

A Transdiagnostic Intervention for Youth Sleep and Circadian Problems

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Sleep disturbance is an important contributor to, and maybe even cause of, vicious cycles of escalating vulnerability and increased risk among youth as they prepare to, and transition into, adulthood. The aim of this paper is to describe the scientific derivation of, and components of, the Youth version of the Transdiagnostic Sleep and Circadian Intervention (TransS-C-Youth) to improve sleep. TransS-C-Youth draws from sources that are informed by basic sleep/circadian principles and aims to help clinicians address the broad range of sleep disturbances that are often experienced during adolescence and the transition to adulthood years. The advantages of developing a transdiagnostic treatment are outlined and include that this approach may reduce the "too many empirically supported treatments problem" (Weisz, Ng, & Bearman, 2014, p. 68). TransS-C-Youth is comprised of both core and optional modules and thus promotes maximum flexibility as well as efficiency.

HERE are multiple junctures over the course of development associated with heightened risk. Particularly significant, but understudied, are the unique set of challenges faced by youth as they prepare to, and transition into, adulthood. This transition period involves multiple domains of change, including: (a) physical and psychological individuation as parental guidance and monitoring diminish while the expectation of autonomy increases; (b) establishing and maintaining new relationships, and new types of relationships, extending beyond family relationships; (c) changes in major social roles such as transitioning to college, vocational training, or becoming a full-time worker for the first time; (d) increased challenges created by the opportunities to access a wide range of risky activities, such as increased availability and use of substances and alcohol, engaging in risky and unprotected sex, and driving at high speed or while intoxicated; and (e) facing life decisions across multiple domains that have a long-term impact on future functioning, including educational/career decisions and decisions relating to marriage and starting a family (Arnett, 2000; Bachman, Johnston, O'Malley, & Schulenberg, 1996; Boles, 1999; Jessor, Donovan, & Costa, 1991).

We have been interested in whether interventions aimed at adolescence and this transitional period, a time just before embarking on adult social roles, may be a particularly effective time for stabilizing and establishing better self-regulatory capacities. During this age it may be

possible to take advantage of any remaining degree of structure and/or parental monitoring/scaffolding, allowing the intervention to help the young person to establish better skills and habits before facing the next level of challenges, thereby reducing risk and building resilience.

Why Is Sleep Important in Adolescence and the Transition to Adulthood?

Sleep disturbance is an important contributor to, and maybe even cause of, vicious cycles of escalating vulnerability and increased risk among youth. A biological shift in the circadian system at puberty in the direction of a delayed sleep phase (Carskadon, Acebo, & Jenni, 2004; Lee, Hummer, Jechura, & Mahoney, 2004) is compounded by social changes such as less parental control, increased access to stimulating social activities (music, Internet, text messaging, etc.), and increased use of alcohol and substances that contribute to sleep disruption. Together, the social influences interact with the biological tendencies toward phase delay, and can spiral quickly into a pattern of very delayed bedtimes (Carskadon, 2011). Yet, school/work usually requires a fixed early wake-up time (Hansen, Janssen, Schiff, Zee, & Dubocovich, 2005). Hence, these biopsychosocial and behavioral forces converge to constrain time available for sleep, resulting in very high rates of youth obtaining insufficient sleep (Carskadon, 2002; Carskadon, Mindell, & Drake, 2006; Hansen et al., 2005). Compounding this vicious cycle, most attempts to "catch-up" on sleep occur on weekends on a phase-delayed schedule (Crowley, Acebo, & Carskadon, 2007; Sivertsen, Harvey, Lundervold, & Hysing, 2013a). This is a problem because the jet lag literature documents that it is easier to adapt to westward travel (involving delaying bedtimes)

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relative to eastward travel (involving advancing bedtimes) (Lowden & Åkerstedt, 1999; Waterhouse, Reilly, Atkinson, & Edwards, 2007). This finding is highly relevant because teenagers will easily adapt to late-night bedtimes and wake times on weekends and will then have more difficulty establishing earlier sleep schedules starting on Sunday night and on weekdays. Thus, many youth are struggling with the burdens of sleep deprivation and the consequences of repeated circadian shifts (Carskadon, 1990).

While the basic biological shift toward eveningness during this phase may be difficult to modify, the psychosocial and behavioral contributors can be modified. Moreover, modifying the psychosocial and behavioral contributors may well eliminate key factors that exacerbate the biological shift. Hence, the aim of this paper is to describe the scientific derivation of, and components of, the youth version of the Transdiagnostic Sleep and Circadian Intervention (TranS-C-Youth) to improve sleep. TranS-C-Youth draws from sources that are informed by basic sleep/circadian principles.

The hope is that youth in the later teen years and the transition to adulthood years can obtain as close to 9 hours of sleep per night as possible (Carskadon et al., 1980; Wolfson & Carskadon, 1998), to facilitate the rapid body and brain development that continues well into the early 20's (Casey, Jones, & Somerville, 2011; Giedd, 2004). Also, it is important to emphasize that one aim of TranS-C-Youth is to equip the client with tools and methods to help them go on treating themselves and continuing to improve once therapy is over.

Basic Sleep and Circadian Principles

TranS-C-Youth was derived from several sources, which will be described in the section that follows. The relevance of these sources will be more apparent following a brief description of the two processes that govern the sleep-wake cycle (Borbely & Wirz-Justice, 1982).

The first is the circadian process, which arises from the endogenous pacemaker in the suprachiasmatic nuclei (SCN) (Reppert & Weaver, 2002). At the molecular level, intrinsically rhythmic cells within the SCN generate rhythmicity via an autoregulatory transcription-translation feedback loop regulating the expression of circadian genes. The process by which the pacemaker is set to a 24-hour period and kept in appropriate phase with seasonally shifting day length is called entrainment, which occurs via zeitgebers. The primary zeitgeber is the daily alteration of light and dark (Roennebert & Foster, 1997). The light-entrainable SCN synchronizes networks of subordinate circadian oscillators controlling fluctuations in other brain regions and, in particular, in neural circuitry supporting reward seeking (centered on ventral striatum) (Venkatraman, Chuah, Huettel, & Chee, 2007) and emotion processing (centered on amygdala and orbitomedial prefrontal cortex) (Yoo,

Gujar, Hu, Jolesz, & Walker, 2007), two circuits highly relevant to risk taking among teens and that continue developing well into the teenage years (Blakemore, Burnett, & Dahl, 2010; Giedd et al., 1999). Hence, TranS-C-Youth incorporates timed light exposure. The SCN is also responsive to nonphotic cues such as arousal/locomotor activity, social cues, feeding, sleep deprivation, and temperature (Mistlberger, Antle, Glass, & Miller, 2000). Hence, TranS-C-Youth takes advantage of powerful nonphotic cues such as meal times and exercise.

The second process governing the sleep-wake cycle is the homeostatic process that regulates the duration and structure of sleep based on prior sleep and wakefulness; sleep pressure increases during wake and dissipates during sleep (Jenni, Achermann, & Carskadon, 2005; Taylor, Jenni, Acebo, & Carskadon, 2005). TranS-C-Youth includes methods for increasing homeostatic drive to sleep. When we talk about this second process with clients it has been helpful to refer to it as the "hunger" or "appetite" for sleep. Together, these basic sleep principles informed the sources for deriving TranS-C-Youth.

Sources for the TranS-C-Youth

Principles from three evidence-based interventions were the source of TranS-C-Youth. These were combined to optimize sleep functioning and interaction between the circadian and homeostatic processes outlined in the prior section.

Source 1: Cognitive Behavior Therapy for Insomnia (CBT-I)

There is robust evidence from multiple meta-analyses (Irwin, Cole, & Nicassio, 2006; Morin, Culbert, & Schwartz, 1994; Murtagh & Greenwood, 1995; Smith et al., 2002) and a systematic review for CBT-I in adults (Morin et al., 2006). The evidence for CBT-I among adolescents is small but promising (Bootzin & Stevens, 2005; de Bruin, Oort, Bögels, & Meijer, 2014; Gradisar, Dohnt, Gardner, Paine, Starkey, Menne, and Trenowden, 2011a; Gradisar, Gardner, and Dohnt, 2011b; Paine & Gradisar, 2011; Schlarb, Liddle, & Hautzinger, 2010). The studies conducted among youth to date reflect the diversity of choices facing clinicians, including combining CBT-I components with mindfulness (Bootzin & Stevens, 2005) or bright light (Gradisar, Dohnt, et al., 2011a), delivering CBT-I over the Internet or in a group (de Bruin et al., 2014) or in a classroom setting (Cassoff, Knäuper, Michaelsen, & Gruber, 2013), involving parents in the treatment (Schlarb et al., 2010) and including an emphasis on motivational interviewing (Cassoff, et al., 2013). Although much more treatment research is needed, with larger samples, randomization, and control groups, this emerging literature justified including a focus on CBT-I in TranS-C. In particular, TranS-C-Youth draws on the CBT-I components that increase homeostatic pressure to sleep

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