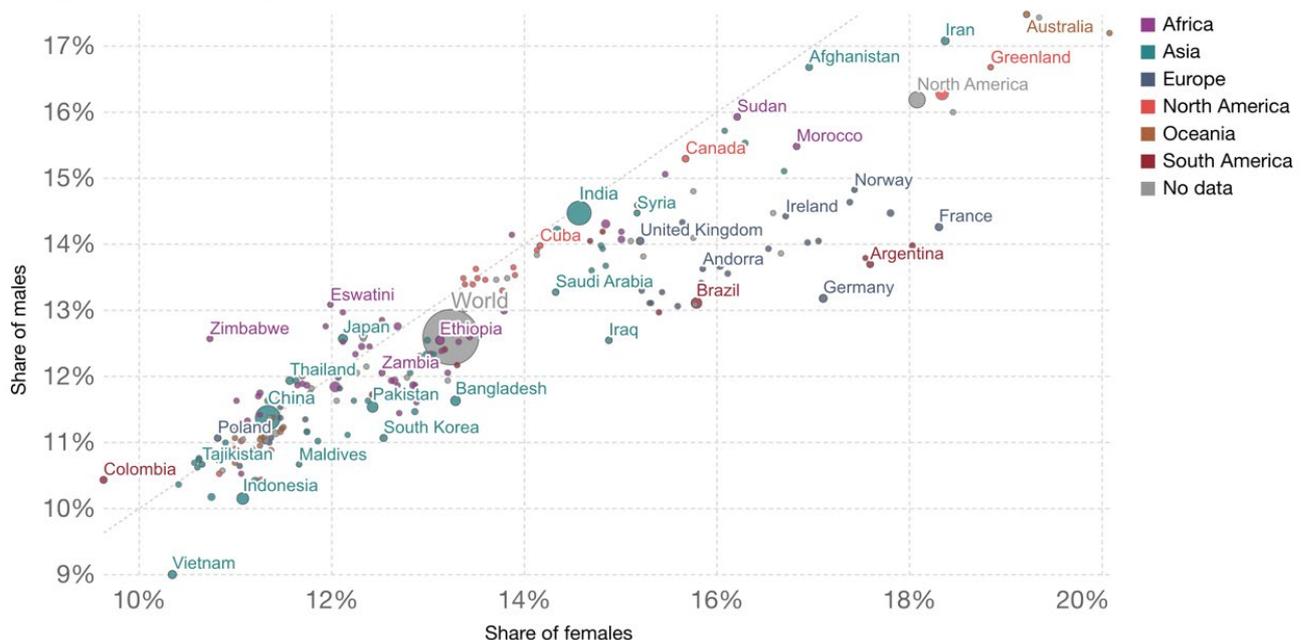
Mental Health in Australia

In 2017, of the over 180 countries included in the World Health Organisations 'Depression and Other Common Mental Disorders Global Health' survey. Australia had the second highest rate of depression (5.9% of the population) after Ukraine (6.3% of the population).

Share of population with mental or substance disorders, male vs. female, 2017



Share of males vs. females with any mental health or substance use disorder; this includes depression, anxiety, bipolar, eating disorders, schizophrenia, alcohol and drug use disorders, and neurodevelopmental disorders. Due to the widespread under-diagnosis, these estimates use a combination of sources, including medical and national records, epidemiological data, survey data, and meta-regression models.



Source: IHME, Global Burden of Disease

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Figure 4. Share of population with mental or substance disorders, male vs female, 2017. Source: Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2016 (GBD 2016) Results. Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2017.

Three of the most prevalent mental health disorders in Australia are anxiety, depression and substance misuse (Australian Institute of Health and Welfare, 2019). \$9.1 billion was spent on mental health in Australia in 2016-2017 and an estimated 4.2 million people received mental health related prescriptions in 2017-2018. This figure increased to \$11

billion spent on mental health in Australia in 2019-2020 (Australian Institute of Health and Welfare, 2022). Mental health challenges are particularly pronounced in young Australians (Landstedt et al., 2016). In a recent newspaper article, young Australians suggested issues such as finding future employment, the climate crises and the global pandemic have exacerbated mental health issues (The Guardian, 2021). Although this may be true, these concerns are not unique to Australia and mental health issues have likely been intensified by barriers to young Australians seeking professional help. Despite a record investment of \$152 million in 2018 and a further \$44 million in 2022 (Australian Department of Health, 2022) in Headspace, the only free, federally funded mental health service in Australia, waiting lists to access psychologists continues to grow (ABC, 2021). Increased demand has been attributed to the Covid-19 pandemic and recent efforts to reduce the stigmatisation of people living with mental health issues (Spagnolo et al., 2008; Hampson et al., 2018; Sandhu et al., 2019). It is therefore crucial that other organisations become increasingly involved in engaging young people in effective mental health interventions in an effort to help safeguard Australian society.

Mental Health in Adolescence

Engaging young people in mental health and wellbeing interventions can be challenging. Young people may have a lack of knowledge and awareness of mental health symptoms, existing services or even the appropriate vocabulary to express how they feel. Although the largest cohort suffering from mental health issues globally (Gore et al., 2011), they are the least likely age group to seek professional help (Australian Institute of Health and Welfare, 2011). This may be compounded by previous negative experiences with mental health services or more generally a lack of interest in prescribed programs. Indeed, the dynamic transition between childhood and adulthood must be carefully considered. Adolescents and young adults may wish to be perceived as adults however, may still be prone to less developed behaviours and responses to situations and scenarios (Bingley & Milligan, 2007). Investigating the characteristics of successful programs therefore is a critical component for any prospective mental health intervention. Dunne et al., (2017) conducted a significant review into 'effective youth engagement for mental health and substance use interventions'. Dunne et al., (2017) highlighted six distinct approaches to youth engagement:

1. Youth empowerment through participation in program development
2. Engagement through parental relations
3. Engagement through technology
4. Engagement through the medical or mental health clinic
5. Engagement through social marketing
6. Engagement through schools

Each pathway offers unique strategies to overcome the challenge of successful youth engagement although, no single approach could be considered "most effective". Dunne et al., (2017) suggest a combination of these strategies is the most appropriate way to maximise participation and consequently improvements in adolescent mental health.

If we consider the first distinct approach, 'youth empowerment through participation in program development', numerous Australian studies provide strong evidence of program success if the adolescents, intended to benefit from the program, are involved during aspects of its design (Tobin et al., 2002; James, 2007; Mason & Thurley, 2011; Faithful, 2018; Simmons et al., 2020). Tobin et al., (2002) found low levels of 'consumer' participation could be attributed to the following; participants' reluctance to being labelled 'mental health consumers'; an inability to understand a project's requirements and a general suspicion of a researcher's intent. A strong positive correlation was found between participation rate and how good their relationship was with the active researchers, indicating how crucial rapport and trust are between participants and researchers investigating mental health. James (2007) suggest by including the participation of an adolescents' family and/or carers, researchers may increase the success of a proposed youth mental health programs. They also caution however, that during this transitional stage, many adolescents are reducing their dependence on parents. It is therefore important for researchers to strike the balance between all parties to maximise the success of their program. Faithful et al., (2018) amalgamate a range of findings that support the recruitment of young people in mental health research stating involving people with lived experience of mental illness can;

"increase the relevance of research questions, increase recruitment rates, ensure the rights of research participants are upheld, increase stakeholder buy-in, provide additional insight into data analysis, enhance dissemination of results, improve the efficacy and sustainability of outcomes and ensure that the language of interventions is appropriate and *youth friendly*"

Faithful et al., (2018) suggest one of the biggest barriers to successful engagement is the implementation of tokenistic, unauthentic programs usually related to a researcher's inability to relinquish control over the research program. It is clear that the meaningful participation of a young person can in of itself have a positive impact on mental health and wellbeing (Oliver et al., 2006; Howe et al., 2011). Given the need for good rapport, trust and time to successfully implement engaging intervention strategies, it is perhaps unsurprising that such research projects are becoming more commonplace in school environments (Fazel et al., 2014; Plumb et al., 2016; O'Reilly et al., 2018).

Engagement through schools

The results of school based mental health interventions can be striking. A 2004 study by McNeely & Falci found teacher support was protective against substance use such as tobacco, alcohol and marijuana. They also found teacher support had a significant protective effect against suicide attempts. Many studies have found strong feelings of school connectedness in school students had strong impacts on prosocial behaviour and negative associations with smoking, drug behaviour and antisocial behaviour. Low school connectedness can lead to an increased risk of anxiety and depressive symptoms or elevated incidence of substance use (Bond et al., 2007; Fletcher et al., 2008; Murnaghan et al., 2014). To achieve such positive results, it is imperative schools select appropriate interventions that can be successfully implemented within their own school contexts.

Two words that are often used together or interchangeably in school contexts are mindfulness and wellbeing. Jon Kabat-Zinn, often referred to as the father of modern mindfulness, defines mindfulness as,

"paying attention in a particular way: on purpose, in the present moment, and non-judgementally".

Wellbeing is often harder to define, indeed even the correct spelling of 'wellbeing' or 'well-being' is still subject to debate. After an extensive review of descriptions and definitions of wellbeing Dodge et al., (2012) propose wellbeing should be considered as a state of equilibrium and balance, proposing a new definition:

"stable wellbeing is when individuals have the psychological, social and physical resources they need to meet a particular psychological, social and/or physical challenge.

When individuals have more challenges than resources, the saw-tooth dips, along with their wellbeing, and vice-versa".

It is difficult to avoid reductionism when describing such complex phenomenon however, for the purposes of this study, we suggest that increasing exposure to different mindfulness practices may increase a young person's overall wellbeing.

Many mindfulness based programs have been shown to improve levels of anxiety, depression and wellbeing in clinical and non-clinical settings (Khoury et al., 2013, 2015; Zoogman et al., 2014). Kabat-Zinn created Mindfulness-Based Stress Reduction (MBSR), a structured program that takes place over a 5 - 10 week period. Such programs contain multiple activities such as breathing techniques, meditation, yoga etc designed to focus the attention of participants and ultimately gain more control over their physical and mental activity (Greenberg & Harris, 2012). One purported benefit of regular structured activities is that they can be practiced and improved over time (Kabat-Zinn, 2003; Burke 2010). Embedding regular structured mindfulness exercises within a school context is therefore more likely to achieve sustained improvements in mental health and wellbeing, than a standalone mindfulness event (Carsley et al., 2018). For the purposes of this study, we researched activities with proven benefits on an individual's mental health which could be embedded regularly into a high school timetable while being mindful of maintaining participants engagement, trust and connection throughout the process.

Effective strategies

Sensory engagement

Occupational therapy is a broad discipline that incorporates a range of strategies and techniques to improve an individual's physical and mental health. The World Federation of Occupational Therapists defines occupational therapy as follows,

"as a profession concerned with promoting health and well-being through occupation.

The primary goal of occupational therapy is to enable people to participate in the activities of everyday life. Occupational therapists achieve this outcome by enhancing the individual's ability to participate, by modifying the environment, or by adapting the activity to better support participation. Another way of thinking about the ideas contained in these definitions could be: occupational therapy is about understanding the importance of an activity to an individual, being able to analyse the physical, mental and social

components of the activity and then adapting the activity, the environment and/or the person to enable them to resume the activity. Occupational therapists would ask, 'Why does this person have difficulties managing his or her daily activities (or occupations), and what can we adapt to make it possible for him or her to manage better and how will this then impact his or her health and well-being?' ".

Occupational therapy is a broad field and is used by children and adults of all ages who may be experiencing mental difficulties or living with physical or learning disabilities. Occupational therapy can play an extremely important role in adolescents, particularly at-risk youth in high school. Occupational therapy can enable at-risk youth to participate more fully in meaningful occupations such as school, improving psychological and physiological health, reducing school dropout rate - improving future employability possibilities and quality of life (Marczuk et al., 2014).

Although given considerably more attention in early education, occupational therapy is often inaccessible to students in secondary education (Spencer et al., 2003; Kardos & White, 2005; Mankey, 2011). One major barrier to occupational therapists operating in this space is the focus on disability rather than need. To have access to a trained occupational therapist most students need to qualify on the basis of an educational disability not occupational need (Marczuk et al., 2014). Therefore many individuals who would benefit from such interventions are not deemed eligible.

A narrow strand of occupational therapy that may improve an individual's quality of life, by improving sensory modulation, is sensory informed intervention or sensory integration therapy (Sinclair et al., 2020). Sensory modulation is the ability to respond appropriately to sensory information. This is particularly useful for those suffering from trauma, mental health issues and addiction. It is also useful for individuals who have developed problematic behaviours who are unaware of their sensory needs or how they are impacted by particular sensory input (Champagne & Stromberg, 2004; Chalmers et al., 2013). This lack of understanding may lead to the development or continued deterioration of mental health issues. Importantly, by increasing an individual's awareness of sensory inputs through sensory engagement and/or adapting external environments to become more conducive to sensory needs, an individual's symptoms may improve (Worthen, 2010; Luborsky, 2017; Whiting, 2018). Sensory engagement may include activation of a number of senses from taste, sight, touch, smell, sound, balance (vestibular system), movement and location (proprioception). Raising awareness and improving control of these sensory and motor systems within an individual, appears fundamental for higher-order thinking. By establishing a strong baseline through sensory engagement individuals may feel more empowered to tackle personal challenges (Whiting, 2018).

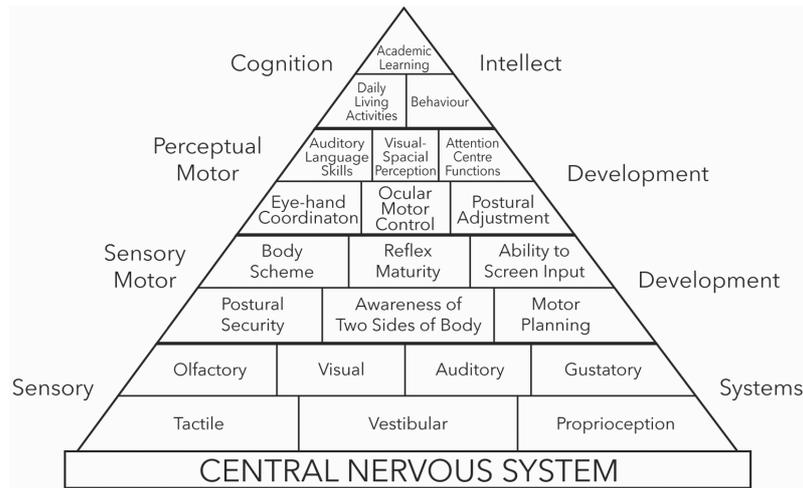


Figure 5. Pyramid of Learning. Source: Williams & Shellenberger (1996)

Exercise

Prescribing exercise as medicine dates back to antiquity. One of the earliest known references, around 600 BCE, can be attributed to a physician named Susruta from the Indus Valley Civilisation who prescribed moderate daily exercise to his patients (Tipton, 2008, 2014). Around the same period in Ancient Greece (570 - 490 BCE) the philosopher Pythagoras made an important contribution that flew in the face of the dominant Hellenistic culture, which was centered on polytheistic and animistic worship. Pythagoras claimed he did not believe disease and ailments were produced by gods, but rather by a lack of harmony between elements within an individual's life, including the fitness of their body. These ideas took hold and were expanded upon during the Greek Golden Age namely by Herodotus (500 BCE), considered the father of sports medicine, and Hippocrates (460-370 BCE) the father of scientific medicine (Tipton, 2014) and later by Galen (129 - 216 CE) in the Roman Empire. Unsurprisingly, modern literature related to the connection between physical exercise and health is well-established (Sothorn et al., 1999; Warburton et al., 2006; Jansen & LeBlanc, 2010; Reiner et al., 2013). Modern technology has not only allowed physicians and sport scientists to confirm long held beliefs of the positive impact of exercise on individuals, they are now able to assess these impacts with incredible precision and detail. Recent physiological studies describe links between exercise and protection from oxidative stress within tissue (Yan & Spaulding, 2020), genetic regulation of proteins reducing cardiovascular disease (Zucker & Musch, 2018) and improvements in cerebrovascular function, cognition and neuroplasticity, reducing the risk of the dementia in adults (Bliss et al., 2021). The psychological impacts of exercise have also been studied. Studies have shown exercise can moderately improve levels of depression and anxiety (Salmon, 2001; Guskowska, 2004; Jayakody et al., 2014), however, most studies cite a short term impact rather than long term improvements (Mead et al., 2008). One issue surrounding exercise and mental health is determining what type of exercise is most effective. Numerous studies have shown comparable psychological results from activities that differ significantly in intensity and duration such as running (Szabo, 2003; Hoffman & Hoffman, 2008), swimming (Valentine & Evans, 2001) and cycling (Petruzzello et al., 2009) to yoga (Lavey et al., 2005; Streeter et al., 2010) and

walking (Dasilva et al., 2011). Therefore, explanations such as the endorphin release hypothesis (Dunn & Dishman, 1991; Morgan, 2013) become less adequate at explaining the observed psychological effects (Szabo, 2013).

A number of factors should be considered and discussed with adolescents prior to the implementation of exercise for mental health purposes. Having a positive or negative experience with exercise during adolescents may impact the life-time adoption and maintenance of exercise. Adolescents are particularly vulnerable to developing self-esteem issues which may be exacerbated or magnified in group sport scenarios surrounded by peers. In doing so, practitioners attempting to promote mental health actually run the risk of doing the opposite. Australia's focus and investment in competitive group sport is evident by their sporting success both nationally and internationally. Australia ranks 7th in the world on the International Sporting Index. The index is calculated using various datasets analysing the following elements:

- National Exercise Level
- Global Sport Recognition
- Elite Sport Success
- Prevalence of Sports Stadiums
- Olympic Medal Success
- FIFA World Ranking

Australia's prominent position on the ISI, is at odds with Australia's prominent position on the World Health Organisations 'Depression and Other Common Mental Disorders Global Health' survey, given the plethora of physiological and psychological benefits associated with exercise. A study by van der Aa et al., (2010) reported a decline in participation of moderate exercise in 13 to 19 year old's, and much of that variation (72% to 85%) could be explained by genetic factors. Therefore, it appears likely that engagement and success in particular types of sport and exercise are highly dependent on an individual's genetic make-up. This may restrict the positive impacts of exercise to a smaller population of adolescents, if competitive sport is the sole type of exercise offered in a school context. This is not to discount the benefits associated with competitive sports, where individuals are more likely to push themselves to their limit (maximum intensity) (Budts et al., 2020) however, if a school is aiming to achieve positive mental health outcomes, studies have shown psychological change can still be initiated after a brief 10-minute session (Sullivan et al., 2010; Anderson & Brice, 2011). Szabo (2013), presents a strong case that the placebo effect cannot be ignored in these scenarios. He states

"Knowing, that exercise performed at self-selected intensity, exercise of very short duration, and exercise that varies in modality (or form) *all yield psychological benefits*, the common denominator of the widely reported benefits could be the placebo effect."

In light of this, creating holistic, brief exercise interventions are perhaps more impactful in a school setting than focusing solely on intense, lengthy, competitive sport.

One example of a school intervention created to tackle physical inactivity in school students is The Daily Mile. The Daily Mile was first established in a primary school in Stirling, Scotland in 2012 and now over 14,000 schools have registered with the program worldwide (The Daily Mile, 2022). The Daily Mile consists of teachers leading their students

in walking, jogging or running for 15-minutes within class time. The distance covered in this time is approximately 1 mile (1.6km). Researcher and teacher observations highlighting the myriad of benefits to students may explain the exceptional uptake of schools globally. A study by Chesham et al., (2018) found students participating in The Daily Mile reduced sedentary time and increased physical fitness and body composition compared with students from schools that did not participate. Teachers have also reported improved teacher-pupil relationships and a positive impact on student health and wellbeing (Malden & Doi, 2019). The relative ease in which schools can adopt the The Daily Mile has also contributed to its success. The Daily Mile is a simple intervention, is adaptable and encourages teacher autonomy through its flexible delivery (Ryde et al., 2018). To ensure the sustainability of any exercise activity these factors appear crucial (Marchant et al., 2020) and are probably a key consideration for any school-based intervention.

Therapeutic Writing

A number of studies have reported psychological and even physiological health benefits of therapeutic writing. Amazingly, research has shown writing about traumatic life events can enhance immune function (Esterling et al., 1994; Petrie et al., 2004) and reduce symptoms in people suffering from asthma and rheumatoid arthritis (Smyth et al., 1999). Hiemstra (2001) reports the benefit of journal writing is an enhanced ability of self-discovery, that by;

"Learning to trust that inner voice and interpret new thoughts or even dreams can increase not only self-confidence in the classroom but many other settings, too".

A study by Burton and King (2004), found evidence of enhanced mood and decreased health visits for illness in participants who wrote about intensely positive experiences for 20 minutes for three consecutive days, compared with those that did not. Recent studies further support improved outcomes in wellbeing, psychopathology and satisfaction through structured narrative writing (Levis & Levis, 2021). Perhaps the most well studied form of therapeutic writing is expressive writing. Expressive writing encourages participants to write about personal and emotional subjects without worrying about writing conventions such as grammar, spelling or structure. James W. Pennebaker, Professor of Psychology at the University of Texas, is an authority on this subject and created the Pennebaker Writing Paradigm (Pennebaker & Beall, 1986). The paradigm, like The Daily Mile, is at its core simple, however, the impacts may be profound. The paradigm asks participants to commit to at least 15 minutes of continuous writing for 3-4 consecutive days, participants are encouraged to write without stopping and prompted to write about the following topics;

- Something that you are thinking or worrying about too much
- Something that you are dreaming about
- Something that you feel is affecting your life in an unhealthy way
- Something that you have been avoiding for days, weeks, or years

Studies have reported numerous impacts from using the original and modified versions of the Pennebaker Writing Paradigm, most of which are not observed until weeks or months after the experiment. Kiels and Boal (2001) reported increased working memory after 7 weeks in active participants compared with those in the control group. Pennebaker & Graybeal (2001) found participant language began to change over time, and were more likely to talk about and laugh about their trauma. Interestingly, they also found social implications as participants began to subtly change friendship networks. The study by Smyth (1999), which reported reduced symptoms in asthma and arthritis may also be related to this change in internal language and mood. Changes in mood and internal language may produce internal biological shifts, however the underlying mechanisms are extremely complex (Pennebaker, 2004). Numerous studies have demonstrated how expressive writing can reduce symptoms of depression (Gortner et al., 2006; Krpan et al., 2013; Procaccia et al., 2021) and anxiety (Graf et al., 2008; Meshberg et al., 2014).

Despite the apparent benefits, even Pennebaker provides a word of caution that participants may feel slightly sad or depressed after this process however, the feelings should alleviate after a few hours. Indeed, Honos-Webb et al., (2000) suggest potentially negative effects of the Pennebaker Paradigm in 'the absence of a supportive therapy to fully integrate the experiences'. This should be seriously considered by schools prior to implementation of such an intervention with young people.

Outdoor Adventure Education

Kurt Hahn, a German educator and philosopher, founded a number of programs such as Outward Bound (1941) and the Duke Of Edinburgh Award (1956). Hahn's educational philosophy was based around providing opportunities for adolescents to take personal responsibility and observe results from their own personal actions. In a biography by James (1990) Hahn's approach to learnings is explained in the following way.

"Students should experience failure as well as success. They should learn to overcome negative inclinations within themselves and prevail against adversity. He believed, moreover, that students should learn to discipline their own needs and desires for the good of the community. They should realise, through their own experience, the connection between self-discovery and service. He also insisted that true learning required periods of silence and solitude as well as directed activity".

Outward Bound and the Duke of Edinburgh Award are still in operation today, and are found in countries across the world. The adventure components of these programs, usually characterised by overnight hikes in the wilderness, have received considerable attention in recent years. Studies have shown young people, particularly adolescents can improve attentiveness, increase group cohesion, reduce prejudice and more recently, experience mental health benefits such as increasing self-efficacy, mindfulness and subjective wellbeing (Mutz and Müller, 2016).

Successful outdoor adventure programs have been described (Hattie, 1997; Ewert & McAvoy 2000; Sibthorpe et al., 2007; Deane & Harré, 2014) as;

- Taking place in unfamiliar natural environments
- Containing challenging activities with real consequences
- Involve cooperation between peers

- Characterised by small group social settings
- Led by trusting individuals who can provide physical and emotional support

To maximise the benefits of adventure education, participants must also be in a state of high attentiveness and receptiveness (Mutz and Müller, 2016). This psychological state of mind has been referred to as the 'groan zone' where individuals are between their 'panic zone' and 'comfort zone'. Luckner and Nadler (1997) refer to this zone as follows,

"Through involvement in experiences that are beyond one's comfort zone, individuals are forced to move into an area that feels uncomfortable and unfamiliar - the groan zone. By overcoming these anxious feelings and thoughts of self-doubt while simultaneously sampling success, individuals move from the groan zone to the growth zone".

Despite the promising outcomes of adventure education, barriers exist regarding the validity and reliability of many studies (Hattie et al., 1997). Most studies are limited statically with low sample sizes and further hampered by a lack of randomised controlled trials (Deane & Harré, 2014).

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