

Sleep Duration and Subjective Cognitive Decline Among Adults Aged 45 Years and Older: A Cross-Sectional Analysis of the Behavioral Risk Factor Surveillance System, 2018, 2020, and 2022

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Abstract. Introduction: Sleep duration has declined in recent years, with evidence suggesting downstream cognitive consequences. This study examines the association between sleep duration and subjective cognitive decline (SCD), highlighting the potential parallels between insufficient sleep and self-perceived cognitive impairment.

Methods: The present study used the 2018, 2020, and 2022 Behavioral Risk Factor Surveillance System (BRFSS), an annual, state-based, telephone survey of U.S. adults conducted by the CDC. Sleep duration was self-reported. The Cognitive Decline module is optional; it was fielded by 27 jurisdictions across the three cycles, so estimates represent participating jurisdictions rather than the nation. Participants were adults aged ≥ 45 years ($n=137,930$). Covariates are demographics, socioeconomic factors and health behaviors/comorbidities. Consequential SCD was defined as SCD accompanied by functional interference with household activities such as chores, or with work, volunteering or social activities. Results: Among 40,631 participants who slept < 7 hours, 12.6% had SCD; 14.7% among those who slept ≥ 9 hours. Compared with those sleeping 7–8 hours, adults sleeping < 7 hours had higher odds of SCD (OR 1.43, 95% CI 1.28–1.60) and of consequential SCD (OR 1.54, 95% CI 1.29–1.84). Adults sleeping ≥ 9 hours had higher odds of SCD (OR 1.37, 95% CI 1.19–1.57) and of consequential SCD (OR 1.69, 95% CI 1.36–2.09). Only 47.3% of adults with SCD had ever discussed these symptoms with a health professional — 35.0% without functional limitation versus 58.8% with ($p<0.001$).

Conclusion: Given that both insufficient and excessive sleep were associated with increased odds of SCD, these findings highlight sleep duration as a factor for cognitive decline. Because this study used cross-sectional data, it cannot establish a causal or temporal relationship among hours of sleep, SCD, and SCD-related functional limitation.

Keywords. Sleep duration; Subjective cognitive decline (SCD); Cognitive aging; Functional limitation; Cross-sectional study

1. Introduction

According to the Centers for Disease Control and Prevention, approximately 30% of Americans obtain insufficient sleep.¹ Insufficient sleep has been shown to exert adverse physiological effects and impair bodily function. Lee et al previously demonstrated, using data from the 2018 Korea Community Health Survey, a higher prevalence of subjective cognitive decline (SCD) among individuals with poor sleep quality, as measured by the Pittsburgh Sleep Quality Index (PSQI).² Zimmerman et al conducted a clinical trial to compare performance outcomes under conditions of insufficient versus adequate sleep. Utilizing baseline assessments and practice trials, Zimmerman et al reported that practice effects were diminished among participants who slept an insufficient amount relative to those who obtained adequate sleep.³ However, existing research provides limited evidence establishing a correlation between sleep duration and SCD, particularly within the American population. Understanding this relationship is critical, as subjective cognitive decline is often an early indicator of more serious neurocognitive disorders, and identifying modifiable risk factors such as sleep duration could inform early intervention strategies aimed at preserving cognitive health in aging populations. The objective of this study is to examine whether individuals who sleep for < 7 or ≥ 9 hours exhibit a correlation

with SCD. We hypothesize that adults who sleep for < 7 or ≥ 9 hours will demonstrate a higher incidence of subjective cognitive decline.

2. Methods

2.1. Study Design and Data Source

We analyzed the Behavioral Risk Factor Surveillance System (BRFSS), an annual, state-based, cross-sectional telephone survey of non-institutionalized U.S. adults conducted by the Centers for Disease Control and Prevention (CDC).⁴ Public-use SAS transport (.XPT) Landline/Cellphone (LLCP) files were used. The exposure and outcome co-occur only in survey years that field both the sleep item and the optional Cognitive Decline module, namely 2018, 2020 and 2022.

2.2. Study Population

The habitual sleep-duration item (SLEPTIM1) appears in the 2018, 2020 and 2022 public-use files and is absent from 2019, 2021, 2023 and 2024, so a 2024-only analysis was not possible. The Cognitive Decline module continued to be fielded in 2023 and 2024 (renamed CIMEMLO1); it is the sleep item, not the module, that limits the eligible cycles. We therefore pooled the three most recent eligible cycles — 2018, 2020 and 2022 — each of which contains both SLEPTIM1

and the Cognitive Decline module. Files for 2018, 2020 and 2022 were obtained from the CDC BRFSS annual-data portal. Each file was read and variables were harmonized across cycles, reconciling year-to-year variable-name changes (sex SEX1→SEXVAR; depression ADDEPEV2→ADDEPEV3; income _INCOMG→_INCOMG1; race/ethnicity _RACEGR3→_RACEGR4, which use an identical five-level scheme). To account for pooling three independent annual samples, the design weight was divided by the number of pooled years (pooled weight = $_LLCPWT / 3$)⁴, and the sampling stratum was defined as the interaction of survey year and BRFSS stratum (_STSTR). The Cognitive Decline module is optional and separately elected by each jurisdiction. It was fielded by 3 jurisdictions in 2018, 18 in 2020 and 12 in 2022 — 27 distinct jurisdictions in total, of which two (the District of Columbia and Puerto Rico) are not states, and only Oregon participated in all three cycles. Pooled, these respondents represent 10.9% of BRFSS participants over the three cycles. BRFSS weights yield estimates representative of the adult population of each participating jurisdiction; they do not make this set of jurisdictions representative of the United States as a whole.

2.3. Measures

SCD: Assessed with the BRFSS Cognitive Decline module core item (CIMEMLOS):

“During the past 12 months, have you experienced confusion or memory loss that is happening more often or is getting worse?”

Respondents answering “Yes” were classified as having SCD (=1) and “No” as not (=0); “Don’t know/not sure” and “Refused” were set to missing. This single item is the standard BRFSS SCD definition used in prior CDC surveillance reporting; it operationalises the construct set out in the international consensus framework for subjective cognitive decline.^{5,6}

Consequential SCD: Because a crude yes/no item cannot distinguish incidental from disabling symptoms, we additionally defined a severity outcome.

Among respondents with SCD, the module administers follow-up items on functional impact, each scored 1=Always, 2=Usually, 3=Sometimes, 4=Rarely, 5=Never: giving up day-to-day household activities or chores (CDHOUSE); needing assistance with those activities (CDASSIST); and interference with work, volunteering, or social activities (CDSOCIAL). A further item (CDDISCUS) records whether the person discussed the symptoms with a health professional.⁵

We defined consequential SCD as SCD accompanied by functional interference occurring “always,” “usually,” or “sometimes” (codes 1–3) on any of the three interference items (CDHOUSE, CDASSIST, or CDSOCIAL); the denominator is all analytic respondents (i.e., non-SCD respondents are coded 0). A three-level cognitive status variable (no SCD / SCD without functional limitation / consequential SCD) was derived from the same items. In a sensitivity analysis we

applied a stricter threshold requiring interference “always” or “usually” (codes 1–2).

Habitual sleep duration (SLEPTIM1: self-reported average hours of sleep per 24 hours; valid range 1–24) was modeled two ways: a five-level categorical variable (≤ 4 , 5–6, 7–8, 9, ≥ 10 hours) for the dose-response/U-shape description and figure, and a three-level variable (short <7h; normal 7–8h [reference]; long ≥ 9 h)^{7,8} for regression.

Covariates, entered in blocks, were: demographics (age group, sex, race/ethnicity); socioeconomic factors (education, household income, marital status, employment); and health behaviors/comorbidities (BMI category, smoking status, physical-activity in past 30 days, ever-diagnosed depression, and general health). Analysis was restricted to adults aged ≥ 45 years, consistent with the module’s target population and prior SCD literature.⁵

2.4. Statistical Analysis

All estimates incorporated the BRFSS complex survey design using Taylor-series linearization (R survey package)⁹. Following CDC BRFSS analytic guidance⁴, the design was specified with strata (year $\times$ _STSTR) and the pooled final weight, with $ids \sim 1$ (the public-use _PSU field is a record identifier rather than a true sampling cluster). Table 1 reports survey-weighted percentages by sleep category with design-based Rao–Scott χ^2 tests.¹⁰ Table 2 reports survey-weighted SCD and functional-item prevalences with 95% confidence intervals across the five-level sleep variable. Table 3 reports the survey-weighted proportion of SCD-positive respondents who had discussed their symptoms with a health professional, overall and by SCD severity.

The primary inferential analysis was a pre-specified sequentially adjusted (hierarchical) logistic regression: Model 1 unadjusted; Model 2 adds demographics; Model 3 adds socioeconomic factors; Model 4 adds health behaviors and comorbidities. Models were fit as design-weighted quasibinomial GLMs and are reported as odds ratios with 95% CIs for short and long sleep versus the 7–8h reference. To ensure that movement in the estimate across models reflects adjustment rather than changing samples, Models 1 through 4 were fitted on the common complete-case sample ($N = 103,296$). Model 4c was fitted on 103,262 of those respondents, excluding 34 who were SCD-positive but could not be classified by severity. The same Model-4 specification was refitted with consequential SCD as the outcome (Model 4c). Effect modification by depression was tested with a design-based Wald test of the sleep $\times$ depression interaction ($p = 0.34$; not retained). Two sensitivity analyses were pre-planned: refitting Model 4 within each survey year, and applying the stricter consequential-SCD threshold. Analyses were conducted in R 4.6 using the survey package for weighted estimation; the full analysis pipeline is scripted and reproducible.

2.5. Ethical Considerations

Because BRFSS data are publicly available, de-identified, and collected by the CDC using a standardized protocol, this study does not constitute human-subjects research and did not require Institutional Review Board (IRB) review.

3. Results

3.1. Sample Characteristics

The final analytic sample included 137,930 adults from the pooled 2018, 2020, and 2022 BRFSS cycles, after excluding respondents with missing or refused sleep and SCD data (Table 1). Short sleep duration (<7 hours) was reported by 32.6% of the weighted sample, normal sleep duration (7–8 hours) by 58.8%, and long sleep duration (≥9 hours) by 8.6%.

Participants across sleep duration categories differed significantly on nearly all sociodemographic and health-related characteristics examined (all $p < 0.001$, Rao-Scott χ^2), with the exception of sex ($p = 0.73$). Compared to normal sleepers, short sleepers were disproportionately younger, had lower household income, and were more likely to be employed, whereas long sleepers were disproportionately older, more likely to be retired, and had a higher prevalence of inability to work (13.8% vs 12.7% among short sleepers and 5.4% among normal sleepers). Racial and ethnic composition also varied across groups, with White non-Hispanic participants comprising a smaller proportion of short sleepers (67.9%) relative to normal (76.8%) and long sleepers (75.5%).

Health-related characteristics followed a similar pattern of disparity. Obesity prevalence was highest among short sleepers (39.2%) and lowest among normal sleepers (31.5%), while short sleepers exhibited the highest prevalence of current smoking (17.1%). Depression history was most common among long sleepers (26.2%), followed by short sleepers (23.4%) and normal sleepers (14.3%). Physical activity was lowest among long sleepers (61.8%) and highest among normal sleepers (76.9%). Rural residence was also more common among long sleepers (8.1%) compared to short (7.5%) and normal sleepers (6.8%).

3.2. Primary Outcome

Among participants who reported the recommended sleep duration (7–8 hours), the prevalence of SCD was 6.9% (95% CI: 6.5–7.2), with a prevalence of consequential SCD of 2.8% (95% CI: 2.5–3.1). Among participants who reported sleeping four hours or less, the prevalence of SCD was substantially higher at 22.2% (95% CI: 19.5–24.8), with a prevalence of consequential SCD of 16.8% (95% CI: 14.3–19.2). Participants who reported sleeping five to six hours exhibited a prevalence of 11.2% (95% CI: 10.5–11.9) for SCD and 6.0% (95% CI: 5.4–6.6) for consequential SCD. Among participants who reported sleeping nine hours, the prevalence of SCD was 9.6% (95% CI: 8.3–10.8), with a corresponding prevalence of consequential SCD of 4.3% (95% CI: 3.3–5.3). Finally, participants who reported sleeping ten hours or more exhibited the highest

Table 1. Characteristics of the study sample.

Characteristic	Short <7h	Normal 7–8h	Long ≥9h	p†
Weighted % of population	32.6	58.8	8.6	—
Age 45–54	31.5	26.5	18.5	<0.001
55–64	32.8	29.1	22.7	
65–74	22.8	26.7	28.5	
75+	12.9	17.8	30.4	
Female	53.1	53.1	54.0	0.73
White NH	67.9	76.8	75.5	<0.001
Black NH	12.4	7.4	10.7	
Hispanic	12.1	10.1	9.4	
Other/Multiracial NH	7.6	5.7	4.4	
Education: < high school	13.7	9.5	15.0	<0.001
High school graduate	28.3	26.0	29.4	
Some college	32.7	30.2	31.0	
College graduate	25.3	34.3	24.7	
Income < \$25k	26.7	17.5	31.1	<0.001
\$25k–\$50k	23.2	23.1	28.6	
≥ \$50k	50.1	59.4	40.3	
Married	54.6	63.8	54.0	<0.001
Employed	46.5	46.4	22.7	<0.001
Unemployed	5.1	3.7	4.6	
Homemaker/Student	4.4	4.6	4.4	
Retired	31.3	39.9	54.5	
Unable to work	12.7	5.4	13.8	
BMI: underweight (<18.5)	1.4	1.3	2.0	<0.001
Normal weight (18.5–<25)	24.0	28.9	28.8	
Overweight (25–<30)	35.4	38.4	35.1	
Obese (≥30)	39.2	31.5	34.2	
Current smoker	17.1	10.6	14.9	<0.001
Physically active	66.8	76.9	61.8	<0.001
Depression history	23.4	14.3	26.2	<0.001
Rural residence	7.5	6.8	8.1	<0.001
Urban residence	92.5	93.2	91.9	

Values are survey-weighted column percentages. For multi-level variables (age, race/ethnicity, education, income, employment, BMI, residence) categories sum to ~100%; binary indicators (female, married, current smoker, physically active, depression history) show the percentage with the characteristic. The reference category is former/never smokers for current smoking and physically inactive adults (no leisure-time physical activity in the past 30 days) for physical activity. Unweighted Ns: short 40,631; normal 84,328; long 12,971. †Design-based Rao–Scott χ^2 p-value (one test per variable, shown on the variable's first row). Source: BRFSS 2018+2020+2022 pooled, adults ≥45 y; excludes missing/refused sleep or SCD. Final analytic N = 137,930.

prevalence rates among the extended-duration categories, with a prevalence of 20.5% (95% CI: 18.3–22.8) for SCD and 14.6% (95% CI: 12.6–16.6) for consequential SCD.

Among respondents reporting any SCD ($n = 13,096$), 47.3% (95% CI: 45.4–49.2) had discussed their cognitive symptoms with a health professional. This proportion varied by symptom severity: among respondents with SCD but no functional limitation ($n = 7,088$), 35.0% (95% CI: 32.8–37.3) reported discussing their symptoms with a health professional, compared to 58.8% (95% CI: 55.8–61.7) among those with consequential SCD ($n = 5,996$). This gradient was statistically significant (design-based Rao-Scott χ^2 , $p < 0.001$), indicating that respondents with more severe cognitive symptoms were more likely to have sought professional consultation. Twelve SCD-positive respondents with a valid response could not be classified by severity because of missing functional-limitation items, so the two severity groups sum to 13,084 rather than

Table 2. Weighted prevalence of subjective cognitive decline and of functional impact, by reported sleep duration.

Sleep (h)	n	Any SCD % (95% CI)	Consequential SCD %‡ (95% CI)	Among SCD+: % consequential	Gave up household§	Interferes social/work§	Discussed w/ provider§
≤4	5,088	22.2 (19.5–24.8)	16.8 (14.3–19.2)	75.9	60.3	54.9	56.6
5–6	35,543	11.2 (10.5–11.9)	6.0 (5.4–6.6)	54.0	40.1	38.6	47.3
7–8 (ref)	84,328	6.9 (6.5–7.2)	2.8 (2.5–3.1)	41.5	27.6	26.6	43.9
9	7,495	9.6 (8.3–10.8)	4.3 (3.3–5.3)	44.9	27.1	26.2	50.0
≥10	5,476	20.5 (18.3–22.8)	14.6 (12.6–16.6)	71.5	56.4	49.5	52.2

Survey-weighted percentages (95% CI). ‡Consequential SCD = SCD and functional interference (household, social/work, or self-care assistance) occurring always/usually/sometimes; denominator = all respondents. §Among SCD-positive respondents. Source: BRFSS 2018+2020+2022 pooled, adults ≥45 y, N = 137,930.

13,096. Notably, despite this gradient, over half of all adults with any SCD, and roughly two in five of those with consequential SCD, had never discussed their symptoms with a health professional.

Table 4 presents results from a hierarchical series of survey-weighted logistic regression models examining the association between short (<7 hours) and long sleep (≥9 hours) duration and SCD, using the complete-case sample (N = 103,296) with 7–8 hours as the reference category. In the unadjusted model (M1), both short sleep and long sleep were associated with significantly higher odds of SCD relative to normal sleep duration (short: OR = 2.03, 95% CI: 1.83–2.24; long: OR = 2.29, 95% CI: 2.00–2.61).

This association was attenuated but remained statistically significant after sequential adjustment for covariates. Adjusting for demographic characteristics (age, sex, race/ethnicity; M2) slightly increased the estimate for short sleep and reduced it for long sleep (short: OR = 2.08, 95% CI: 1.88–2.30; long: OR = 2.18, 95% CI: 1.90–2.49), while subsequent adjustment for socioeconomic factors (education, income, marital status, employment; M3) substantially reduced the association (short: OR = 1.73, 95% CI: 1.56–1.91; long: OR = 1.68, 95% CI: 1.46–1.93). Further adjustment for behavioral and comorbidity variables (BMI, smoking, physical activity, depression, general health; M4) attenuated the association slightly further, though it remained significant (short: OR = 1.43, 95% CI: 1.28–1.60; long: OR = 1.37, 95% CI: 1.19–1.57).

In the fully adjusted model restricted to consequential SCD as the outcome (M4c), short and long sleep duration remained significantly associated with higher odds of consequential SCD

(short: OR = 1.54, 95% CI: 1.29–1.84; long: OR = 1.69, 95% CI: 1.36–2.09). All odds ratios across models were statistically significant ($p < 0.001$). A Wald test for a potential interaction between sleep duration and depression was not significant ($p = 0.34$), indicating no evidence that the association between sleep duration and SCD differed by depression status.

4. Discussion

4.1. Principal Findings

Among adults aged 45 years and older in the jurisdictions that fielded the BRFSS Cognitive Decline module, short and long sleep duration was associated with elevated odds of subjective cognitive decline, measured as confusion or memory loss that is occurring more often or getting worse. These cognitive difficulties were associated with meaningful functional impact, as affected adults reported reduced participation in valued activities, including social engagements and household responsibilities.

4.2. Comparison with Prior Literature

Prior literature, such as Lee et al,² established an association between sleep quality and SCD. The present study extends this line of inquiry by examining sleep duration rather than sleep quality, demonstrating a significant correlation between hours slept and SCD. Lee et al also considered SCD-related functional difficulties; the present study extends that work

Table 3. Discussion of memory symptoms with a health professional, among adults with SCD

Group	n	Discussed w/ health professional % (95% CI)
Any SCD	13,096	47.3 (45.4–49.2)
SCD without functional limitation	7,088	35.0 (32.8–37.3)
Consequential SCD	5,996	58.8 (55.8–61.7)

Survey-weighted percentages (95% CI) among respondents with SCD. The CDDISCUS item was administered only to SCD-positive respondents, so the denominator is SCD-positive respondents with a valid response (n shown). Source: BRFSS 2018+2020+2022 pooled, adults ≥45 y.

Table 4. Hierarchical survey-weighted logistic regression

Model	Short <7h OR (95% CI)	Long ≥9h OR (95% CI)
M1 — Unadjusted	2.03 (1.83–2.24)	2.29 (2.00–2.61)
M2 — + demographics	2.08 (1.88–2.30)	2.18 (1.90–2.49)
M3 — + socioeconomic	1.73 (1.56–1.91)	1.68 (1.46–1.93)
M4 — + behaviors/comorbidities	1.43 (1.28–1.60)	1.37 (1.19–1.57)
M4c — Consequential SCD (M4 covariates)	1.54 (1.29–1.84)	1.69 (1.36–2.09)

Odds ratios (95% CI) for short (<7h) and long (≥9h) sleep vs 7–8h reference; Models 1–4 on the common complete-case sample (N = 103,296); Model 4c on 103,262. Design-weighted quasibinomial GLM. M2 adds age, sex, race/ethnicity; M3 adds education, income, marital status, employment; M4 adds BMI, smoking, physical activity, depression, general health. All ORs $p < 0.001$. Sleep×depression interaction Wald $p = 0.34$ (NS). Source: BRFSS 2018+2020+2022 pooled, adults ≥45 y.

by relating sleep duration specifically to functionally limiting cognitive decline in a U.S. survey sample. Additionally, Lo et al¹¹ investigated polymorphisms of the PER3 gene, reporting that variation in this gene is associated with differences in alertness and wakefulness. These findings introduce a genetic component to the relationship between sleep and cognition, offering a potential explanation for interindividual variability in vulnerability to sleep loss. Zimmerman et al³ similarly demonstrated that insufficient sleep impairs short-term memory and diminishes the benefits gained from skill practice. While the present study's outcome measures primarily reflect subjective cognitive decline and long-term memory, the observed association between short and long sleep duration (<7 or ≥9 hours) and SCD suggests that both short-term and long-term memory processes may be adversely affected by sleep duration. Notably, the present study identifies a U-shaped association between sleep duration and SCD, with elevated odds of cognitive decline observed at both short (<7 hours) and long (≥9 hours) sleep durations relative to the 7–8 hour reference group. A comparable U-shaped association between sleep duration and long-term cognitive decline has been reported in a national cohort, though for objectively assessed cognition rather than for functionally consequential subjective decline. Zimmerman et al³ examined performance outcomes under conditions of sleep restriction but did not address whether excessive sleep duration similarly impairs cognitive function. Likewise, Lee et al² examined sleep quality broadly rather than duration, and did not report findings specific to long sleep duration. The consistency of elevated SCD odds across both ends of the sleep duration spectrum in the present study suggests that cognitive risk may not be driven solely by sleep insufficiency, but rather by deviation from an optimal sleep duration range.

Several biological mechanisms may help explain the observed association between sleep duration and SCD. During sleep, the glymphatic system facilitates clearance of metabolic waste products from the brain, including amyloid-beta and tau proteins; this clearance is accelerated during normal sleep compared to sleep deprivation, as demonstrated in a randomized crossover trial showing that glymphatic clearance during normal sleep increased morning plasma levels of Alzheimer's disease biomarkers relative to sleep deprivation.¹² Short sleep duration may therefore impair this clearance mechanism, contributing to the accumulation of amyloid-beta and tau, whose pathological aggregation is implicated in cognitive decline. Furthermore, sleep disturbance and long sleep duration have been associated with elevated systemic inflammatory markers, including C-reactive protein and interleukin-6, which have in turn been linked to poorer cognitive outcomes.¹³ Taken together, these mechanisms suggest that the pattern observed in the present study may reflect distinct but converging pathological pathways at the extremes of the sleep duration spectrum. Further longitudinal and mechanistic research is needed to clarify these pathways and establish causality.

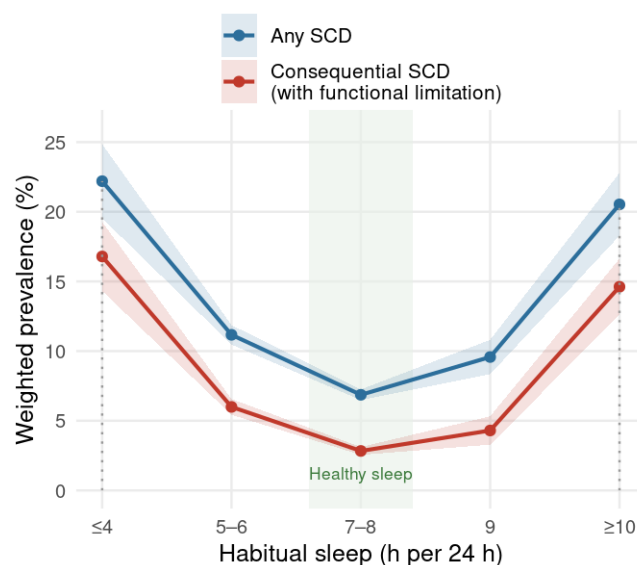


Figure 1. Weighted prevalence of any subjective cognitive decline and of consequential SCD, by reported hours of sleep per 24 hours. BRFSS 2018, 2020 and 2022 pooled; adults aged 45 years and older in jurisdictions fielding the Cognitive Decline module (N = 137,930). Estimates are unadjusted and account for the complex survey design; shaded bands are 95% confidence intervals. Consequential SCD denotes SCD with functional interference occurring always, usually or sometimes.

4.3. Interpretation and Public Health Significance

Both short and long sleep duration were associated with a higher prevalence of SCD and consequential SCD, producing the U-shaped pattern shown in Figure 1. This shows that cognitive risk might increase from a short or long amount of hours slept and there is a range of hours slept in which cognitive decline chance decreases. The persistence of this association, even after adjusting for covariates, could suggest that sleep duration may be independently associated with SCD. Furthermore, these findings point to a broader public health concern: a substantial proportion of participants with consequential SCD had not discussed their symptoms with a health care professional. This finding is significant, as it suggests a potential lack of awareness, among either patients or providers, or both, regarding SCD and its associated functional consequences. The overall proportion who had discussed their symptoms with a health professional (47.3%) closely reproduces the 45.4% reported in CDC surveillance for 2015–2016, indicating that this gap has persisted across a different set of years and jurisdictions.

4.4. Strengths and Limitations

This study is strengthened by several methodological features. First, it draws on a large population-based sample of 137,930 adults aged 45 years and older from the pooled 2018, 2020, and 2022 BRFSS cycles, giving precise estimates within the jurisdictions that fielded the Cognitive Decline module. Second, all analyses incorporated survey weighting to account

for the complex sampling design of BRFSS, yielding more accurate population-level prevalence estimates and minimizing bias arising from unequal probabilities of selection. Third, the hierarchical regression approach permitted systematic adjustment across multiple covariate domains (demographic, socioeconomic, and behavioral/comorbidity factors) allowing for a more precise evaluation of the extent to which the association between sleep duration and SCD persisted independent of these factors, rather than relying on a single, fully adjusted model alone. Finally, the inclusion of consequential SCD as a distinct outcome, in addition to any SCD, enabled a more clinically meaningful assessment of functional impact, rather than relying solely on the presence or absence of subjective cognitive symptoms.

Because the data are cross-sectional, exposure and outcome were measured at the same point in time and no causal or temporal ordering can be established. Reverse causation is plausible: early cognitive change may itself disrupt sleep, so the association may partly reflect cognitive decline acting on sleep duration rather than the reverse. Residual confounding is also possible, since unmeasured factors — undiagnosed illness or medication use, for example — could influence both sleep duration and cognition. Finally, both the exposure and the outcomes are self-reported and may be subject to recall and social-desirability bias; no imputation was performed, and all analyses are complete-case.

A further limitation concerns generalizability. The Cognitive Decline module is not part of the BRFSS core: each jurisdiction chooses whether to field it, and only 27 did so across the three cycles studied, with participation heavily uneven (3 jurisdictions in 2018 against 18 in 2020). Jurisdictions that elect an optional cognitive-health module may differ systematically from those that do not, in the prevalence of cognitive symptoms as well as in the age structure and health profile of their populations. The estimates reported here should therefore be read as describing the participating jurisdictions, not the United States as a whole, and national prevalence should not be inferred from them.

4.5. Future Directions

Future efforts to increase awareness among health professionals regarding SCD and its associated risk factors, including short and long sleep duration, may improve early identification and management of SCD-related symptoms. Enhanced patient education could also encourage individuals experiencing cognitive symptoms to seek timely medical consultation, potentially mitigating the functional impact associated with untreated SCD.

4.6. Conclusion

In summary, this study found that adults who report either short (<7 hours) or long (≥ 9 hours) demonstrate significantly higher odds of subjective cognitive decline compared to those sleeping the recommended 7–8 hours. These cognitive difficulties were associated with meaningful functional impact in daily life,

yet a substantial proportion of affected individuals had not discussed their symptoms with a health professional. These findings underscore the importance of sleep duration as a potentially modifiable factor in cognitive health and highlight a need for improved clinical awareness and screening for SCD among adults with these short and long sleep patterns.

Declarations

Funding. None.

Conflicts of interest. None declared.

Data availability. Analyses used publicly available, de-identified survey data.

AI use. Claude (Anthropic) was used to assist in writing the R code for the survey-weighted analyses and in drafting and editing portions of this manuscript during pre-submission review. The authors reviewed and verified all AI-assisted output, including every statistical result reported here, and take full responsibility for the content of this manuscript. AI tools are not authors of this work.

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