Is Sleeplessness Destiny? Age, Cohort and Gender Variations in Problem Sleep

ABSTRACT

Objectives: Conventional wisdom and prior studies suggest that problem sleep increases with age. However, extant evidence on the issue is limited for two reasons: the reliance on cross-sectional data and the confounding of age changes and cohort differences. This study addresses four key questions in the age and sleeplessness hypothesis: (1) Does the age growth trajectory show an increase in sleeplessness in late life?; (2) Is there cohort heterogeneity in the age growth trajectories of sleeplessness?; (3) Can social and health risk factors explain the age effect?; (4) Are there gender differences in the age growth trajectories of sleeplessness?

Methods: This study used accelerated longitudinal data from the Health and Retirement Study (HRS) and applied multilevel model to assess age growth trajectory of sleeplessness, including variations across cohorts

Results: The results show remarkable differences in the age growth trajectories of sleeplessness by gender. Specifically, problem sleep increased with age in women but not in men. For women, age growth trajectories were more rapid for earlier cohorts. The growth trajectories can be partially accounted for by education, economic resources, marital status, and declining health.

Discussion: The findings challenge the general hypothesis of increasing problem sleep with age. Variations of life course experience by gender and cohort may shape age growth trajectory of sleeplessness.

Keywords: Aging; cohort effects; gender differences; growth trajectory; sleep

Sleeping well is essential for health and well-being. An individual's ability to consistently get a good night's sleep, however, appear to change over the life course. It is commonly assumed that older people tend to have a harder time falling asleep and more trouble staying asleep compared with younger adults. Many epidemiological and population-based studies document the high prevalence of sleep problems among the elderly population in countries across the world (Ancoli-Israel, 2009; Liu, Uchiyama, & Kim, 2000; Stewart, Besset, & Bebbington, 2006). In general, estimates from these cross-sectional studies show that approximately one-fifth to one-half of older adults report at least one symptom of insomnia (Foley, Monjan, & Brown et al., 1995; Lauderdale, Schumm, & Kurina et al., 2014). Furthermore, among the elderly population, the older the individuals concerned, the higher the prevalence of problem sleep (Lauderdale, Schumm, & Kurina et al., 2014). Thus, it appears to be self-evident that problem sleep increases with age.

A close scrutiny of the issue, however, pose questions to the general hypothesis of increasing problem sleep with age. First, extant support for the belief comes from cross-sectional data. While these cross-sectional studies offer a very first look of the association between age and sleep, they do not offer answers to the key question of the hypothesis: how sleep changes as individuals age. Second, the general hypothesis of increasing problem sleep with age overlook the role of many factors such as health changes, experience and transitions over the life course in shaping age growth trajectory of sleep. Finally, the belief implies that sleeplessness is the destiny for older adults regardless of gender. It is well-known that women reported higher prevalence of problem sleep than men (Arber, Bote, & Meadows, 2009; Lindberg, Janson, Gislason et al., 1997; Ohayon, 2002). Prior studies also suggest that gender role can contribute to women's higher prevalence of problem sleep (Burgard, 2011; Venn, Arber, Meadows, & Hislop, 2008).

However, there remains no discussion the potential variation in age growth trajectory in problem sleep between women and men. Because of these limitations, our understanding of whether problem sleep increases with age remains very limited; despite the belief that increasing problem sleep with age is so widespread among the general public and the scientific community.

The present study aims to contribute to this issue by reviewing existing theoretical perspectives on age and sleep association and providing one of the very first systematic analysis of the issue using longitudinal data from multiple cohorts of older adults. Results offer a more comprehensive understanding of patterns of age growth trajectory of sleeplessness.

Theoretical Perspectives on Age and Sleeplessness

A number of theoretical hypotheses offer different explanations and predictions regarding the association between age and sleep. The following sections elaborate these different theoretical perspectives.

Physiological Changes. Research in sleep physiology does suggest age as a potential cause of sleeplessness (Wolkove, Elkholy, Baltzan, & Palayew, 2007). Evidence from neuropsychology suggests that even among the healthy elderly, sleep architecture becomes more and more fragile as people age (Espiritu, 2008; Pace-Schott & Spencer, 2011; Vitiello, 2006). Studies of older people show an increase in the time it takes to fall asleep (Geisler, Tracik, & Crönlein, 2006; Vitiello, Larsen, & Moe, 2004), an overall decline in REM sleep and an increase in time awake (Van Cauter, Leproult, & Plat, 2000). Older people therefore spend more time in the lighter stages of sleep than in deep sleep (Van Cauter, Leproult, & Plat, 2000). Physiological changes with age appear to provide a good explanation for the sleeplessness associated with aging.

Health Decline. Aside from physiological changes, there are three perspectives that can also explain the association between age and sleep. First, much of the sleep disturbance that occurs among the elderly can be attributed to physical and psychiatric illnesses and the medications used to treat them (McCrae & Lichstein, 2001; Taylor, Mallory, & Lichstein, 2007). Research shows that patients with depression, digestive diseases, heart disease, and rheumatic disorders have a higher prevalence of poor sleep (Foley, Ancoli-Israel, Britz, & Walsh, 2004; Sutton, Moldofsky, & Badley, 2001). As many of these chronic health problems are common among the elderly, declining health in old age leads to a positive association between age and poor sleep.

Life Course Perspective. Second, the life course perspective connects individuals' experience in the social world to problem sleep. Changes in problem sleep may mirror changes in an individual's social life. Problem sleep can arise as a consequence of major changes during late adulthood, such as marital disruption, widowhood, and economic hardship. Prior research shows that significant changes in social relationships and economic well-being during old age are associated with disturbed sleep (Paine, Gander, Harris, & Reid, 2004; Troxel, Buysse, & Matthews, 2010). Thus, these transitions may contribute to the positive association between age and poor sleep. Third, selective survival may also affect the association between age and sleep. Problem sleep reduces survival (Sivertsen, Pallesen, Glozier et al., 2014; Vgontzas, Liao, & Pejovic, 2010), and the social and health risk factors for problem sleep (such as low socioeconomic status and chronic diseases) also increase mortality. Because people with severe problem sleep may die earlier than those with better sleep, selective survival can lead to a negative association between problem sleep and age. Empirically, the above hypothesis can also be examined from a cohort analysis perspective, as differential cohort survival has been well documented. Cohorts born since the turn of the 20th century have successively lower mortality rates and less disability at older ages (Crimmins, 1981; Crimmins, 2004). The considerably lower survival to old age for cohorts born earlier suggests that the contemporary "oldest old" population is a highly select group in terms of health and well-being. Therefore, the selective survival hypothesis suggests that older cohorts have lower levels of problem sleep.

Empirical Evidence on Age and Sleeplessness

Extant studies on age and sleep association show mixed results (Ohayon, 2002). Some studies document a positive association between age and problem sleep (Doi, Minowa, Okawa, & Uchiyama, 2000; Ford & Kamerow, 1989; Hetta, Broman, & Mallon, 1999; Leger, Guilleminault, Dreyfus et al., 2000), whereas other studies find no significant association (Arber, Bote, & Meadows, 2009; Foley, Ancoli-Israel, Britz, & Walsh, 2004; Foley, Monjan, Brown et al., 1995). Most importantly, existing studies on the association between age and sleep are limited in several key ways. First, prior studies rely on cross-sectional data. Without longitudinal data, it remains unclear how sleep changes as people age (e.g., Foley, Monjan, Brown et al., 1995; Lauderdale, Schumm, Kurina et al., 2014). Second, cross-sectional studies confound age effects and cohort effects and are thus unable to uncover the imprint of social structural change on the developmental trajectory of sleeplessness (Lindberg, Janson, Gislason et al., 1997). Different cohorts may have differential, cohort-specific exposures to social risk factors. Research that identifies such cohort variations may deepen our understanding of the exogenous social environmental factors that contribute to variations in sleeplessness in late life. Third, prior studies have failed to consider differential selective survival across cohorts and how this may generate variation by cohort in the association between age and sleep. Finally, we understand very little about how declining health, changes in marital status and economic well-being affect the age and sleep association. Thus, while theories suggest complex pathways through which age, physiological and social factors contribute to the growth trajectory of problem sleep, no study has carefully considered these factors in conjunction using longitudinal data. Our understanding of how sleep changes as individuals age remains very limited for the general population of older adults.

Gender Variation on Age and Sleeplessness

More importantly, prior research on the association between age and sleep fails to consider gender differences in the age trajectory of sleeplessness. It is well documented that women report poorer sleep than do men (Arber, Bote, & Meadows, 2009; Lindberg, Janson, Gislason et al., 1997; Ohayon, 2002). Such gender gaps in reports of poor sleep continue into old age (Lauderdale, Schumm, Kurina et al., 2014). The widely documented pattern of gender differences in sleep thus suggests that men and women appear to have different trajectories of problem sleep over the life course. Indeed, there are strong reasons to believe that the age and sleep association can vary by gender. First, hormonal changes during menopause can significantly affect women's sleep. Research has demonstrated that estrogen has powerful effects on body temperature regulation, circadian rhythms, and stress reactivity, all of which affect sleep (Moe, 1999). Changing and decreasing levels of estrogen after menopause therefore lead to changes in sleep. Accordingly, post-menopausal women often reported more frequent experiences of interrupted sleep and more frequent awakenings than did pre-menopausal women (Kravitz, Zhao, Bromberger et al., 2008). Second, women usually play the role of caregiver in their families, and this role is considered a unique social risk factor for problem sleep that disproportionally affects women. Studies from sociology and social epidemiology show that women with children are more likely to wake up during the night and to have shorter sleep duration (Burgard, 2011; Venn, Arber, Meadows, & Hislop, 2008). Third, women survive longer than their male counterparts and tend to report higher levels of problem sleep. Thus, it is expected that problem sleep increases more rapidly with age for women. In summary, the above discussion suggests that men and women may show different trajectories with regard to sleeplessness. In particular, the above mechanisms suggest that there are stronger age and sleep associations among women than among their male counterparts.

However, to our knowledge, no prior studies have carefully considered gender variation when examining the association between age and sleeplessness. A careful investigation of the age and sleep association by gender can contribute to both the epidemiology and sleep literatures by providing key insights into how gendered life courses and experiences accumulate over time to contribute to the high prevalence of problem sleep in women. It is therefore critical to examine whether men and women show similar rates of increase in problem sleep as they age.

The Present Study

In summary, this project will address four fundamental questions around the aging-sleeplessness hypothesis: (1) Does the age growth trajectory show an increase in sleeplessness in late life? (2) Are there cohort variations in age growth trajectories with regard to sleeplessness? (3) What demographic characteristics, as well as social and health risk factors, are associated with these effects? (4) How do age growth trajectories vary by gender?

METHODS

Data

This project used 5 waves (2002, 2004, 2006, 2010, 2014) of data from the Health and Retirement Study (HRS), a nationally representative, longitudinal survey of U.S. older adults. The survey started in 1992, and respondents were followed every two years. In addition, the survey added a new cohort of elderly 50 years old or older every six years. This unique accelerated longitudinal design of the HRS allowed me to identify the trajectories of aging much more effectively compared with the use of repeated cross-sectional data and longitudinal data with respondents from a single birth cohort. While HRS began in 1992, sleep measures were first added to the Study in 2002; therefore, this project was limited to data after 2002. The 2008 and 2012 waves of data were excluded because sleep data were not collected in those two survey years. This study organizes the life histories of sample members into six birth cohorts: 1) born 1929 and earlier, 2) born 1930-1935, 3) born 1936-1941, 4) born 1942-1947, 5) born 1948-1953, and 6) born 1954-1959. The first four cohorts were followed beginning in 2002. Cohort 5 was added in 2004 and followed until 2014. Cohort 6 was added in 2010 and followed again in 2014. The final sample has 91,302 person-year observations (38,464 for men and 52,838 for women).

Measures of problem sleep

Starting with the 2002 wave of the core HRS survey, each respondent was asked four questions about their sleep. These sleep questions were assessed again in 2004, 2006, 2010, and 2014. The four questions were “How often do you have trouble falling asleep?”, “How often do you have trouble with waking up during the night?”, “How often do you have trouble with waking up too early and not being able to fall asleep again?”, and “How often do you feel really rested when you wake up in the morning?”. Respondents had the following answer options: most of the time = 2, sometimes = 1, rarely or never = 0. These questions capture key components of clinical definitions of insomnia and are considered good indicators of sleeplessness (Chen, Waite, & Lauderdale, 2015). This study sums the four items to create a sleeplessness scale, ranging from 0 to 8 (after reverse coding the last question). The scale has been used in other studies and shows acceptable psychometric properties (Chen, Waite, Kurina et al., 2014).

Covariates

This study included additional variables to investigate whether the trends vary when key time-invariant and time-varying covariates are included in the statistical model. These variables included the following: race and ethnicity (coded as White, Black, Hispanic, and other), years of education, current marital status, self-rated health, and numbers of diagnosed chronic conditions (including high blood pressure or hypertension, diabetes, cancer or a malignant tumor of any type except skin cancer, chronic lung disease except asthma, heart attack, coronary heart disease, angina, congestive heart failure or other heart problems, stroke or transient ischemic attack, and arthritis or rheumatism).

Statistical model

This study used a 2-level multilevel model to analyze and graphically display the age growth trajectory of sleeplessness, including variations across cohorts (Miyazaki & Raudenbush, 2000; Yang, 2007). Analyses of men and women were performed separately. The first level represented survey wave and the second level represented individuals. Because the quadratic age coefficient is not significant, this study does not include additional cubic age.

The individual increase in sleeplessness depends on person-level characteristics and varies by cohort membership. The level-2 model specifies the average trajectory for each cohort and includes personal-level, time-invariant covariates.

In addition, this study also modeled the age trajectories and cohort effects using a negative binomial model as a sensitivity analysis. The results were similar. Thus, results from the linear model were reported for simplicity. All results were unweighted because the HRS provided no longitudinal weights. In addition to examining the sleeplessness scale, this study also analyzed each sleep question separately to investigate the growth trajectories of each aspect of sleep.

RESULTS

Table 1 assesses age effects in the presence of cohort effects for men. Model 1 was estimated without adjusting for covariates, and Model 2 included all covariates. The expected growth trajectories of sleeplessness and the cohort-specific trajectories for both models are presented in Figure 1. Model 1 shows the estimated gross age and cohort effects. The coefficient of age indicates that sleeplessness scores do not vary with age over time. The results also show no cohort effects. Controlling for covariates (Model 2) does not change the pattern. For older men, the general hypothesis that sleeplessness increases with age is not supported. Table 3 shows the results for women. The pattern, however, is different from that for men. The coefficient of age is positive and statistically significant. This suggests an increase in sleeplessness with age over time. In addition, Table 2 shows cohort differences in sleeplessness among women. Younger cohorts of women start with higher sleeplessness scores. However, the growth rate of sleeplessness is slower for younger cohorts of women. Controlling for covariates substantially reduces the growth rate, cohort effects, and growth rates by cohorts. This provides evidence that increased sleeplessness during late life is not purely an aging-related phenomenon.

Race/ethnicity, years of education, currently married, household income, chronic illness, and self-rated health were all correlated with sleeplessness scores in the expected directions for men and women. Non-white individuals reported substantially lower levels of sleeplessness. Higher household income and more years of education appear to be protective factors for sleeplessness in later life. Number of chronic illnesses and poor self-rated health were significantly associated with sleeplessness for older men and women.

Table 3 provides additional results of net age and cohort effects for each sleep measure. All results were adjusted for covariates (but coefficients were excluded for brevity). Panel A presents the results for men. As the table shows, feeling rested decreased with age in men. However, there is no association between age and sleep in the other three sleep measures: troubling falling asleep, waking up at night, and waking up too early. Panel B presents the results for women, revealing a completely different pattern. There are strong age and sleep associations for troubling falling asleep, waking up at night, waking up too early, and feeling rested. As women become older, they tend to report more sleep problems as measured by these four questions. In short, while age is associated with not feeling rested for both men and women, women also reported more trouble falling asleep, waking up at night, and waking up too early with increasing age. Every aspect of women’s sleep appears to deteriorate with age. However, the same pattern was not observed among older men.

DISCUSSION

Conventional wisdom and theories from sleep physiology consider age to be a key determinant of problem sleep in old age. However, other theoretical perspectives suggest age and sleep association are also shaped by health, behavioral factors, and social processes. Using accelerated longitudinal data from the HRS, this study investigates age trajectories of problem sleep in old age and whether age trajectories vary by cohort and by gender. Three major findings of this study significantly extend previous findings from cross-sectional studies. First, the results contradict the general hypothesis that age is an independent risk factor for problem sleep for the general population of older adults. The patterns revealed in this study suggest that the association between age and problem sleep is gendered. Reported problem sleep increased with age in women but not in men. Second, there are strong cohort effects in women. Younger cohorts reported a higher prevalence of problem sleep than did older cohorts, supporting the selective survival hypothesis. Third, declining health, changes in social relationships and changes in economic well-being partially explained the association. However, even after taking these factors into account, there were strong age growth trajectories of problem sleep in women. In summary, problem sleep did increase with age but only for women, not men.

The findings of this study have several important implications. First, there are remarkable gender differences, as the phenomenon of aging and sleeplessness was only found in women but not in men. This result challenges the conventional wisdom and suggest that the widespread belief that increasing problem sleep with age is unwarranted. The findings, however, do not necessarily suggest that there are fundamental differences between men and women in terms of changes in sleep physiology. Differences in social experience between men and women throughout the life course may also contribute to the differences found in this study, making older men more resilient than older women to the changes of sleep physiology in old age. The exact mechanisms that produce such gendered trajectories need further exploration.

Second, women in recent birth cohorts reported more problem sleep. Such cohort differences were not explained by differences in health conditions, relationships, and socioeconomic status. However, if biological aging is responsible for the association between age and sleep, cohort differences should be minimal. Thus, cohort-specific exposures to social and environmental conditions may be responsible for the declining age and sleep association found in younger cohorts. Future studies should explore the mechanisms through which age has a smaller effect on problem sleep for older adults born after 1936.

Third, poor sleep is a critical risk factor that has been linked to declines in cognitive function (Cricco, Simonsick, & Foley, 2001) and to increases in diabetes (Gangwisch, Heymsfield, Boden-Albala et al., 2007), heart disease (Phillips & Mannino, 2007) and mortality (Cappuccio, D'Elia, Strazzullo, & Miller, 2010). The patterns of age and sleeplessness reveal in this study thus can have important implications for policy and intervention. Results suggest that since sleeplessness is not destiny for individuals in old age, efforts can be made to improve sleep health as individuals age. More specifically, this study sends a strong message that women needs to be the target for public health initiatives on sleep. Such an intervention should start earlier in order to close the gender gap in problem sleep.

A number of limitations need to be acknowledged. First, this study relies on self-reported measures of problem sleep. This study provides no information on how sleep architecture and sleep physiology change with age. However, these self-reported sleep questions captured key aspects of insomnia symptoms as described in the DSM and ICD (American Psychiatric Association, 2013; WHO, 2012) which constitute one key aspect of sleep and have been used for diagnosis of insomnia. Thus, these questions still provide important information into individuals' sleep. Second, the relationship between sleep and age remains associational instead of causal. We should be very cautious and not interpreting age as a cause of problem sleep in women.

In sum, this study modified and extended conventional views on old age and problem sleep based on cross-sectional studies. The findings emphasized gender and cohort differences in individuals' aging experiences and established the importance of social roles and differential exposure to social risk factors in reaching conclusions about the relationship between aging and problem sleep. This study has found that aging per se is not necessarily associated with increases in problem sleep. Sleeplessness is not destiny as people age. Men and women, and women in different birth cohorts, experience different growth trajectories of problem sleep with age. From a policy and practical perspective, we need a better understanding of the elevated problem sleep of more recent cohorts of older adults. As poor sleep in old age is related to many chronic diseases and excess mortality, this trend – if it continues – may present a daunting challenge for population health and health care in the United States.

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Table 1. Coefficient Estimates of Growth Models of Poor Sleep for Men (N=38,464).

	Model 1	Model 2
Intercept	0.393 (2.393)	2.470 (2.364)
Growth rage: age	0.017 (0.057)	-0.021 (0.057)
Age square	0.000 (0.003)	0.001 (0.000)
Cohort		
Cohort 2	-0.746 (0.642)	-0.635 (0.633)
Cohort 3	-0.270 (0.840)	-0.616 (0.828)
Cohort 4	0.521 (1.085)	0.164 (1.071)
Cohort 5	0.657 (1.278)	0.013 (1.260)
Cohort 6	1.473 (1.459)	0.729 (1.438)
Age × cohort		
Age × cohort 2	0.013 (0.008)	0.010 (0.008)
Age × cohort 3	0.008 (0.011)	0.011 (0.011)
Age × cohort 4	-0.001 (0.015)	0.001 (0.015)
Age × cohort 5	0.002 (0.018)	0.008 (0.018)
Age × cohort 6	-0.009 (0.022)	-0.002 (0.021)
Race		
Black		-0.271 (0.042)***
Hispanic		-0.231 (0.050)***
Others		-0.122 (0.085)
Years of Education		-0.031 (0.005)***
Marital status		-0.244 (0.028)***
Household income		-0.025 (0.007)***
Chronic illness		0.179 (0.010)***
Self-rated health		0.338 (0.010)***

Note. * P<.05; ** P<.01; *** P<.001.

Table 2. Coefficient Estimates of Growth Models of Poor Sleep for Women (N=52,838).

	Model 1	Model 2
Fixed effects		
Intercept	-7.869 (2.022)***	-5.510 (2.000)**
Age (growth rate)	0.245 (0.048)***	0.195 (0.047)***
Age square	-0.001 (0.000)***	-0.001 (0.000)***
Cohort		
Cohort 2	0.415 (0.569)	0.280 (0.562)
Cohort 3	2.198 (0.736)**	1.720 (0.728)*
Cohort 4	3.996 (0.935)***	3.267 (0.924)***
Cohort 5	5.193 (1.102)***	4.170 (1.090)***
Cohort 6	5.688 (1.250)***	4.677 (1.235)***
Age × cohort		
Age × cohort 2	-0.002 (0.007)	-0.001 (0.007)
Age × cohort 3	-0.025 (0.010)**	-0.020 (0.009)*
Age × cohort 4	-0.0499 (0.013)***	-0.041 (0.013)**
Age × cohort 5	-0.065 (0.016)***	-0.053 (0.015)**
Age × cohort 6	-0.072 (0.019)**	-0.060 (0.018)**
Race		
Black		-0.440 (0.037)***
Hispanic		-0.331 (0.048)***
Others		-0.284 (0.082)**
Years of Education		-0.043 (0.005)***
Marital status		-0.103 (0.023)***
Economic hardship		-0.018 (0.006)**
Chronic illness		0.158 (0.009)***
Self-rated health		0.368 (0.009)***

Note. * P<.05; ** P<.01; *** P<.001.

Table 3. Coefficient Estimates of Growth Models of Each Item in Problem Sleep Scale.

	Trouble Falling Asleep	Waking Up at Night	Waking Up Too Early	Feeling Rested
		A. Men		
Age (growth rate)	-0.006 (0.020)	0.049 (0.026)	-0.003 (0.022)	-0.08 (0.02***)
Age square	0.000 (0.001)	-0.003(0.001)*	0.000 (0.001)	0.001 (0.000)***
Cohort				
Cohort 2	-0.046 (0.227)	0.036 (0.284)	-0.346 (0.250)	-0.521 (0.254)*
Cohort 3	0.047 (0.298)	-0.094 (0.374)	-0.426 (0.328)	-0.495 (0.335)
Cohort 4	-0.003 (0.386)	0.156 (0.484)	-0.084 (0.425)	-0.300 (0.433)
Cohort 5	-0.003 (0.454)	0.198 (0.570)	-0.138 (0.500)	-0.623 (0.410)
Cohort 6	0.624 (0.517)	0.509 (0.649)	-0.050 (0.570)	-0.795 (0.581)
Age × cohort				
Age × cohort 2	0.001 (0.003)	-0.001 (0.004)	0.005 (0.003)	0.007 (0.003)*
Age × cohort 3	0.001 (0.004)	0.001 (0.004)	0.006 (0.004)	0.007(0.004)
Age × cohort 4	0.002 (0.005)	-0.003 (0.007)	0.002 (0.006)	0.005 (0.006)
Age × cohort 5	0.003 (0.006)	-0.003 (0.008)	0.003 (0.007)	0.011 (0.007)
Age × cohort 6	-0.007 (0.008)	-0.008 (0.010)	0.003 (0.008)	0.015 (0.009)
		B. Women		
Age (growth rate)	0.083 (0.018)***	0.064 (0.020)**	0.074 (0.018)***	-0.039 (0.018)*
Age square	-0.001 (0.000)***	-0.000 (0.000)***	-0.000 (0.000)***	0.000 (0.000)*
Cohort				
Cohort 2	0.042 (0.211)	0.234 (0.239)	0.271 (0.218)	-0.346 (0.217)
Cohort 3	0.555 (0.274)*	0.402 (0.311)	0.640 (0.283)*	0.011 (0.281)
Cohort 4	0.926 (0.348)**	0.757 (0.395)	1.154 (0.360)**	0.315 (0.358)
Cohort 5	1.461 (0.411)***	0.905 (0.466)	1.314 (0.424)**	0.243 (0.421)
Cohort 6	1.690 (0.465)***	0.848 (0.528)	1.772 (0.481)***	0.062 (0.478)
Age × cohort				
Age × cohort 2	0.000 (0.003)	-0.003 (0.003)	-0.003 (0.003)	0.005 (0.003)
Age × cohort 3	-0.006 (0.004)	-0.006 (0.004)	-0.008 (0.004)*	0.001 (0.004)
Age × cohort 4	-0.011 (0.005)*	-0.011 (0.005)*	-0.015 (0.005)**	-0.003 (0.005)
Age × cohort 5	-0.018 (0.006)**	-0.013 (0.006)*	-0.017 (0.006)**	-0.001 (0.006)
Age × cohort 6	-0.022 (0.007)**	-0.012 (0.007)	-0.025 (0.007)**	0.003 (0.007)

Note. * P<.05; ** P<.01; *** P<.001.

Appendix A. Birth Cohorts and Availability of Sleep Measures of the HRS Sample.

Birth Cohort	2002	2004	2006	2010	2014
1929 or earlier	×	×	×	×	×
1930-1935	×	×	×	×	×
1936-1941	×	×	×	×	×
1942-1947	×	×	×	×	×
1948-1953		×	×	×	×
1954-1959				×	×