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Daily Experiences and Adolescent Health

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Abstract

Daily stress experiences trigger biological and psychological responses that help to manage the stress experience. However, if repeated or chronic, these stress responses are harmful to biological and psychological health. Stress during adolescence is especially important to consider because it can entirely reshape the persons' lifelong health and disease risk. This reshaping of health occurs partly as a result of stress-induced biological changes, conceptualised as 'allostatic load'. Allostatic load is the cumulative cost of chronic stress experiences and is measured using biomarkers of risk in the body's cardiovascular and metabolic systems. There is strong evidence of the relationship of stress and allostatic load in adults, but this relationship is rarely considered in adolescents, despite evidence that adolescents experience transition-stress via the biopsychosocial changes during this developmental stage. As this transition-stress is experienced when adolescents are still developing stress-regulation skills, the effects of stress may be exacerbated, and manifest as allostatic load. Preventing the onset and progression of allostatic load requires adaptive patterns of stress regulation in combination with positive health behaviours. The aim of this research is to understand the interaction of these factors and identify effective ways for adolescents to reduce allostatic load risk and develop positive health behaviours. This project will measure allostatic load (i.e. cardiovascular and metabolic biomarkers), daily experiences, (using ecological sampling methodologies) and health behaviours (e.g. sleep, exercise) in adolescents to investigate the interaction of psychological and biological processes. The project will contribute to adolescent health research by mapping the interaction of biology and psychosocial experience at adolescence, which is critical for developing interventions to improve lifelong biological and psychological health.

Keywords: stress, adolescence, adolescent health.

Stress during adolescence

Adolescence is a formative period marked by changes in physical health as well as social and emotional experiences. The Lancet (2016) has extended the age of adolescence and the new

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age range spans from ten to twenty-four years to reflect changes in brain, body and behaviour that are ongoing during this time. These changes are also occurring during a time when adolescents are still developing regulatory skills to balance internal and external demands, as well as learning about themselves and developing a sense of identity. With all of this in mind, it is easy to see how adolescence was once known as a period of 'storm and stress'. However, what was formerly considered a stressful period, is becoming increasingly recognised as a period of growth and adaptation. The current research project, alongside recent research in the area of adolescent health and development, aims to strengthen our understanding of stress processes during this period, and contribute to the growing view of adolescence as a time of increased opportunity.

Stress itself is an adaptive response, which serves to protect us. During the stress response, our body produces hormones such as cortisol, and mobilises energy from physiological systems in our body to promote action. In the short-term this response is helpful and alerts us to danger, however if this response becomes heightened, failed, or over activated for longer periods, it can exert a toll on both our physical and mental health. The wear and tear, which can occur overtime as result of this toll, is known as allostatic load. The relationship between daily stress and health is well documented later in life; however, less is known about the effects of this stress at earlier stages of life, and the ways in which emotional experiences can become embedded and effect physical health outcomes. As adolescence is a period marked by biological, psychological and social changes, it is important that we adopt a biopsychosocial perspective to understanding adolescent development. This research has two primary aims:

1. To test the suitability of an allostatic load index in a sample of adolescents;
2. To examine how psychobiological responses to daily experiences in adolescence contribute to physical health.

Allostatic Load

We know that stress is an adaptive response; we also know that the period of adolescence requires heightened levels of adaptation. The term 'homeostasis' was used to describe the body's desire to maintain stability for optimal functioning. However, due to the ever-changing environments in which we live, the concept of homeostasis was extended upon and 'allostasis' then became known as the process of maintaining stability through change. Although this process is beneficial in the short-term, overtime it can place a toll on the body's physiological systems. The consequences of repeated hits, or continuous activation of the systems involved in regulating the stress response became known as emph'allostatic load'.

Allostatic load (AL) results from chronic dysregulation of the neuroendocrine, cardiovascular, immune and metabolic systems, as these systems all work together in responding to stressors. AL has been associated with the onset of chronic diseases later in life, with most of the research conducted on older adults.[3] More recently, there is some evidence that AL

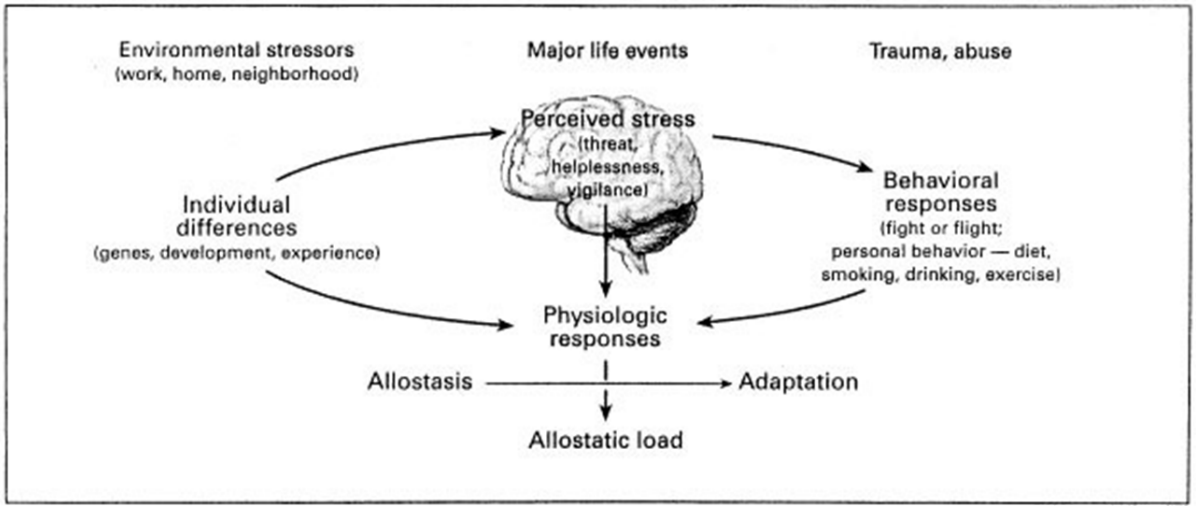


Figure 1: Allostatic Load (McEwen, 1998)[2]

may be present earlier in life, such as in adolescents. Certain biomarkers, such as cortisol and heart rate, are known to be more sensitive to the effects of stressors, and these biomarkers have been used to form an index of AL. However, obtaining biological indicators of stress has proven methodologically challenging, and so the AL index has undergone significant levels of variation since it was first operationalised.[1] Figure 2 represents the most common measures of AL used within an adolescent population. The choice of measures used to quantify AL is important, as different markers may be more meaningful at different life stages. For example, markers of metabolic function, such as body-mass index (BMI), are considered some of the earliest sub-clinical markers of AL within adolescent populations, whereas markers of cardiovascular function, such as blood pressure, may be more pertinent in adult populations. Findings from a recent review[4] also argued that because AL describes chronic dysregulation across multiple physiological systems in response to stress, markers from each of the four systems (neuroendocrine, metabolic, immune, and cardiovascular) should be included in an AL index.

Research Design

Study 1 – 'Evaluating measures of allostatic load in adolescents: A systematic review'

The first study conducted as part of this project was a systematic review of measures used to quantify allostatic load within adolescent populations.[4] For the purpose of this review we used the Lancet's (2016) extended definition of adolescence from 10-24 years. A total of 25 papers were included in the final synthesis, and the most common index of AL comprised of 6 biomarkers – cortisol, epinephrine, norepinephrine, body-mass index, systolic blood pressure, and diastolic blood pressure. The number of biomarkers used within studies ranged from 1-14. Some common methodological challenges were encountered across studies and led to

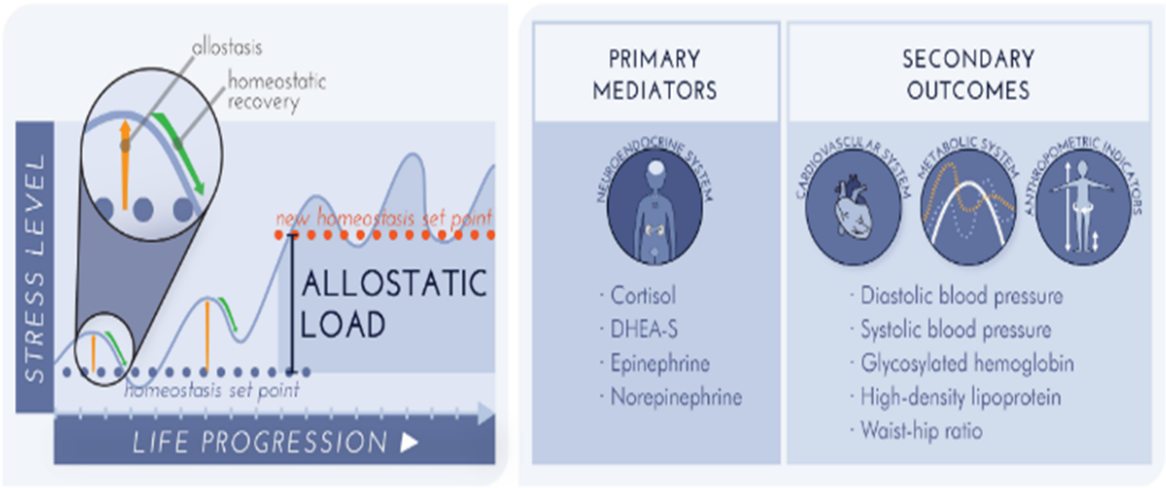


Figure 2: Allostatic Load Index (Whelan et al., 2021)[4]

increased variation across indices. Findings from this review indicated that defining measures of AL during adolescence may help to identify vulnerabilities specific to adolescents, which may shape their lifelong health trajectories.

Study 2 – Secondary data analysis of the Avon Longitudinal Study of Parents and Children

The aim of this study is to examine the relationship between daily activities, emotional experiences and health status in late childhood and health outcomes in mid-adolescence. The ups and downs of daily life contribute to health status in meaningful ways, particularly during adolescence when the developmental changes taking place may increase sensitivity to hassles and uplifts. These daily experiences may contribute to heightened emotional responses and influence patterns of behaviour, which form the basis of psychological and physical health outcomes. Using the AL framework, we will seek to identify the experiences, which contribute to positive health outcomes, and those that amplify risk for future health problems.

Study 3 - Teen Daily Activities Emotions and Health Study (DAEHS)

The third and final study, 'Teen DAEHS', is currently underway. We are now recruiting adolescents aged 10-14 years from Cork City and County to take part in this research study. This project will examine daily experiences of adolescents and using the allostatic load theory, the project will examine how emotional experiences are transformed into health outcomes, and scrutinise the unique contribution of both daily stressors and daily uplifts. Biological measures (e.g. salivary cortisol, cholesterol) will be gathered to indicate individual health profiles, and used with measures of health behaviours (e.g. diet, exercise, sleep) and adolescent diary-reports of daily experience to examine the impact of experiences on health. Biological measures will

be collected in a lab session, followed by a series of questionnaires (e.g. Positive and Negative Affect Scale), which ask about participant's emotional health and wellbeing. Following the lab session, using experience sampling methods (ESM), adolescents will complete an online daily diary for four consecutive days and asked to report on their emotional states in close proximity to their daily activities. While at home, participants will also be asked to provide saliva samples at set times throughout the day to measure their cortisol response.

Implications

The wider benefit of future research investigating adolescent health behaviours could highlight a window of opportunity, which could improve the health of future generations. This project will contribute to existing knowledge by providing multidisciplinary researchers with a framework for studying both the protective effects of stress mediators in response to daily stress encounters, and the detrimental effects of stress exposure during adolescence. This study extends an established psychobiological framework previously used to explain adult health, to understand how adolescent health is shaped by psychobiological responses to daily experiences.

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Declaration of Interests

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