

An abstract painting featuring large, expressive brushstrokes in shades of red, orange, and blue. The composition is dominated by a large, central face-like form with a prominent eye, rendered in warm red and orange tones. To the left, another face is partially visible in cooler blue and teal tones. In the lower-left quadrant, there is a smaller, more detailed figure of a person in a dark, crouching or sitting pose, also rendered in blue and teal. The overall style is gestural and emotional, with a dark background that makes the vibrant colors stand out.

ARTIST  
MADELINE CHAN

# RESEARCH INSIGHT

Variation in health outcomes associated with childhood maltreatment: Social and physiological factors

CW: su\*cide mention, s\*lf-h\*rm mention

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**ABSTRACT**

Maltreated children tend to experience worse health in adulthood. The physiological model of allosteric load helps to explain why maltreated children often experience adverse physical health outcomes including stroke, cancer, and diabetes in adulthood. However, since mental health and health behaviours vary depending on one's social environment, understanding mental health and risky health behaviours among people who experienced childhood maltreatment requires integrating biological and psychosocial analyses. Among older survivors of childhood maltreatment, variation in mental health and health behaviours corresponds to variation in socioemotional adjustment. This variation in socioemotional adjustment corresponds to variation in parasympathetic nervous system functioning as measured by respiratory sinus arrhythmia (RSA). Clinicians could potentially use RSA as a screening tool to identify maltreated children whose poor socioemotional adjustment puts them at greater risk of adverse health outcomes in adulthood.

**INTRODUCTION**

Chronic childhood stress predicts poor physical health in adulthood, increased participation in risky health behaviours, and worse mental health.<sup>1</sup> Child maltreatment refers to emotional, physical, and sexual abuse as well as experiences of neglect, all of which cause chronic stress.<sup>2</sup>

Negative physical health outcomes among survivors of childhood maltreatment can be explained using the biological model of allosteric load. Allosteric load refers to the cumulative effect of having a chronically active physiological stress response, for instance, “wear and tear” of major organ systems.<sup>3</sup> Exposure to stressors triggers the physiological stress response causing the sympho-adrenomedullary and hypothalamic-pituitary-adrenal (HPA) axis to release chemical signals that help prepare the body for fight, flee, or freezing responses.<sup>1</sup> Blood vessels constrict to increase blood pressure, heart and respiration rates increase to maximize oxygen supply, lipolysis breaks down adipose tissue to increase blood sugar, and the immune system is suppressed.<sup>1</sup> Normally, the HPA axis is inhibited via a negative feedback loop and the child can relax once the threat has passed.<sup>1</sup> Maltreated children however, are exposed to more stressors over longer periods of time, resulting in chronic activation of the physiological stress response systems. Since the physiological stress response is energetically costly, chronic activation strains bodily organs to increase allosteric load. The effects of the additional allosteric load accumulate over time, contributing to poorer health outcomes in adulthood. The concept of allosteric load can be used to explain the positive correlation between levels of chronic stress in childhood and the prevalence of physical health problems

such as heart disease, cancer, chronic bronchitis, and diabetes in adulthood.<sup>1</sup> Risky health behaviours during adolescence may exacerbate the strain caused by allosteric load.<sup>1,3</sup>

Adverse childhood experiences are significantly associated with risky health behaviours such as illicit drug use, cigarette smoking, and reckless self-endangerment, as well as more frequent mental health problems including alcoholism and depression.<sup>1,4,5</sup> However, risky health behaviour and mental health outcomes vary among adults who experienced child maltreatment, which may be the result of differing socioemotional adjustment during childhood.<sup>5</sup> Examining how social situations and physiological features interact over the course of development to produce different health behaviours among maltreated children is essential for effective intervention programs.

**RESEARCH DESIGN**

The objectives of this review are to demonstrate the relationship between poor socioemotional adjustment and risky health behaviours among maltreated children by exploring the connection between parasympathetic nervous activity and socioemotional adjustment. Additionally, this review further explores if respiratory sinus arrhythmia (RSA) moderates the relationship between childhood maltreatment and poor socioemotional adjustment.

Research article selection began with a brief review of the works produced by researchers at the Child Emotion Lab at McMaster University. The Child Emotion Lab examines the relationships between personality traits (primarily shyness), early life environment, and social behaviour. From there, other articles were selected using Google Scholar, PubMed, and Scholars Portal. Given the interdisciplinary nature of the research, a broad array of keywords were used, including “respiratory sinus arrhythmia”, “childhood maltreatment”, “socioemotional adjustment”, “early adversity”, “self-regulation”, “mental health”, “resilience”, and “emotional flexibility”.

**MEASURING SOCIOEMOTIONAL ADJUSTMENT**

Socioemotional adjustment refers to the quality of an individual's interaction with their environment. Researchers studying socioemotional adjustment examine how children's traits affect the social situations they experience, and how social situations evoke a variety of responses in different children. For example, a child with a negatively reactive temperament tends to interpret neutral stimuli as threatening, and has disproportionately intense reactions of distress or anger. This temperamental style contributes to aggressive responses with little provocation, which hinder the development of positive social relationships. Researchers gauge socioemotional adjustment in children by examining social outcomes such as peer rejection, reputation, and social network strength.<sup>6</sup> For the purposes of this review, poor socioemotional adjustment refers to lacking positive social engagement and exhibiting intense negative reactivity.

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## RISKY HEALTH BEHAVIOURS AND VARIATION IN SOCIOEMOTIONAL ADJUSTMENT

Socioemotional adjustment varies among children exposed to maltreatment. Positive social engagement is generally associated with improved health among maltreated youth.<sup>7</sup> For maltreated youth placed in the foster care system, differences in the quality of peer relationships among the youth accounted for up to 19% of the variance in their likelihood to engage in risky behaviours, including unsafe sex, substance abuse, and suicidal behaviours approximately one year later.<sup>8</sup> Similar effects have been observed in college students, suggesting that having a strong social network and positive social engagement protects against adverse health outcomes among people with a history of maltreatment throughout their life.<sup>9</sup>

Maltreated youth with balanced life outlooks engage in risky health behaviours less often than their more negatively reactive peers.<sup>5,10</sup> Specifically, higher levels of negative emotional reactivity were positively correlated with frequent self-harming behaviour among female survivors of childhood maltreatment.<sup>11</sup> The ability to respond flexibly to emotional stimuli, rather than react with blanket negativity, has been positively associated with resilient functioning in a variety of contexts.<sup>12,13</sup>

## THE PARASYMPATHETIC NERVOUS SYSTEM AND SOCIOEMOTIONAL ADJUSTMENT

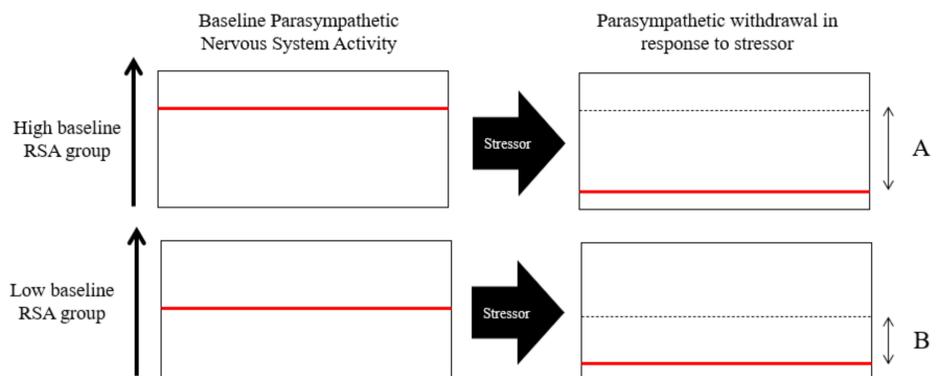
The parasympathetic nervous system has a calming, inhibitory influence on the body. Under normal conditions, this system helps maintain homeostasis by inhibiting the sympathetic nervous system, preventing a chronic stress response. For example, the inhibitory influence of

the parasympathetic nervous system keeps heart rate low in the absence of danger. When a threat is detected, the parasympathetic nervous system withdraws its inhibitory effect, allowing heart rate to increase. The sympathetic nervous system activates, increasing the heart rate further.<sup>1,14</sup>

RSA is used to index parasympathetic nervous system activity. Through indexing parasympathetic nervous system functioning, RSA informs researchers about one's ability to respond flexibly to social situations.<sup>14</sup> Baseline RSA is positively associated with executive functioning, emotional regulation, and attentional shifting.<sup>15-17</sup> The parasympathetic nervous system influences heart rate via the 10th cranial nerve and RSA measures how heart rate varies with respiration. Thus RSA indirectly indexes PNS activity.<sup>14,17</sup> High baseline RSA reflects effective parasympathetic nervous system functioning and the ability to respond flexibly to stress, while low baseline RSA reflects a lack of flexibility because there is more lability for change in the event of encountering environmental stressors. Because high levels of baseline RSA suggest more parasympathetic activation, parasympathetic nervous system functioning should decrease in response to environmental stressors. Since the parasympathetic nervous system is operating at a relatively low level among children with low baseline RSA, a smaller increase in arousal occurs in response to a stressor (see Figure 1).<sup>14-16,18</sup>

## RSA AS A PREDICTOR OF SOCIOEMOTIONAL ADJUSTMENT IN MALTREATED CHILDREN

Differences in baseline RSA correspond to differences in negative reactivity and social network quality. Baseline RSA is negatively associated with negative reactivity throughout development. One study measured baseline



**FIGURE 1.** Higher baseline RSA indicates higher baseline parasympathetic nervous system activation. People with higher baseline RSA then have more room to maneuver when responding to threats; the magnitude of the difference between their baseline state and their state of emergency is greater for people who have low baseline RSA ( $A > B$ ). Thus, people with high baseline RSA have more flexibility to respond to environmental stressors.

RSA among a sample of maltreated adolescent girls, and used baseline RSA to predict levels of neuroticism over one year. Neuroticism is a personality trait associated with blanket negative reactivity; neurotic individuals tend to interpret neutral stimuli as negative and struggle to regulate their emotions. This study found that baseline RSA predicted neuroticism trajectories over the course of the year, such that neuroticism increased among girls with low baseline RSA, and remained low and stable among girls with high baseline RSA.<sup>19</sup>

Baseline RSA has been directly linked to social engagement in the general population, and this relationship likely exists among people who experienced childhood maltreatment.<sup>20</sup> However, differences in RSA correspond to differences in aggressive behaviour among maltreated youth aged 6 to 19, as behaving aggressively makes it harder for a child to make friends.<sup>21,22</sup> Anti-social maltreated children have pre-established aggressive behaviour patterns by the time they enter school, suggesting that aggressive behaviours contribute to peer rejection, rather than the reverse.<sup>23</sup> High baseline RSA may act as a buffer for aggressive behaviour.<sup>22</sup> The effects of RSA in moderating aggressive behaviour are especially significant considering aggressive behaviour contributes to peer rejection during childhood and into adolescence.<sup>23</sup> Given that adolescent peer relationships buffer against mental illness and risky health behaviours among survivors of maltreatment, RSA may be an effective screening tool to identify children at risk of adverse developmental trajectories.<sup>7-10</sup>

### CONCLUSIONS

Individual differences in parasympathetic activity moderate the effect of childhood maltreatment on socioemotional adjustment. Differences in socioemotional functioning can then partially explain differences in

health-risk behaviours (see Figure 2). RSA should be considered as a tool for predicting socioemotional adjustment in maltreated children. If physicians can identify which maltreated children are most likely to struggle socially, physicians can use targeted interventions to improve socioemotional adjustment among those children, thereby reducing the risk of mental health issues and risky health behaviours. Further research should assess the reliability and validity of RSA in directly predicting future risky health behaviours and mental health outcomes of maltreated children.

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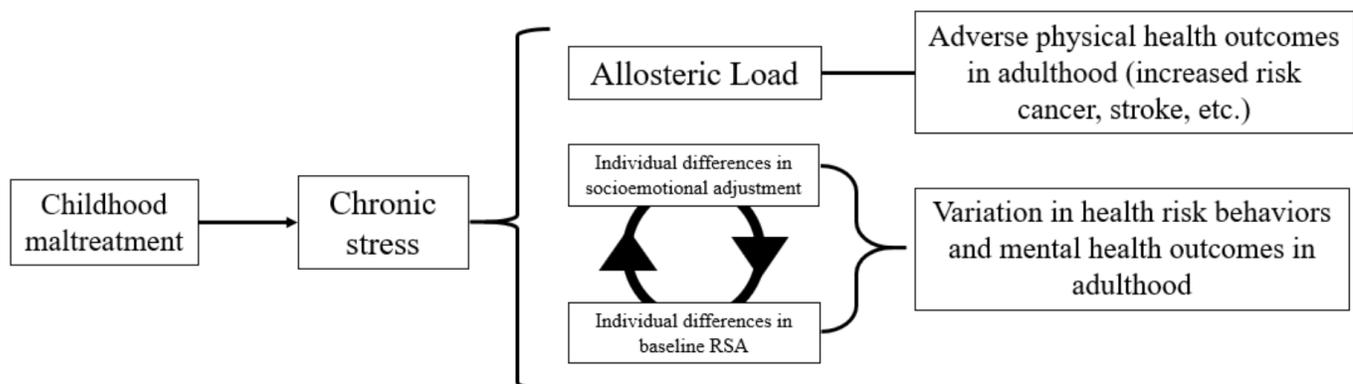
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**FIGURE 2.** Proposed model for the impact of childhood maltreatment on adverse health outcomes, variable health risk behaviours and mental health outcomes in adulthood.