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The impact of daily and trait loneliness on diurnal cortisol and sleep among children affected by parental HIV/AIDS

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ABSTRACT

Dysregulation of the Hypothalamic-Pituitary-Adrenal (HPA) axis and disruptions of restorative processes (e.g., sleep) have been proposed as two key mechanisms through which loneliness leads to medical morbidity in adults and late adolescents. Whether loneliness acts through these biological and behavioral intermediaries in children as well remains unexplored. In a sample of 645 children aged 8–15 affected by parental HIV/AIDS in rural China, trait and state (i.e., daily) loneliness were measured in a 3-day diary study, wherein participants also provided cortisol samples and sleep measures. Whereas high levels of trait loneliness were found to predict lower morning cortisol levels, longer time in bed, lower sleep quality, and a higher number of night awakenings, daily loneliness was associated with a flatter diurnal cortisol slope and shorter time in bed. Although the association between trait loneliness and daily loneliness with HPA activity remained significant after controlling for psychological constructs that overlap with loneliness (e.g., depression and daily negative affect), some of the associations between loneliness and sleep measures became non-significant after including these additional covariates. These findings provide the first empirical evidence to our knowledge of associations between trait and state loneliness and health-related outcomes among school-aged children and young adolescents.

1. Introduction

The "Pit of Despair" and "Well of Loneliness" were among the most common names given by psychologist Harry F. Harlow to the small vertical apparatus he used for his experiments on social isolation in rhesus macaques. The consequences of placing animals in these inescapable metal cages were lethal; in Harlow's words: "Placed in a free-living situation, most of these animals would be driven off or eliminated before they could have an opportunity to learn to adapt to the group" (Harlow et al., 1965).

In humans, social isolation, the measurable condition of having a withered social network (i.e., few and infrequent social contacts), is associated with broad adult medical morbidity and mortality. For example, receiving low social support has been associated with higher risk of heart disease (Barth et al., 2010), susceptibility to common respiratory illness (Cohen et al., 1997), and mortality (Eng et al., 2002). Similar findings have emerged in people reporting high levels of loneliness (Caspi et al., 2006; Patterson and Veenstra, 2010), the emotional discomfort associated with the perceived discrepancy between desired and available quality and quantity of social contacts. Despite being obviously related, social isolation and loneliness can have non-overlapping effects on health (Steptoe et al., 2013), especially when social isolation does not predict loneliness (e.g., Fees et al., 1999).

Although loneliness is a common experience, stigmatized populations, such those living with HIV, are at greater risk of feeling socially isolated. HIV-infected individuals are often socially rejected and must face recurrent discrimination across a variety of social realms, including work and health care settings (Nyblade et al., 2009). This chronic psychological stressor can have daunting mental and physical consequences not only for HIV-positive individuals, but also for their children, who predominantly depend on them, regardless of their HIV status (Chi et al., 2014). Children

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affected by parental HIV, in fact, are more often socially excluded by peers and family members, and report recurrent experiences of humiliation and reduced social support (Cluver et al., 2008). Understanding how the multifaceted construct of loneliness influences health outcomes among children affected by parental HIV has important implications for tailoring multilevel (individual, family, community) intervention programs in this population.

The overarching aim of the current study was to investigate the contribution of different aspects of loneliness to two biobehavioral intermediaries—sleep and cortisol secretion—associated with physical health in a group of children affected by parental HIV. From this perspective, a distinction can be made between trait loneliness, the chronic perception—accumulated over time—of inadequate quantity and quality of social relationships, and state (i.e., daily) loneliness, a transient and more circumstantial feeling (De Jong-Gierveld and Raadschelders, 1982). This distinction is particularly meaningful in diary studies, where data from participants are collected as they live through their quotidian life, as it allows the researcher to disentangle the effect of sustained loneliness (i.e., trait loneliness) as well as between people variability in transient experiences of loneliness (i.e., daily loneliness), which provide a more proximal picture of the individual feelings of isolation during the testing days (Doane and Adam, 2010). This approach is also important in light of the fact that daily loneliness may not strongly correlate with trait loneliness, especially during childhood, wherein the degrees of stability and fluidity of one's social network are more malleable (Cairns et al., 1995).

Alteration in the activity of the Hypothalamic-Pituitary-Adrenal (HPA) axis has emerged as one of the key mechanisms underlying the association between loneliness and health. For example, several cross sectional studies have found small—but consistent—positive associations between subjective feelings of social isolation and salivary cortisol (Cacioppo et al., 2000; Steptoe et al., 2004; Pressman et al., 2005; Edwards et al., 2010) and urinary cortisol (Kiecolt-Glaser et al., 1984; Hawkley et al., 2006). These findings have been confirmed with daily dairy data, wherein daily assessments of loneliness were prospectively associated with larger cortisol responses to awakening in adults and late adolescents (i.e. cortisol awakening response, or CAR, Adam et al., 2006; Doane and Adam, 2010; but see Sladek and Doane, 2015), while trait loneliness was associated with a flatter decline in diurnal cortisol in late adolescence (Doane and Adam, 2010; but see, Sladek and Doane, 2015, for a null association between trait loneliness and cortisol slope in the same age group). Despite the insights provided by these data, critical gaps remain unaddressed in this literature. To date, no work has investigated the link between loneliness and health-related biology in children. Extending the link between the HPA axis and loneliness in children is important for at least two reasons. Recent empirical evidence showed that loneliness at a young age is predictive of health risk factors in young adulthood (Caspi et al., 2006) and dysregulation in cortisol secretion might be a key biological intermediary through which these effects take place.

A second mechanism that has been recognized as crucial in mediating the effect of loneliness on physical health is the dysregulation of restorative processes (e.g., sleep) (Hawkley and Cacioppo, 2010). The intuitive association between sleep and various biological risk factors (for a reviews, see Irwin, 2015; Mullington et al., 2009) and, consequently, medical morbidity during adulthood (e.g., King et al., 2008) and mortality (Kripke et al., 2002) is well established. Within this framework, loneliness in adulthood has emerged as a reliable antecedent of poor sleep quality (Cacioppo et al., 2002b; Steptoe et al., 2004; Pressman et al., 2005) and disruptions in sleep continuity (Cacioppo et al., 2002a), but not sleep duration (Cacioppo et al., 2002b; Hawkley et al., 2010; Kurina et al., 2011). Studies on adolescents replicated and extended these findings by showing that not only was loneliness positively associated with sleep disturbances (e.g., number of night awakenings) (Mahon, 1994; Harris et al., 2013), but also with difficulty of falling asleep (i.e. sleep onset latency or SOL) (Harris et al., 2013). Overall, this pattern of results demonstrates the importance of measuring different sleep outcomes across subsequent days rather than single assessments at one point in time.

The aim of the current study was to investigate the impact of trait loneliness and daily loneliness on diurnal cortisol and daily reports of sleep in a large sample of children aged 8–15 years affected by parental HIV/AIDS in rural China. Loneliness among children in rural China is widespread (Chen et al., 2014) and, as mentioned above, this feeling can be further exacerbated among children whose parents belong to a stigmatized group, such as HIV infected individuals (Chi and Li, 2013). Working with this high-risk sample offers a unique opportunity to investigate the link between loneliness and biobehavioral health mechanisms among youth living in adversity.

2. Method

2.1. Participants

Seven hundred and ninety children aged 6–17 affected by parental HIV participated in a randomized controlled trial of a psychological intervention currently under way; the current investigation used baseline data (i.e., prior to intervention) drawn from this larger study. Of the larger sample of 790 children, 746 fit the inclusion criterion of 8 to 15 years of age, based on the age range for which the self-report measures used in the present analyses were normed. Further, of those 746 children, 645 (86.4%) provided valid saliva samples for cortisol analyses (48.1% female, age, $M = 10.67$ years, $SD = 1.79$ years) and were therefore used in the analyses. At the end of the study, each child received either toys or school supplies depending on their age as tokens of appreciation. Appropriate informed consent/assent was obtained before participation and all procedures received approval by the Institutional Review Boards at Wayne State University in the United States and Henan University in China.

2.2. Procedure

Children and their caregivers completed confidential survey questionnaires in Chinese. The survey included detailed measures of demographic information and several psychosocial scales. The majority of the child surveys were self-administrated in a small group in which two interviewers were present. The daily diary data collection occurred during the same time as daily saliva collection. From Thursday to Saturday, children were instructed in detail to fill the daily sleep diary immediately after the first saliva sample was collected, and to fill the daily mood diary (including momentary loneliness and other daily emotions). The primary caregiver was allowed to provide assistance during the collection of daily diary measures.

2.3. Measures

2.3.1. Trait loneliness

The Children's Loneliness Scale (CLS, Asher et al., 1984) was used to assess trait loneliness. An overall index ($M = 2.10$, $SD = 0.47$) is calculated by averaging children's self-reported scores on 16 items rated on a 4-point Likert scale, ranging from "Always True" to "Not True at All". Sample items included, "It's easy for me to make new friends at school"; "I feel alone" (reversed); "I have nobody to talk to" (reversed). The scale also contained 10 (8 in the original scale) additional filler items that are not included in the scoring. The high