

Stress and salivary telomere length in the second half of life: A comparison of life-course models

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ABSTRACT

Background: Previous research has explored the relationship between childhood and adulthood stressful life events (SLEs) and adult salivary telomere length (TL), but no research to date has tested different life-course models in which stress in adulthood may fully, partly, or not mediate the relationship between childhood stress and adult TL.

Methods: To fill this gap, we elaborate over previous work by Puterman et al. (2016) and other standard models that do not account for the temporal order of stressors in childhood and adulthood, by using structural equation modeling (SEM) for a sample of 5754 Health and Retirement Study (HRS) participants to compare the fit of three nested life-course models—social trajectory, early critical period, and cumulative risk.

Results: Results indicated that the *social trajectory* model, in which the association between childhood SLEs and TL in later adulthood is fully mediated by adulthood SLEs, fit the data better than the *early critical period* (no mediation) and *cumulative risk* (partial mediation) models.

Conclusion: In the *social trajectory* model, childhood SLEs are related to TL in later life only through adulthood SLEs. The direct physiological effect of childhood SLEs on TL in later life would be overestimated if adulthood SLEs are overlooked.

1. Introduction

Telomeres are the protective tips of chromosomes that shorten with cell replication (Blackburn, 1991). Shorter telomere length (TL) is consistently associated with older age and various morbidities, including cardiovascular disease (Bojesen, 2013; Haycock et al., 2014; Muezzinler, Zaineddin, & Brenner, 2013), though the strength of these associations may lessen among older populations (Simons, 2015). While some variance in telomere lengths across individuals is present at birth and attributable to genetic and prenatal factors (Factor-Litvak, Susser, Kezios, et al., 2015), exposure to stressful life events (SLEs) may increase the rate of telomere shortening across the life course (Factor-Litvak and Susser, 2015; Shalev, 2012). TL therefore could be an indicator of weathering (Geronimus et al., 2015).

There is a growing literature that assesses the relationship between TL in older adults and stressful, traumatic, or adverse events across the life course. We organized this literature into four “standard models” depicted in the top panel of Fig. 1: studies that regressed adult TL on

either (i) childhood SLE scores, (ii) adulthood SLE scores, (iii) both child and adult scores as covariates, or (iv) a summed total of child and adult scores. To date, no research has explicitly tested life-course models in which stress in adulthood may fully, partly, or not mediate the relationship between childhood stressors and adult TL. As the bottom panel of Fig. 1 illustrates, the mediation may be one of three kinds of “life-course models.” To fill this gap, we elaborate over previous work by Puterman and colleagues (2016) that used the Health and Retirement Study (HRS), moving beyond standard modeling approaches in order to test the theoretical validity of the three competing life-course models.

1.1. Standard models linking adult telomere length (TL) and stressful life events (SLEs)

The standard models used to study the relationship between TL in older adults and SLEs across the life course tend to focus either on SLEs that occurred during childhood, typically defined as prior to age 18, or

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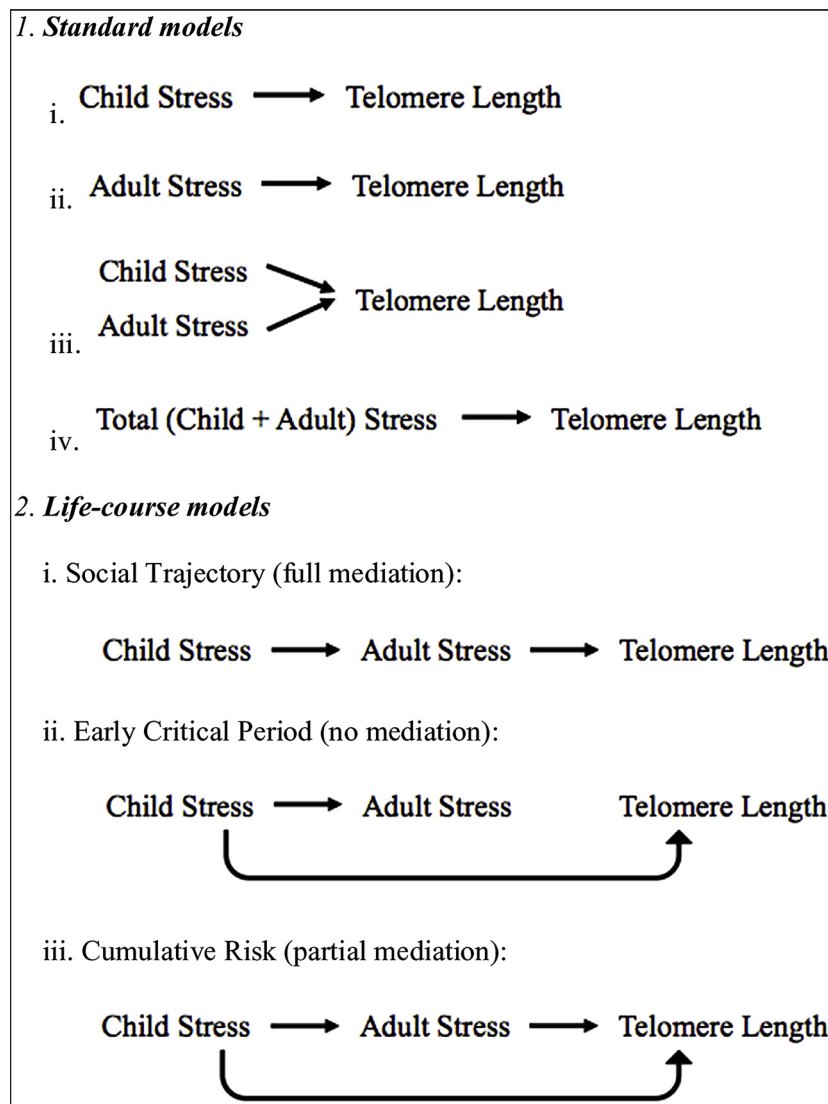


Fig. 1. Standard models and life course models of the relationship between stress and adult telomere length.

SLEs that occurred during adulthood. Among the studies that focused specifically on the relationship between early childhood adversities, traumas, or stressful events and TL in adults, several found a significant negative association between childhood SLEs and TL in adulthood (Kananen et al., 2010; Osler, Bendix, Rask, & Rod, 2016; Tyrka et al., 2010; Vincent et al., 2017; Zalli et al., 2014). Other studies, however, found no significant association between childhood SLEs and TL in adulthood (Kuffer, O'Donovan, Burri, & Maercker, 2016; Savolainen et al., 2014; Van Ockenburg et al., 2015), or an association for those under age 45 but not those over 45 (McFarland, Taylor, Hill, & Friedman, 2018). Based on data from the Netherlands Study of Depression and Anxiety (NESDA), no association was observed between childhood SLEs and a cross-sectional measure of adult TL (Revesz, Milaneschi, Terpstra, & Penninx, 2016; Schaakxs et al., 2016; Verhoeven, van Oppen, Puterman, Elzinga, & Penninx, 2015), but more childhood SLEs were significantly associated with TL attrition over six years in this sample of adults ranging in age from 18 to 65 (Revesz et al., 2016).

For the effect of stress in adulthood, several studies found an association between recent SLEs and shorter TL (Revesz et al., 2016; Surtees et al., 2011; Verhoeven et al., 2015) or TL attrition over time (Puterman, Lin, Blackburn, & Epel, 2015; Van Ockenburg et al., 2015). Other studies, however, found no relationship between TL and recent

SLEs (Osler et al., 2016; Savolainen et al., 2014; Schaakxs et al., 2016; Surtees et al., 2011).

Several of the above studies (Osler et al., 2016; Revesz et al., 2016; Savolainen et al., 2014; Schaakxs et al., 2016; Surtees et al., 2011; Van Ockenburg et al., 2015; Verhoeven et al., 2015) assessed child and adult SLEs in separate models. Other authors have included measures of both child and adult SLEs concurrently as covariates in the same model. Using the Health and Retirement Study (HRS), Puterman and colleagues (2016) found that adversities in adulthood were not significantly associated with later life TL, but those in childhood were. Another study using the same HRS dataset found neither an association between TL and childhood nor adulthood SLEs (Whisman, Robustelli, & Sbarra, 2016). However, the contradictory findings between these two studies may be due to two important differences in the analyses: first, Whisman and colleagues used fewer indicators of childhood SLEs than Puterman and colleagues; and secondly, Whisman utilized a subsample of individuals with TL measures in the HRS that was smaller and younger than Puterman's sample.

Studies assessing the association between TL and additive measures of SLEs across childhood and adulthood report a variety of findings. Puterman and colleagues (2016), who examined childhood and adulthood SLEs as covariates as described above, found that more lifespan adversities were associated with a greater odds of having shorter TL.

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