

A First Glimpse at the Latent Structure of Sleep Valuation Using a Sleep Valuation Item Bank

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Introduction: Sleep valuation is the relative worth individuals place on sleep. Our prior study using a Sleep Valuation Item Bank (SVIB) showed that sleep valuation relates to age, gender, and health status. In this study, the psychometric properties of the SVIB and its latent factor structure were explored. We also investigated how sleep valuation factors relate to demographic, psychological, and sleep features.

Methods: Participants (N = 854) were recruited through TurkPRIME and completed a survey consisting of demographic, psychological, and sleep-related questions. The distributional properties of the SVIB items were quantified. Cronbach's alpha and correlation analyses were used to assess the internal consistency and test-retest reliability of SVIB items. Iterated principal factoring with a Promax rotation was used on the SVIB to explore its latent factor structure. Multiple regression analyses were used to investigate the variables associated with each factor.

Results: The factor analysis identified 29 items with factor loadings ≥ 0.4 on four major factors, tentatively called (1) sleep wanting, (2) sleep prioritizing, (3) sleep onset preference, and (4) sleep devaluation. While women had higher sleep wanting and lower sleep devaluation scores than men, they had lower sleep prioritizing. Older individuals tended to value sleep less but also devalued it less than younger participants. Finally, although both individuals with insomnia and depression devalued sleep, depressed individuals prioritized it more than those who were less depressed, while individuals with insomnia symptoms wanted sleep and preferred sleep onset more than those with less insomnia symptoms.

Discussion: The current SVIB captures broad dimensions of sleep valuation (wanting, prioritizing, preferring) and sleep devaluation. These broad dimensions had distinct patterns across person-level factors. Recognition of individual differences in sleep valuation may help target sleep health advocacy efforts and individualized treatment approaches, including for those with depression or insomnia.

Keywords: sleep valuation, sleep health, sleep quality, insomnia, depression

Sleep valuation is the relative worth placed on sleep. The active part of this concept, valuation is defined herein broadly as the degree of value (ie, importance, desire, wanting, preference, liking, or satisfaction) placed on objects, activities, and experiences. As the valued "object", sleep is conceptualized as a set of reversible, naturally reoccurring states involving reduced conscious awareness. Many types of values have been proposed including those values held by an individual (ie, individual values) and those values held by societies, institutions, and organizations (ie, societal values).¹ This paper focuses more specifically on sleep valuation held at the individual level, which has long been known to contribute to thoughts, feelings, and behaviors about its object.² As such, sleep valuation has major implications for sleep health behavior and sleep disorder prevention and treatment efforts. Indeed, valuing sleep was recently highlighted as the first of 5 Principles of good sleep health: value, prioritize, personalize, trust, and protect sleep.³

At the individual level, valuation can be broken down into intrinsic and extrinsic forms. Intrinsic value has been described as the value an individual places on objects, activities, and experiences for their own sake, while extrinsic value refers to values held for their ends. Sleep can be thought of as both an end in itself (intrinsic value) and a means to an end (extrinsic value). Sleep psychologists have framed sleep in instrumental conditioning theory as having intrinsic value, proposing that sleep is

a self-reinforcing consequence of sleep onset and associated behaviors.⁴ Survey results support the view that sleep has intrinsic value, in that 33% of Americans said they like or love sleep, feel good/great/OK about sleep, or felt grateful for sleep, 14% reported sleep as their favorite part of the day, and 6% reported sleep was a personal indulgence.⁵ Some people view sleep as a reprieve or escape from the pains and cares of wakefulness and may, likewise, value sleep for these intrinsic benefits. These observations support the view that sleep can serve as a positive or negative reinforcer with intrinsic value. Sleep psychologists have also framed sleep as a complex behavior with its own set of instrumental consequences.⁶ Sleep researchers have argued variously that sleep is the price we pay for wakefulness, plasticity, or life and have long wondered why mammals invest so much time in sleep.⁷⁻⁹ Sleep is associated with a host of health outcomes that may be deemed rewarding, such as rejuvenation of cognitive, affective, and physical functioning. Conversely, poor sleep has been linked to impairments in these domains.¹⁰ As such, many people may come to extrinsically value sleep for its secondary gains or avoidance of the negative consequences of its neglect. Indeed, in the aforementioned survey, 62% of respondents reported that sleep is necessary to recharge/restore/refresh.⁵ Whether intrinsic or extrinsic, sleep valuation is reflected in the large amount of money spent on sleep promotion each year, including on sleep treatments, over-the-counter remedies for sleep problems, beds and bedding, sleep-related apps, sleep tracking devices, and other devices designed to promote sleep quality.¹¹⁻¹⁴ There is evidence that sleep is valued by many individuals as a valid currency that is used transactionally with other objects, activities, and experiences. One of the earliest human writings, dating over 3000 years ago, describes this transaction process in the Epic of Gilgamesh whose hero weighed his accomplishments during wakefulness against his sacrificed sleep, "Of my slumber sweet my face had too little, I have scourged myself by going sleepless, I have filled my sinew with sorrow, and what have I achieved by my toil?"¹⁵ This ancient reference highlights how two ends, sleep and wakefulness, having supreme status commonly come in conflict in this transaction. Modern economists have sought to estimate the opportunity cost of an hour of sleep,¹⁶ and currently terms such as sleep debt and sleep deficit reflect the analogy of monetary value placed on sleep, often bargained against waking activities.^{17,18} Collectively, these findings support the view that because sleep is a valued state of being and a state that has value-laden consequences on health and daytime functioning, it also carries the potential for high individual value.

We recently introduced a novel Sleep Valuation Item Bank (SVIB), the first measure designed specifically to study the construct of sleep valuation.¹⁹ That study provided reliability estimates for each item of the item bank and found concurrent validity for the total score with several demographic, sleep, and health variables.¹⁹ Consistent with a national survey,²⁰ we showed that women value sleep more than men and that greater sleep valuation was associated with poorer mental and physical health. These latter associations were explained by the shared relationship of sleep valuation and health with poorer sleep. However, the sample was relatively small and had limited diversity, preventing us from conducting an exploratory factor analysis to determine the latent structure of sleep valuation captured by the SVIB. In the present study, we sought to further develop the construct of sleep valuation in a larger, nationally stratified adult sample using the SVIB. We quantified the internal consistency reliability and test-retest reliability of items. As a preliminary step to investigate the latent structure of sleep valuation, we used exploratory factor analysis. Additionally, we investigated associations between the SVIB factors and individual differences in demographic, psychological, and sleep features.

Methods

The SVIB is a list of 43 items generated by Dr. Kay and his research team to capture attitudes and behaviors that might reflect sleep valuation.¹⁹ These items were sent to 17 of Dr. Kay's peers who had an advanced degree (Ph.D. or M.D.) and prior publications in sleep research. Evaluators were offered \$20 for sharing their time and insights. To help the evaluators provide feedback from respondents' perspective, they were instructed to first respond to each item as a respondent. Next, they were asked to rate how essential each item was on a 3-point rating scale of necessity (ie, Essential = 2, Useful but Not Essential = 1, Not Necessary = 0). In total, 9 individuals scored each item. Several evaluators left insightful comments on individual items. Overall, evaluators felt that the items were useful or essential, with an average rating of 1.42/2 (Supplemental Table 1). There was general agreement that items 15, 16, 30, and 32 were not necessary. Items 13, 25, and 37 met criteria for being essential using Lawshe's equation for determining the content validity ratio (CVR), $(n_e - N/2)/(N/2)$ where n_e is the number of panelists who rated an item as "essential", N is the total number of evaluators, and $CRV = 0.78$ is the threshold for significance at $p < 0.05$.²¹ Evaluators were also encouraged to make comments about each item and reasons for their ratings. A few evaluators noted that some items (ie, 2, 9, 15, 17, 26, 30, 32) may reflect depression rather than sleep valuation.

Based largely on peer evaluation, the sleep valuation items were modified for clarity before being administered as part of a Qualtrics survey study to a sample of individuals recruited through TurkPrime. A stratified sample was sought based on age (18–99), race (50% White, 17% Black, and 8.33% for each American Indian, Asian, Pacific Islander, and other), gender (50/50 female/male), and employment status (50% employed full time and 8.33% for each part-time, homemaker, retired, student, temp worker, unemployed, and disabled). This survey study complied with the Declaration of Helsinki and the study protocol was approved by the Institutional Review Board at Brigham Young University.

Participant informed consent was obtained electronically by clicking on a button that indicated that they understood the purpose of the study, accepted the minimal risk associated with the study, and qualified for the study. Upon providing consent, participants completed a Qualtrics survey that assessed basic demographic information including gender, race/ethnicity, age, state residence, marital status, level of education, employment status, living arrangements, number of dependents, age of children, annual income, general health estimate on a scale from 0 (extremely unhealthy) to 100 (extremely healthy), caffeine consumption, drug use, and medications. Following the demographics questions, participants answered the items from the SVIB. Participants rated agreement with each item on a scale from 0 (strongly disagree) – 100 (strongly agree). They then completed questionnaires on sleep and mood including the Pittsburgh Sleep Quality Index (PSQI), a valid and reliable measure of sleep quality over the prior month,²² the Insomnia Severity Index, a 7-item reliable and valid assessment of insomnia severity,²³ the Patient-Reported Outcomes Measurement Information System (PROMIS) Depression Item Bank, a 24-item validated assessment of depression severity,²⁴ the PROMIS Sleep-Related Impairment (PROMIS-SRI) Item Bank a 16-item validated assessment of impairment related to sleep difficulty,²⁵ and the PROMIS Sleep Disturbance (PROMIS-SD) Item Bank, a validated 27-item measure of sleep disturbance severity.²⁵ At the end of the survey participants again completed the sleep valuation items. Participants were debriefed electronically after completing the survey.

Analyses

Of the 1110 individuals in the original sample pool provided by TurkPrime, 164 participants were excluded due to failure to complete at least 95% of the survey and/or completing the survey in less than 7 minutes. An additional 92 participants were excluded following a visual inspection of response set patterns. Individuals who responded consistently high or consistently low, despite negative or positive wording of items on the SVIB, were excluded. Analyses were conducted on the remaining 854 participants. Psychometric properties including distributional properties, normality, central tendency, and variance were assessed for each item of the SVIB. Agreeing with peer evaluators, items 17, 30, and 32 were removed prior to analyses due to poor face validity (ie, reflected depression). Cronbach's alpha and Pearson's correlation coefficient were used to help identify SVIB items with poor internal and test-retest reliability. Negatively worded items were reverse scored to compute the total score prior to its use in analyses (note that these items were not reverse scored in the factor analysis described below). [Supplemental Table 1](#) shows the full list of original questionnaire items and psychometric properties. Item-level correlations with the total score showed that 12 items (3, 14, 16, 20, 21, 22, 29, 31, 33, 34, and 42) had negligible to low correlations (>-0.3 to <0.3) with the total score, perhaps suggesting lesser relevance in their ability to discern overall sleep valuation. Most of these items were negatively worded. Alpha levels of the items all exceeded 0.92 with an average of 0.92, indicating acceptable internal consistency.

We performed iterated principal factoring with a Promax rotation on the remaining 40 items to explore the latent factor structure of the SVIB. Factor loadings <0.40 were suppressed. The scree plot method was used to identify the appropriate number of factors to extract, and we used Bartlett's method to compute the factor scores used in subsequent analyses.

Multiple regression analyses were used to determine the variables most strongly associated with each SVIB factor. The independent variables in the multiple regression analyses were gender referenced to "male", race/ethnicity referenced to "White", marital status referenced to "married", education referenced to "graduated 4-year college", occupation referenced to "employed full-time", general health estimate, age, income referenced to "\$10,000-\$40,000", depression severity, and insomnia severity.

To investigate whether the sleep valuation factors were more or less associated with extrinsic or intrinsic valuation, we conceptualized the PROMIS-SRI, a measure of sleep-related impairment as an instrumental valuation marker. We used Pearson correlations to quantify the association between PROMIS-SRI and each factor and then used Fisher's Z test to compare the strength of the correlations. Analyses were performed with STATA 16 (StataCorp. 2019. Stata Statistical

Software: Release 16. College Station, TX: StataCorp LLC). With the exception of the test-retest correlations, all analyses were conducted on the first administration of the SVIB.

Results

Table 1 shows the demographic features of the sample. In summary, the sample was stratified across gender (49%/50%/1% female/male/transgender), age (range 18–79), race (53% White, 18% Black, 12% Asian, 9% Latino, 5% other, 4%

Table 1 Demographic Features

Gender	
Male	427 (50%)
Female	421 (49%)
Transgender	7 (1%)
Age, y	46 (17)
Race/Ethnicity	
White/Caucasian	450 (53%)
Black/African American	152 (18%)
Asian/Asian American	100 (12%)
Latino/Latina	76 (9%)
Other	40 (5%)
Mixed	33 (4%)
Education	
Grade 7–12	30 (4%)
Graduated high school equivalent	50 (6%)
Graduated high school	134 (16%)
Some college	205 (24%)
Graduated 2-year college	97 (11%)
Graduated 4-year college	209 (25%)
Part graduate degree	21 (2%)
Completed graduate degree	105 (12%)
Income	
<\$10,000	219 (26%)
\$10,000-\$40,000	328 (39%)
\$40,001-\$90,000	210 (25%)
\$90,001-\$190,000	75 (9%)
>\$190,000	19 (2%)
Marital Status	
Married	334 (39%)
Never married	327 (38%)
Divorced/Annulled	86 (10%)
Widowed	49 (6%)
Cohabiting	44 (5%)
Separated	13 (1%)
Occupation	
Employed full-time	306 (36%)
Retired	175 (21%)
Employed part-time	97 (11%)
Unemployed, seeking work	79 (9%)
Disabled	68 (8%)
Caregiving/housekeeping full-time	52 (6%)
Full-time student/training	38 (4%)
Unemployed, not seeking work	25 (3%)
Other	7 (1%)
General health estimate	71 (22)

Note: n(%), M(SD).

mixed), and employment status (36% employed full-time, 21% retired, 11% employed part-time, 9% unemployed, seeking work, 8% disabled, 6% caregiving/house-keeping full-time, 4% full-time student/training, 3% unemployed, not seeking work, and 1% other).

In the exploratory factor analysis, we found support for four factors based on the scree plot method (Figure 1). All 4 factors had eigenvalues greater than 1 (Table 2). Item loadings are reported in Table 3. Eleven items had poor factor loadings (<0.4) or double factor loadings and were suppressed. We tentatively labeled the factors sleep wanting, sleep prioritizing, sleep onset preference, and devaluation. On the sleep wanting factor, 13 items had an average factor loading of 0.59. Most of the items on this factor suggest a desire to obtain more sleep, to sleep longer, and to obtain the benefits of sleep: “I generally *desire* more sleep”, “I would *want* to sleep more if my sleep were more restful”, “I *want* to sleep more because I feel sleepy”, and “I *want* to sleep more because I enjoy it so much” (italics added for emphasis). Several items suggest a preference to sleeping longer as opposed to getting up in the morning. On the sleep prioritizing factor, 6 items had an average factor loading of 0.64. Most of the items on this factor suggest a proactive intention to obtaining sleep on principle, which seems decoupled from the instrumental value of sleep, as reflected by item 26: “I want to sleep even when I am not sleepy”. On the sleep onset preference factor, the 3 items had an average factor loading of 0.75. Most of the items on this factor reflect an emphasis on the preference of going to sleep over other activities. On the sleep devaluation factor, 7 items had an average factor loading of 0.55. Factor correlations were medium strong among the 3 sleep valuation factors, but the sleep devaluation factor was only weakly correlated with the other factors (Table 4).

To help determine whether each factor related more or less to extrinsic valuation, we conducted follow up correlations between sleep-related impairments and each sleep valuation/devaluation factor. Using Fisher’s Z , we found that the sleep wanting factor correlated most strongly with sleep-related impairments ($r = 0.60$), as compared to the sleep prioritizing ($r = 0.28$), sleep onset preference ($r = 0.23$), and sleep devaluation ($r = -0.26$) factors, $p < 0.001$ for all comparisons.

Table 5 displays the results of the multiple regression analyses investigating the associations of each sleep valuation factor with demographic, psychological, and sleep features. In adjusted models, women had higher sleep wanting scores, lower sleep prioritizing scores, and lower sleep devaluation scores than men. Race/ethnicity, marital status, and education were largely unrelated to sleep valuation with a few exceptions. Compared to married individuals, separated individuals had lower devaluation scores, and those cohabiting had lower sleep prioritizing scores. Compared to individuals with a college education, those with 7–12 years of education had lower sleep preference scores and those with a professional degree had lower sleep devaluation scores. Age, household income, occupational status, depression severity, and insomnia severity showed nuanced patterns of significance. Older individuals had lower sleep wanting scores and lower sleep prioritizing scores but lower sleep devaluation scores. Compared to those with household income of

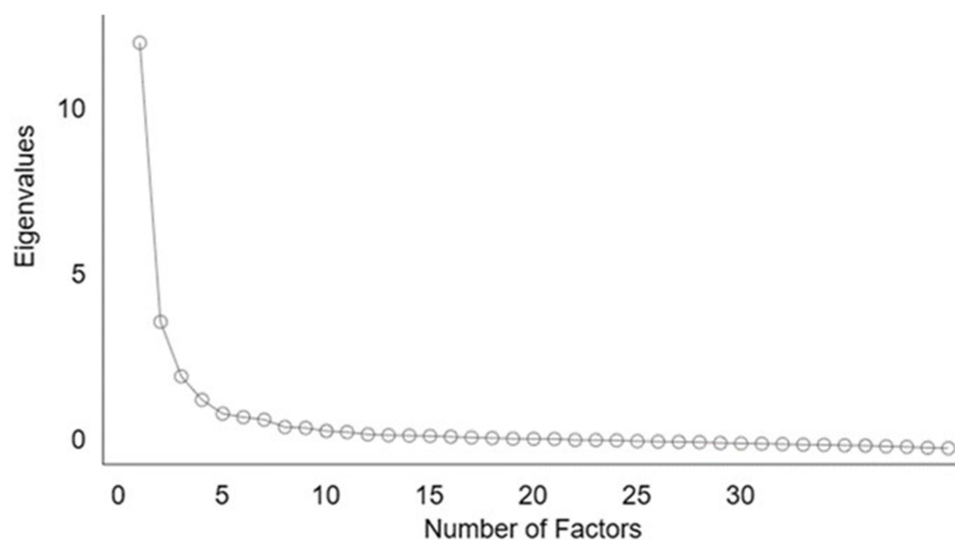


Figure 1 Scree plot with inflection point suggesting 4 factors are captured by the Sleep Valuation Item Bank.

Table 2 Factor Eigenvalues

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor 1 – Sleep Wanting	11.98	8.46	0.65	0.65
Factor 2 – Sleep Prioritizing	3.52	1.65	0.19	0.84
Factor 3 – Sleep Onset Preference	1.87	0.71	0.10	0.94
Factor 4 – Sleep Devaluation	1.16	0.42	0.06	1.00

Table 3 Exploratory Factor Analysis with a Promax Rotation of the Sleep Valuation Item Bank

Item	Sleep Wanting	Sleep Prioritizing	Sleep Onset Preference	Sleep Devaluation
4. I generally prefer to sleep in	0.708			
1. I generally desire more sleep	0.700			
6. If I had to choose between sleeping in a little longer or eating breakfast, I would choose to sleep in	0.698			
7. I try to sleep as much as I can	0.662			
23. I want to sleep more because I feel sleepy	0.638			
27. I want to sleep more because I am not getting enough restful sleep	0.624			
2. When I have nothing to do, I would prefer to sleep	0.571			
9. I would rather stay asleep than wake up	0.542			
5. When I wake up in the morning or my alarm goes off, I generally try to go back to sleep	0.536			
8. I take every opportunity I can to sleep	0.531			
18. I would want to sleep more if my sleep were more restful	0.485			
19. I want to sleep more because I enjoy it so much	0.458			
43. I try to catch up on sleep on days off	0.458			
37. I modify my daytime activities to accommodate my sleep		0.790		
36. I schedule my day around my sleep		0.748		
38. I keep track of how much sleep I have lost and how much sleep I hope to make up later		0.726		
40. If I need more sleep, I am likely to sleep in even if that means I will be late		0.541		
26. I want to sleep even when I am not sleepy		0.536		
39. If I lose sleep on one night, I try to make it up by napping or sleeping more another night		0.505		
11. I would rather get in bed to sleep at night than stay up later to do my hobbies			0.801	
12. I would rather get in bed to sleep at night than stay up to engage in social activities			0.722	
10. I would rather get in bed to sleep at night than stay up to do household tasks			0.716	
42. I feel that sleep is a waste of time				0.654
21. When I feel sleepy at night, I push through it so I can stay awake longer				0.631
31. I dread going to sleep at night				0.606
16. When I am sleepy, I would rather surf the web, watch a movie, engage in social media, or play a video game than go to sleep				0.571
29. I wish I could sleep less				0.492
20. When I feel sleepy at night, I try to go to sleep				-0.488
33. If I could function without sleep, I would sleep less than I do				0.416

Notes: Most of the items that loaded onto the devaluation factor were negatively worded, thus a higher devaluation score is derived from lower scores on those items and a higher score on item 20, which was not negatively worded. The items included in the Sleep Valuation Item Bank have been previously published and are included here in accordance with the original publishers open access policy. Adapted from Nielson SA, Taylor J, Simmons Z, Decker AN, Kay DB, Cribbet MR. Sleep valuation is associated with components of sleep health and daytime functioning in a college sample: a survey study. *Int J Environ Res Public Health* 19

Table 4 Factor Correlations

	Sleep Wanting	Sleep Prioritizing	Sleep Onset Preference
Sleep prioritizing	0.400***	–	–
Sleep onset preference	0.323***	0.329***	–
Sleep devaluation	0.136***	0.160***	-0.125***

Note: ***p < 0.001.

Table 5 Results of the Multiple Regression Predictors of Sleep Valuation Item Bank Factor Scores

Statistic	Sleep Wanting			Sleep Prioritizing			Sleep Onset Preference			Sleep Devaluation						
	f	df	p	Adj. R ²	f	df	p	Adj. R ²	f	df	p	Adj. R ²				
	9.76	35, 711	<0.001	0.291	3.53	35, 711	<0.001	0.106	2.15	35, 711	<0.001	0.051	4.59	35, 711	<0.001	0.144
Characteristic	t	p	β	t	p	β	t	p	β	t	P	β				
Gender (male comparison)																
Female	2.34	0.020*	0.085	-2.64	0.008*	-0.108	-1.51	0.130	-0.064	-2.04	0.042*	-0.081				
Transgender	0.05	0.958	0.002	0.12	0.907	0.004	0.46	0.646	0.017	0.54	0.592	0.019				
Race (White comparison)																
Black/African American	1.76	0.078	0.060	0.32	0.746	0.012	-0.20	0.838	-0.008	-1.73	0.083	-0.065				
Asian/Asian American	0.76	0.448	0.027	1.30	0.193	0.052	-0.36	0.721	-0.015	-1.15	0.250	-0.045				
Latino/Latina	0.53	0.598	0.018	0.23	0.820	0.009	1.03	0.303	0.041	-1.49	0.136	-0.056				
Other	0.04	0.965	0.002	-0.36	0.716	-0.014	-1.59	0.111	-0.062	-0.16	0.873	-0.006				
Mixed	-0.09	0.932	-0.003	-0.17	0.863	-0.006	-0.77	0.439	-0.030	0.05	0.961	0.002				
Marital status (married comparison)																
Never married	-0.07	0.943	-0.003	0.17	0.867	0.008	-0.89	0.373	-0.043	-0.40	0.687	-0.019				
Divorced/Annulled	-0.14	0.886	-0.005	0.28	0.778	0.011	-0.29	0.773	-0.012	-0.11	0.909	-0.004				
Widowed	0.73	0.466	0.026	1.03	0.305	0.040	1.15	0.250	0.047	-0.78	0.435	-0.030				
Cohabiting	0.67	0.504	0.022	-2.10	0.036*	-0.079	-1.44	0.152	-0.055	-0.29	0.775	-0.011				
Separated	-0.10	0.919	-0.003	0.01	0.990	0.001	0.02	0.981	0.001	-2.03	0.042*	-0.071				
Education (graduated 4-year college comparison)																
Grade 7–12	-0.81	0.416	-0.028	-0.34	0.733	-0.013	-2.32	0.020*	-0.092	0.40	0.678	0.015				
Graduated high school equivalent	0.95	0.344	0.033	-0.21	0.830	-0.008	-1.19	0.236	-0.047	1.86	0.064	0.070				
Graduated high school	1.26	0.207	0.049	0.58	0.565	0.025	-1.59	0.11	-0.071	1.06	0.290	0.045				
Part college or trade school but no degree	0.94	0.349	0.038	-0.72	0.471	-0.032	-1.10	0.270	-0.051	-0.73	0.466	-0.032				
Graduate 2-year college or trade school	0.89	0.371	0.032	-0.36	0.719	-0.014	-0.40	0.687	-0.017	-1.22	0.224	-0.048				
Part graduate or professional degree	0.66	0.509	0.022	0.56	0.573	0.021	-1.16	0.247	-0.044	-0.19	0.852	-0.007				
Completed graduate or professional degree	0.94	0.347	0.035	0.59	0.557	0.025	0.22	0.826	0.010	-2.24	0.025*	-0.091				

(Continued)

Table 5 (Continued).

Characteristic	t	p	β	t	p	β	t	p	β	t	P	β
Occupation (employed full-time comparison)												
Retired	-2.46	0.014*	-0.111	-1.42	0.156	-0.072	0.86	0.391	0.045	-0.93	0.350	-0.047
Part-time	-0.75	0.456	-0.027	-2.05	0.041*	-0.083	-2.13	0.034*	-0.089	-1.23	0.221	-0.048
Unemployed, seeking work	-2.77	0.006**	-0.106	-1.38	0.169	-0.059	-0.74	0.462	-0.033	-1.20	0.231	-0.050
Disabled	-1.70	0.089	-0.066	-1.46	0.144	-0.064	0.28	0.782	0.012	-1.96	0.050*	-0.084
Caregiving/housekeeping	-0.91	0.361	-0.034	-0.87	0.387	-0.036	0.94	0.349	0.041	-1.71	0.088	-0.070
Full-time student/training	-0.84	0.401	-0.030	-2.67	0.008**	-0.106	-1.49	0.137	-0.061	0.10	0.917	0.004
Unemployed, not seeking	0.55	0.586	0.019	0.29	0.773	0.011	1.20	0.229	0.047	-0.04	0.968	-0.002
Other	-1.55	0.123	-0.050	-1.89	0.059	-0.069	-0.02	0.986	-0.001	-0.52	0.605	-0.019
General health estimate	0.23	0.817	0.008	0.47	0.639	0.019	0.25	0.806	0.010	-0.89	0.372	-0.035
Age	-3.18	0.002**	-0.159	-2.34	0.019*	-0.131	0.07	0.944	0.004	-3.46	0.001**	-0.189
Income (\$10,000-\$40,000 comparison)												
\$0-\$10,000	-0.52	0.605	-0.021	-0.35	0.723	-0.016	-1.45	0.147	-0.067	0.71	0.475	0.031
\$40,001-\$90,000	-0.33	0.745	-0.012	0.04	0.971	0.002	-0.88	0.381	-0.038	0.48	0.631	0.020
\$90,001-\$190,000	1.07	0.287	0.041	3.18	0.002**	0.137	-0.74	0.460	-0.033	2.55	0.011*	0.107
\$190,000+	-0.66	0.509	-0.022	-0.65	0.514	-0.024	-0.17	0.867	-0.006	0.55	0.580	0.020
Depression	1.52	0.129	0.065	2.81	0.005**	0.135	2.37	0.018*	0.118	2.38	0.017*	0.112
Insomnia Severity Index score	9.93	<0.001***	0.414	1.75	0.080	0.082	2.63	0.009**	0.127	3.20	0.001**	0.147

Note: Bolded values signify significance at * $p < 0.05$, ** $p < 0.01$, or *** $p < 0.001$.

\$10,001-\$40,000, individuals who endorsed \$90,001-\$190,000 yearly income had higher sleep prioritizing scores but higher sleep devaluation scores as well. Individuals with greater depression symptoms had higher sleep prioritizing and sleep onset preference scores, but also higher sleep devaluation scores. Individuals with more severe insomnia had higher sleep wanting and sleep preference scores, but again higher sleep devaluation scores.

Discussion

A primary aim of this study was to explore the latent factor structure of the SVIB, a novel instrument designed to study sleep valuation. Using factor analysis, we found evidence for four factors, which we tentatively labeled sleep wanting, sleep prioritizing, sleep onset preference, and sleep devaluation. Conceptually, factors 1 (wanting) and 3 (preference) include items that signify preference for sleep. However, the preference tends to be for different aspects of sleep, the former staying asleep and the latter going to sleep. The distinction between these factors may relate to the concept of diminishing marginal utility in which each unit of gain is associated with a smaller increase in valuation. From this perspective, sleep onset preference may gain relative value due to its primacy in satisfying the sleep need and the value of waking activities diminishes across the day. In contrast, the sleep wanting factor appears to be more relative to the enjoyment, satisfaction, benefits, or satiation the individual obtains from sleep relative to the wake state. The finding of a stronger correlation between daytime sleep-related impairment and the sleep wanting factor supports the interpretation that it is more related to the utility of sleep. A seemingly odd loading was a “desire” item in the sleep prioritizing factor: “I want to sleep even when I am not sleepy”. However, as with the other items that loaded on this factor, it seems to be more suggestive of commitment to sleep regardless of sleep need, rather than a desire for sleep because of sleep need. The fourth factor, sleep devaluation, was unique in several ways. Its items tended to correlate poorly with the sleep valuation total score and its factor score was only weakly correlated with the other sleep valuation factors. The positive correlations found for sleep devaluation with the sleep wanting and sleep prioritizing factors were somewhat surprising but highlight that many people are ambivalent about sleep. A previous national survey supports a common ambivalence towards sleep’s value, in that 82% of Americans reported that an extra hour of sleep at night would be somewhat or extremely valuable to them, yet only 26% of respondents said they would choose sleep over other activities if they were given an extra hour in the day.⁵ Despite clear intrinsic and extrinsic value, as much as 15% of respondents in that survey had negative feelings about sleep or felt that sleep is a waste of 1/3 of their lives.⁵ More broadly, many people are willing to sacrifice sleep health for other activities, including academic study, social engagement, media use, and entertainment.^{26–28} Collectively, these findings suggest that sleep devaluation and sleep valuation may be separate constructs, as opposed to opposite ends of the same dimension. Collectively, we found evidence for 3 sleep valuation factors and a devaluation factor. As outlined in the introduction, valuation is often broken down into intrinsic and extrinsic types. Our factors did not map cleanly onto this conceptualization. The identified factors appear to reflect broad dimensions of sleep valuation rather than explanatory mechanisms (ie, extrinsic vs intrinsic).

Another major aim of this study was to explore how sleep valuation factors related to individual differences in demographic, psychological, and sleep features. We found several interesting patterns in relation to prior studies. First, while prior evidence suggested that women tend to value sleep more than men, our results suggest that sleep valuation between men and women is more nuanced.^{19,20} Compared to men, women had higher sleep wanting scores and lower sleep devaluation scores, but men tended to have higher sleep prioritizing scores than women. These findings support high levels of ambivalence about sleep’s value among both men and women. Second, consistent with a previous national survey,^{5,20} we found a clear pattern of decreased sleep valuation with age across 3 of the sleep valuation factors. Yet, older individuals tended to devalue sleep less than younger participants. Third, prior evidence has linked employment to sleep behavior. We found that individuals working full-time tended to value sleep more than individuals with other types of work status, but again patterns of associations were nuanced. Interestingly, students tended to have lower sleep prioritizing scores than full-time workers, suggesting they value sleep but are less preoccupied with prioritizing it. The finding that unemployed individuals had lower wanting scores than full-time workers was unexpected, as prior studies showed that unemployed individuals tend to have poorer sleep,²⁹ and poor sleep has been linked to greater sleep valuation.¹⁹ Fifth, congruent with our previous study, we found that those with poorer mental health as indexed by greater depression or greater insomnia tended to have higher sleep valuation.¹⁹ For depression, this was limited to the prioritizing and preference factors. We found no evidence that those with more depressive symptoms wanted sleep more, but they did have higher devaluation. For insomnia, the nuanced pattern across factors was intriguing. Those with more insomnia symptom severity wanted sleep more and valued sleep onset but had greater sleep devaluation. Surprisingly, there was only a trend for sleep prioritizing associated with

insomnia severity. A common clinical observation is that individuals with insomnia desire sleep greatly, potentially maladaptively; this, coupled with a high valuation for sleep onset preference and devaluation of sleep, may contribute to the clinical presentation of insomnia. In combination with our previous study, these results suggest that sleep valuation relates to many person-level factors.

This study has notable limitations. Because the study was conducted online, participants may have rushed through the questions, particularly while doing the relatively long SVIB. At least 10% of respondents appeared to not take notice of the negative wording of several items, responding in a consistent pattern regardless of the direction of the questions. We were able to remove many of the more egregious patterns of response sets through visual inspection of the data, but many of the remaining participants may have missed the need to respond differently on the sleep devaluation items. This may explain, in part, the poor correlation between devaluation items and sleep valuation total score. Separating out the devaluation items from the SVIB may be advisable to explore how a response set may have influenced the results. The current item bank is by no means comprehensive, and development of additional sleep valuation items is warranted. We did not find factors that reflect cleanly, other broad aspects of valuation such as sleep liking, sleep enjoyment, sleep importance, or sleep satisfaction. The lack of a significant loading of item 41 “I enjoy sleeping” may suggest that more items are needed to capture pleasure-based components of sleep valuation such as “liking” or “enjoying” sleep. To capture a distinction between intrinsic and extrinsic valuation, items that more explicitly ask about secondary benefits of sleep are warranted.

The importance of values on attitudes and behavior is well recognized in social science research and in clinical practice more broadly. A rich literature on valuation theory and research has relevance to the field of sleep and sleep medicine. In this study, we focused on sleep valuation at the individual level. Future studies on the antecedents and consequences of sleep valuation are needed. Studies on the relationships between sleep valuation and treatment seeking for sleep problems, willingness to pay for sleep therapy, and adherence to treatment recommendations may inform efforts to promote sleep health and may help to predict treatment outcomes. For example, in cognitive-behavioral therapy for insomnia (CBTI), a major component of treatment is changing dysfunctional beliefs and attitudes about sleep. Research is needed to test if sleep valuation can be used to determine whether treatment effectively replaced maladaptive beliefs and attitudes about sleep with more adaptive ones. Value interventions in the context of sleep medicine may be one interesting untapped adjunct to CBTI and other psychological approaches to insomnia (e.g., Acceptance and Commitment Therapy for Insomnia). Sleep valuation is a novel concept and many questions about it remain. [Supplemental Table 2](#) lists several future directions and questions to facilitate research on this topic.

Conclusion

Sleep valuation is a novel concept with implications on sleep health. Ours is the first study to investigate the latent structure of sleep valuation and how sleep valuation subfactors relate to person-level variables including demographic, psychological, and sleep features. The latent structure found using the SVIB taps into broad domains of valuation including wanting, prioritizing, preferring, and devaluation of sleep. We found wide individual differences in these sleep valuation factors that related to age, gender, employment status, income, depression, and insomnia. Additional work is required to refine the SVIB and eventually validate a brief sleep valuation questionnaire. This line of research may help identify the influence of sleep valuation on sleep health disparities and sleep-related decision-making.

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Disclosure

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