

SUPPLEMENT

An International Multi-Cohort Evaluation of Self-Reported Sleep and Future Depressive Symptoms in Older Adults

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Table of Contents

Supplement A: Cohort Characteristics and Inclusion/Exclusion Criteria	4
Supplementary Table 1. Cohort characteristics	4
Supplementary Table 2. Inclusion criteria.....	5
Supplementary Figure 1. Flow chart detailing sample derivations.....	6
Supplement B: Cohort item details and harmonization	7
Supplementary Table 3. Sleep data harmonization.....	7
Supplementary Table 4. Covariate data harmonization.....	11
Supplement C: Computation of the All-Weighted Composite Score	18
Supplementary Text 1. Technical details.....	18
Supplementary Table 5. Weights from ridge regression in US and RS samples.....	19
Supplement D: Stratified Sample Characteristics	20
Supplementary Table 6. Sample Characteristics for the harmonized United States sample stratified by sex, age, and race. Cells show %(N) or median (Q1, Q3).	20
Supplementary Table 7. Sample characteristics for the Rotterdam Study stratified by sex and age. Cells shown %(N) or median (Q1, Q3)	22
Supplementary Table 8. Clinical and sociodemographic features of individual US cohorts. Cells show N(%) or Median (Q1, Q3).....	23
Supplementary Table 9: Self-Report Sleep Measures in US sample and stratified samples. Cells shown %(N) unless otherwise indicated.	24
Supplementary Table 10: Self-Report Sleep Measures in RS sample and stratified samples. Cells shown %(N) unless otherwise indicated.	26
Supplementary Table 11. Self-reported sleep features of individual US cohorts.....	27
Supplement E: Primary Model results	28
Supplementary Table 12. Relative Risk (95% CI) for each level of each composite score.	28
Supplementary Table 13. Sensitivity, specificity and accuracy of composite scores and individual features. All models include base covariates.....	29
Supplement F: Sensitivity Analysis Results	30
Supplementary Figure 2. Risk ratios and 95% CIs for each sleep indicator and future clinically significant depressive symptoms, adjusting for base covariates. (Sensitivity Analysis 1).....	30
Supplementary Figure 3. Risk Ratios and 95% Confidence Intervals for each composite score level, relative to a score of 0. Models adjust for base covariates. (Sensitivity Analysis 1).....	31
Supplementary Figure 4. Risk ratios and 95% CIs for each sleep indicator and future clinically significant depressive symptoms, adjusting for base covariates. (Sensitivity Analysis 2).....	32
Supplementary Figure 5. Risk Ratios and 95% Confidence Intervals for each composite score level, relative to a score of 0. Models adjust for base covariates. (Sensitivity Analysis 2).....	33
Supplementary Figure 6. Risk ratios and 95% CIs for each sleep indicator and future clinically significant depressive symptoms, adjusting for base covariates. (Sensitivity Analysis 3)	34
Supplementary Figure 7. Risk Ratios and 95% Confidence Intervals for each composite score level, relative to a score of 0. Models adjust for base covariates. (Sensitivity Analysis 3).....	35

Supplement G. Aim 3: Exploratory moderator analyses.....	36
Supplementary Figure 8. Association of individual sleep features and clinically relevant depressive symptoms, stratified by age.....	36
Supplementary Figure 9. Association of composite sleep features and clinically relevant depressive symptoms, stratified by age.....	37
Supplementary Figure 10. Association of individual sleep features and clinically relevant depressive symptoms, stratified by race.....	38
Supplementary Figure 11. Association of composite sleep features and clinically relevant depressive symptoms, stratified by race.....	39
Supplementary Figure 12. Association of composite sleep features and clinically relevant depressive symptoms, stratified by sex.	40
Supplementary Figure 13. Association of individual sleep features and clinically relevant depressive symptoms, stratified by cohort.	41
Supplementary Figure 14. Association of composite sleep features and clinically relevant depressive symptoms, stratified by cohort.	42
Supplement H. References	43

Supplement A: Cohort Characteristics and Inclusion/Exclusion Criteria

Supplementary Table 1. Cohort characteristics

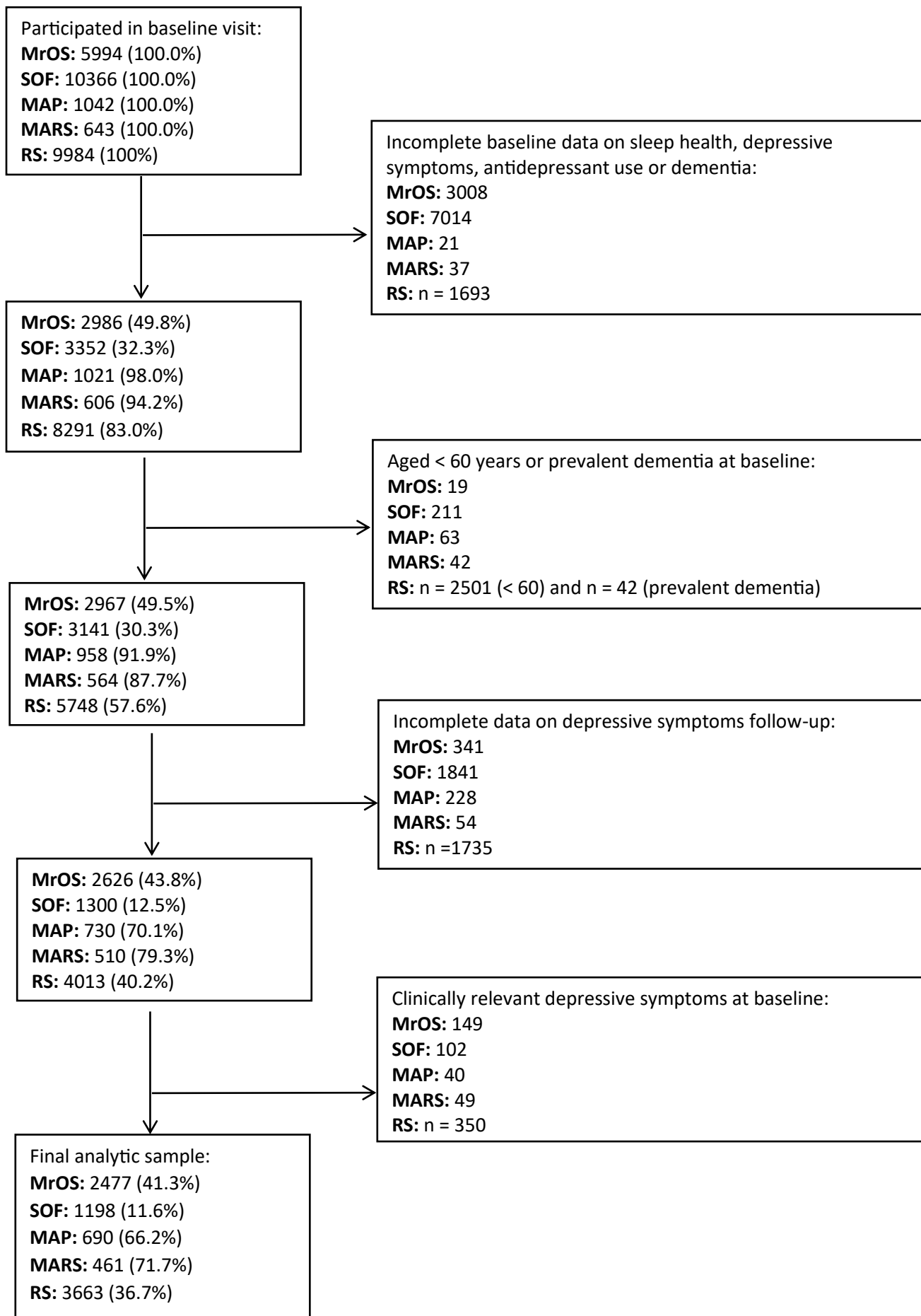
Study	Emphasis of Parent / Ancillary Studies	Parent Study Design (Cohort Start Dates)	Selected Initial Sleep Visit Years
<i>Aggregated United States Sample</i>			
MrOS	Risk of osteoporotic fractures / Sleep and health outcomes	Community dwelling men age ≥ 65 , from 6 clinics in U.S. Walk w/out assistance and no bilateral hip replacement. Individuals with active treatment for snoring or sleep apnea and/or oxygen therapy excluded. (2000-2002)	2003-2005
SOF	Risk of osteoporotic fractures / Sleep and cognition	Community dwelling women age ≥ 65 from community listings and mailed announcements in 4 U.S cities. Walk w/out assistance and no bilateral hip replacement. Individuals with active treatment for snoring or sleep apnea and/or oxygen therapy excluded. (1986-1988)	2002-2004
MAP	Chronic conditions of aging, ADRD / Sleep + ADRD	Adults age ≥ 65 recruited from retirement communities and subsidized senior housing facilities throughout Chicagoland and northeastern Illinois. (1997)	2012 and after
MARS	Cognitive decline and ADRD in older African Americans	Adults age ≥ 65 who self-identify as African American from community areas in Chicago and surrounding suburbs. (2004)	2012 and after
<i>Rotterdam Study (RS) from The Netherlands</i>			
RS	Risk factors of diseases	Adults age ≥ 55 in the Ommoord district of Rotterdam in The Netherlands (1990; additional cohorts added in 2000 and 2006)	2002-2008

Supplementary Table 2. Inclusion criteria.

Criterion	MrOS	SOF	MAP	MARS	RS
Race	Black or White	Black or White	Black or White	Black or White	N/A
Age	≥ 60	≥ 60	≥ 60	≥ 60	≥ 60
Normal Cognitive Status	MMSE ≥ 23 and no self-report of medications	MMSE ≥ 23 and no self-report of medications and no self-report of dementia	No clinical dementia diagnosis	No clinical dementia diagnosis	No clinical dementia diagnosis
No clinically relevant depressive symptoms	< 6 on GDS	< 6 on GDS	< 4 on CESD-10	< 4 on CESD-10	< 16 on the CESD-16

Note: CESD= Center for Epidemiologic Studies for Depression; GDS = Geriatric Depression Scale; MMSE = Mini Mental State Exam

Supplementary Figure 1. Flow chart detailing sample derivations.



Supplement B: Cohort item details and harmonization

Supplementary Table 3. Sleep data harmonization.

Harmonized Variable	MrOS / SOF	MAP / MARS	RS
quality Level of sleep quality or restfulness 1. Very good 2. Fairly good 3. Average 4. Fairly bad 5. Very bad	<i>quality_ms</i> = During the past month, how would you rate your sleep quality overall? 0. Very good 1. Fairly good 2. Fairly bad 3. Very bad quality =1 if <i>quality_ms</i> =0 quality =2 if <i>quality_ms</i> =1 quality =4 if <i>quality_ms</i> =2 quality =5 if <i>quality_ms</i> =3	<i>quality_mm</i> = How often do you feel really rested when you wake up in the morning? 1. Never 2. Rarely 3. Sometimes 4. Often 5. Very often quality = 1 if <i>quality_mm</i> =5 quality = 2 if <i>quality_mm</i> =4 quality = 3 if <i>quality_mm</i> =3 quality = 4 if <i>quality_mm</i> =2 quality = 5 if <i>quality_mm</i> =1	<i>quality_rs</i> = During the past month, how would you rate your sleep quality overall? 0. Very good 1. Fairly good 2. Fairly bad 3. Very bad quality =1 if <i>quality_rs</i> =0 quality =2 if <i>quality_rs</i> =1 quality =4 if <i>quality_rs</i> =2 quality =5 if <i>quality_rs</i> =3
daydys Level of daytime symptoms due to sleepiness 1. No problem 2. Very slight 3. Somewhat 4. Very big	<i>sleepy_ms</i> = During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity? 0. Not during the past month 1. Less than once a week 2. Once or twice a week 3. Three or more times a week <i>enthusiasm_ms</i> = During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done. 0. No problem 1. Very slight 2. Somewhat 3. Very big <i>daydys_ms</i> = <i>sleepy_ms</i> + <i>enthusiasm_ms</i> (PSQI Component 7) daydys =1 if <i>daydys_ms</i> =0 daydys =2 if <i>daydys_ms</i> =1- 2	<i>daydys_mm</i> = In the past month, during your waking time, how often have you felt tired, fatigued, or not up to par? 1. not at all 2. less than once a week 3. once or twice a week 4. three or more times a week 5. nearly every day <i>day_dys</i> =1 if <i>daydys_mm</i> =1-2 <i>day_dys</i> =2 if <i>daydys_mm</i> =3 <i>day_dys</i> =3 if <i>daydys_mm</i> =4 <i>day_dys</i> =4 if <i>daydys_mm</i> =5	<i>sleepy_rs</i> = During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity? 0. Not during the past month 1. Less than once a week 2. Once or twice a week 3. Three or more times a week <i>enthusiasm_rs</i> = During the past month, how often did problems with your sleep hinder you in your daily activities? 0. Not during the past month 1. Less than once a week 2. Once or twice a week 3. Three or more times a week <i>daydys_rs</i> = <i>sleepy_rs</i> + <i>enthusiasm_rs</i> (PSQI Component 7)

	daydys =3 if daydys_ms=3-4 daydys =4 if daysys_ms=5-6		daydys = 1 if daydys_rs = 0 daydys = 2 if daydys_rs = 1-2 daydys = 3 if daydys_rs = 3-4 daydys = 4 if daydys_rs = 5-6
bed_time In decimal format. If bed_time < 12, add 24	<i>bed_ms</i> : During the past month, what time have you usually gone to bed at night? bed_time = bed_ms If bed_time<12, add 24	<i>bedhr_mm</i> : Bedtime (hour) <i>bedmin_mm</i> : Bedtime (min) <i>bedampm_mm</i> : (AM or PM) During the past month, when have you usually gone to bed at night? If bedampm_mm = PM or bedhr_mm = 12, add 12 to bedhr_mm If bedampm_mm = AM and bedhour_mm < 12, add 24 bed_time =(bedhr_mm*60 + bedmin_mm)/60	<i>bed_rs</i> = During the past month, what time have you usually gone to bed at night? bed_time_ = bed_rs) if bed_time < 12, bed_time + 24
wake_time In decimal format	<i>wake_ms</i> : During the past month, when have you usually gotten up in the morning? wake_time = wake_ms	<i>wakehr_mm</i> : wake time (hour) <i>wakemin_mm</i> : wake time (min) <i>wakeampm_mm</i> : (AM or PM) During the past month, when have you usually gotten up in the morning? If wakeampm_mm=PM, add 12 to wakehr_mm wake_time = =(wake_hour*60+wake_min)/60	<i>wake_rs</i> = During the past month, what time did you usually wake up in the morning? wake_time = wake_rs
duration Time asleep during main sleep bout, in decimal format	<i>duration_ms</i> = During the past month, how many hours of actual sleep did you get each night? (This may be different than the number of hours you spent in bed) duration = duration_ms	<i>durationhrs_mm</i> : hours of sleep, numeric range [0,23] <i>durationmin_mm</i> : additional minutes, numeric range [0,59] In the past month, how many hours did you usually sleep at night? duration = durationhrs_mm + durationmin_mm/60	<i>duration_rs</i> = During the past month, how many hours of actual sleep did you get each night? duration = duration_rs

efficiency Sleep efficiency. If >100 then set to 100	efficiency = (duration_ms / timeinbed_ms) * 100 If>100, set to 100	efficiency = (duration_mm / timeinbed_mm) * 100 If>100, set to 100	efficiency = (duration_rs / timeinbed_rs) * 100 If>100, set to 100
fallsip Frequency of difficulty falling asleep 1: Not during the past month 2: Less than once a week 3: Once or twice a week 4: Three or more times a week	<i>fallsip_mros</i> = During the past month, how often have you had trouble sleeping because you cannot get to sleep within 30 minutes? 0.Not during the past month 1. Less than once a week 2. Once or twice a week 3. Three or more times a week fallsip =1 if fallsip_mros=0 fallsip =2 if fallsip_mros=1 fallsip =3 if fallsip_mros=2 fallsip =4 if fallsip_mros=3	<i>fallsip_mapmars</i> = During the past month, how often did you have trouble falling asleep within 30 minutes? 1.Not at all 2.Less than once a week 3.Once or twice a week 4.Three or more times a week 5.Nearly every day fallsip =1 if fallsip_mapmars=1 fallsip =2 if fallsip_mapmars=2 fallsip =3 if fallsip_mapmars=3 fallsip =4 if fallsip_mapmars=4 - 5	<i>fallsip_rs</i> = During the past month, how often have you had trouble sleeping because you cannot get to sleep within 30 minutes? 0.Not during the past month 1. Less than once a week 2. Once or twice a week 3. Three or more times a week fallsip =1 if fallsip_rs=0 fallsip =2 if fallsip_rs=1 fallsip =3 if fallsip_rs=2 fallsip =4 if fallsip_rs=3
staysip Frequency of difficulty staying asleep 1: Not during the past month 2: Less than once a week 3: Once or twice a week 4: Three or more times a week	<i>staysip_mros</i> = During the past month, how often have you had trouble sleeping because you wake up in the middle of the night or early morning? 0.Not during the past month 1.Less than once a week 2.Once or twice a week 3.Three or more times a week staysip =1 if staysip_mros=0 staysip =2 if staysip_mros=1 staysip =3 if staysip_mros=2 staysip =4 if staysip_mros=3	<i>staysip_mapmars</i> = During the past month, how often are you troubled by waking up during the night? 1.Never 2.Rarely 3.Sometimes 4.Often 5.Very often staysip =1 if staysip_mapmars=1 staysip =2 if staysip_mapmars=2 staysip =3 if staysip_mapmars=3 staysip =4 if staysip_mapmars=4 - 5	<i>staysip_rs</i> = During the past month, how often have you had trouble sleeping because you wake up in the middle of the night or early morning? 0.Not during the past month 1.Less than once a week 2.Once or twice a week 3.Three or more times a week staysip =1 if staysip_rs=0 staysip =2 if staysip_rs=1 staysip =3 if staysip_rs=2 staysip =4 if staysip_rs=3
snorefreq Snoring Frequency 1: Never/ not any more 2: Rarely (<1night)	<i>snore_mros</i> = Have you ever snored? 0:No 1:Yes 88:Don't know <i>snorefreq_mros</i> = How often do you snore now? 0.Do not snore anymore	<i>snore_mapmars</i> = Do you snore? 1=Yes 0=No 99=Don't know <i>Snorefreq_mapmars</i> = Over the past month, how often have you been snoring?	<i>snorefreq_rs</i> = How often did you or your partner notice that you snore loudly? 0: Not during the past month 1: < 1 night per week 2: 1-2 nights per week 3: > 2 nights per week 7. Don't know

3: Sometimes (1 or 2 nights) 4: Frequently (3 or 5 nights) 5: Almost always (6 to 7 nights) 6: Don't know Coded as factor.	1. Rarely (< 1 night a week) 2. Sometimes (1 - 2 nights /wk) 3. Frequently (3- 5 nights/ wk) 4. Always or almost always (6- 7 nights/wk) snorefreq=1 if snore_mros=0 or snorefreq_mros=0 snorefreq=2 if snore_mros=1 and snorefreq_mros=1 snorefreq=3 if snore_mros=1 and snorefreq_mros=2 snorefreq=4 if snore_mros=1 and snorefreq_mros=3 snorefreq=5 if snore_mros =1 and snorefreq_mros =4 snorefreq=6 if snore_mros=88	1. Not at all 2. Less than once a week 3. Once or twice a week 4. Three or four times a week 5. Nearly every day 99: don't know snorefreq=1 if snorefreq_mapmars=1 or snore_mapmars=0 snorefreq=2 if snorefreq_mapmars=2 snorefreq=3 if snorefreq_mapmars=3 snorefreq=4 if snorefreq_mapmars=4 snorefreq=5 if snorefreq_mapmars=5 snorefreq=6 if snorefreq_mapmars=99 or snore_mapmars=99	snorefreq=1 if snorefreq_rs =0 snorefreq=2 if snorefreq_rs =1 snorefreq=3 if snorefreq_rs =2 snorefreq=4 if snorefreq_rs =3 snorefreq=6 if snorefreq_rs =7
stopbreath Frequency of stopping breathing during sleep. 1: Not at all 2: Rarely (< once/wk) 3: Sometimes (1-2 times/wk) 4: Frequently (3- 5 times/wk) 5: Always (6-7 times/wk) 6: Don't know Coded as a factor.	<i>stopbreath_mros</i> = Are there times when you stop breathing during your sleep? 0. No 1. Yes 88=Don't know <i>stopbreathfreq_mros</i> = How often do you have times when you stop breathing during your sleep? 1. Rarely (< 1 night/ week) 2. Sometimes (1 - 2 nights /week) 3. Frequently (3 - 5 nights / week) 4. Always or almost always (6 - 7 nights /wk) 88=Don't know stopbreath = 1 if stopbreath_mros = 0 stopbreath = 2 if stopbreathfreq_mros =1 stopbreath = 3 if stopbreathfreq_mros=2 stopbreath = 4 if stopbreathfreq_mros=3 stopbreath = 5 if stopbreathfreq_mros=4 stopbreath=6 if stopbreath_mros=88 or stopbreathfreq_mros=88	<i>stopbreath_mapmars</i> = During the past month, how often have others noticed that you stop breathing or have long pauses between breaths during sleep? 1. Not at all 2. Less than once a week 3. Once or twice a week 4. Three or four times a week 5. Nearly every day 99: Don't know stopbreath=1 if stopbreath_mapmars =1 stopbreath=2 if stopbreath_mapmars =2 stopbreath=3 if stopbreath_mapmars =3 stopbreath=4 if stopbreath_mapmars =4 stopbreath=5 if stopbreath_mapmars =5 stopbreath=6 if stopbreath_mapmars =99	<i>stopbreath_rs</i> = How often did you or your partner notice that you stop breathing during your sleep? 0. Not during the past month 1. < 1 night a week 2. 1-2 nights a week 3. > 2 nights a week 7. Don't know stopbreath=1 if stopbreath_rs=0 stopbreath =2 if stopbreath_rs=1 stopbreath =3 if stopbreath_rs=2 stopbreath =4 if stopbreath_rs=3 stopbreath =6 if stopbreath_rs=7

Supplementary Table 4. Covariate data harmonization.

Harmonized Variable	MrOS	SOF	MAP and MARS	Rotterdam Study
age Participant age at sleep visit	<i>age_mros</i> = Age at sleep visit age = <i>age_mros</i>	<i>age_sof</i> = Age at sleep visit age = <i>age_sof</i>	<i>age_mm</i> = Age at selected initial visit age = <i>age_mm</i>	<i>age_rs</i> = Age at selected initial visit age = <i>age_rs</i>
sex 1 = Female 0 = Male	sex = 0 (all male participants)	sex = 1 (all female participants)	<i>sex_mm</i> = 1 if female, 0 if male. sex = <i>sex_mm</i>	<i>sex_rs</i> = 1 if female, 0 if male. sex = <i>sex_rs</i>
educ Highest education completed, categorical 1 = Elementary/middle/ High school or some college 2 = College or graduate school	<i>educ_mros</i> : Highest year of school completed 1. Some elementary school (1-7 years) 2. Elementary school (8 years) 3. Some high school (9-12 years) 4. High school (12 years) 5. Some college (13-15 years) 6. College (16 years) 7. Some graduate school (17-18 years) 8. Graduate school (19+ years) educ = 1 if <i>educ_mros</i> = 1-5; educ = 2 if <i>educ_mros</i> = 6-8;	<i>educ_sof</i> = Education highest grade or year of school completed educ = 1 if <i>educ_sof</i> < 16 educ = 2 if <i>educ_sof</i> ≥ 16	<i>educ_mm</i> = Number of years of regular school reported at baseline cognitive testing educ = 1 if <i>educ_mm</i> < 16; educ = 2 if <i>educ_mm</i> ≥ 16	<i>educ_rs</i> : Highest level of education completed 0 = primary education 1 = lower / intermediate general education OR lower vocational education = intermediate vocational education OR higher general education 2 = intermediate vocational education OR higher general education 3 = higher vocational education OR university educ = 1 if <i>educ_rs</i> = 0 or 1 educ = 2 if <i>educ_rs</i> = 2 or 3
race_eth 1=White non-hispanic 2=African American 3=Asian 4=Native Hawaiian / Pacific Islander 5=American Indian or Alaskan Native 6=Hispanic 7= Multiracial, other or unknown	<i>race_eth_mros</i> : Q1. Race category 1. White (Caucasian/White) 2. African American (African American/Black) 3. Asian (Asian) 4. Native Hawaiian / Pacific Islander 5. American Indian or Alaskan Native 6. Multiracial 7. Unknown Q2: Hispanic, Latino 0. No	<i>race_eth_sof</i> : What is your racial background? 1 = White 2 = Non-White / Unknown For SOF participants at V1: race_eth =1 if <i>race_eth_sof</i> = 1 race_eth =6 if <i>race_eth_sof</i> = 2	<i>race_eth_mm</i> : Q1. 1: White 2: Black or African American 3: American Indian or Alaska Native 4: Native Hawaiian or Other Pacific Islander 5: Asian 6: Other 7: Unknown Q2: Spanish 1. Yes 2. No	N/A

	1. Yes race_eth = 1 if Q1 = 1 and Q2 = 0 race_eth = 2 if Q1 = 2 and Q2 = 0 race_eth = 3 if Q1 = 3 and Q2 = 0 race_eth = 4 if Q1 = 4 and Q2 = 0 race_eth = 5 if Q1 = 5 and Q2 = 0 race_eth = 6 if Q2 = 1 race_eth = 7 if Q1 = 6 - 7 and Q2 = 0	For SOF at AA visit: race_eth=2	race_eth =1 if Q1= 1 and Q2=2 race_eth =2 if Q1= 2 and Q2=2 race_eth =3 if Q1= 5 and Q2=2 race_eth =4 if Q1= 4 and Q2=2 race_eth =5 if Q1= 3 and Q2=2 race_eth =6 if Q2=1 race_eth =7 if Q1=6 or 7 and Q2=2	
<u>marstat</u> marital status 1 = married 2 = widowed 3 = Other (divorced /separated, never married, prefer not to answer)	<i>marstat_mros:</i> What is your current marital status? 1. Married 2. Widowed 3. Separated 4. Divorced 5. Single, never married marstat=1 if marstat_mros=1 marstat=2 if marstat_mros=2 marstat=3 if marstat_mros=3-5	<i>marstat_sof:</i> What is your current marital status? 1=Married 2=Widowed 3=Separated/never married 4=Divorced marstat=1 if marstat_sof =1 marstat=2 if marstat_sof = 2 marstat=3 if marstat_sof = 3-4	<i>marstat_mm:</i> Marital Status at Baseline Q1: Have you been married? 1. Yes 2. No Q2: Are you now married, separated, divorced, or widowed? 1: Never married 2. Married 3: Widowed 4: Divorced 5: Separated marstat = 1 if Q2 = 2 marstat = 2 if Q2 = 3 marstat = 3 if Q1 = 2 or Q2 = 3 or 4	<i>marstat_rs:</i> What is your marital status? <u>In RS-I and RS-II:</u> 1. Never married 2. Married/living together/ divorced & remarried 3. Widowed 4. Divorced 5. Widowed and remarried 9. No answer marstat=1 marstat_rs = 2 or 5 marstat=2 marstat_rs = 3 marstat=3 marstat_rs =1, 4, or 9 <u>In RS-III:</u> 1. Never married 2. married or living together, including previously divorced and remarried 3. widowed 4. divorced 5. Living apart together 9. No answer marstat=1 marstat_rs = 2 marstat=2 marstat_rs = 3

				marstat=3 marstat_rs =1, 4, 5 or 9
smoke 1=current smoker 2=past smoker or never smoked	<i>smoke_mros:</i> Cigarette smoking status 0: No 1: Past 2: Current smoke=1 if smoke_mros =2 smoke=2 if smoke_mros =1 or 0	<i>smoke_sof:</i> Smoke status [Never, Past, Current] 0: Never smoke 1: Past smoke (not current) 2: Current smoke smoke=1 if smoke_sof =2 smoke=2 if smoke_sof =1 or 0	<i>smoke_mm:</i> Smoking status at baseline. Q1. Do you smoke cigarettes now? (Determine current smokers) Q2. Did you ever smoke cigarettes regularly? (Determine previous smokers) Answer "No" to both questions are categorized as "never smoked" 0: Never Smoked 1: Former smoker (does not currently smoke) 2: Current Smoker smoke=1 if smoke_mm = 2 smoke=2 if smoke_mm = 1 or 0	<i>smoke_rs:</i> <u>In RS-I and RS-II:</u> Q1. Do you smoke cigars? Q2. Do you smoke pipe? 0: No never 1: No, I stopped 2. Yes, less than 1 per day 3: Yes, 1 or more per day Q3. Do you smoke cigarettes? 0: No never 1: Yes 2: No I stopped before last round 3: No I have quit since last research visit smoke = 1 if Q1 = 2- 3 or Q2 = 2-3 or Q3 = 1 smoke = 2 if Q1 = 0- 1 or Q2 = 0-1 or Q3 = 0 or 2-3 <u>In RS-III:</u> Q1: Do you smoke cigarettes? Q2: Did you use to smoke cigarettes? 0: No 1: Yes Q3: Do you smoke cigars? Q4: Do you smoke pipe? 0: No never 1: No but used to 2: Yes smoke = 1 if Q1 = 1 or Q3 = 2 or Q4 = 2 smoke = 2 if Q1 = 0 AND Q2 = 0-1 AND Q3 = 0-1 AND Q4 = 0-1

alcohol 0: No drinks in the past 12 months 1: Less than one drink per week 2: 1-2 drinks per week 3: 3-5 drinks per week 4: 6-13 drinks per week 5: 14 or more drinks per week	<i>alcohol_mros</i> : How many alcoholic drinks per week? 0: No drinks in the past 12 months 1: Less than one drink per week 2: 1-2 drinks per week 3: 3-5 drinks per week 4: 6-13 drinks per week 5: 14 or more drinks per week alcohol = alcohol_mros	<i>alcohol_sof</i> : number of drinks per week, last 30 days alcohol =0 if alcohol_mros: =0 alcohol =1 if alcohol_mros: < 1 alcohol =2 if alcohol_mros: = 1-2 alcohol =3 if alcohol_mros: = 3-5 alcohol =4 if alcohol_mros: = 6-13 alcohol =5 if alcohol_mros: >=14 Decimals <1 set alcohol =1 Decimals >1 round up	<i>alcohol_mm</i> : Grams of alcohol per day at baseline. Assume an average of 13.03 grams per drink. alcohol = 0 if alcohol_mm = 0 alcohol = 1 if alcohol_mm < 1.86 alcohol = 2 if alcohol_mm ≥ 1.86 and alcohol_mm < 3.72 alcohol = 3 if alcohol_mm ≥ 3.72 and alcohol_mm < 9.3 alcohol = 4 if alcohol_mm ≥ 9.3 and alcohol_mm < 24.18 alcohol = 5 if alcohol_mm ≥ 24.18	<i>alcohol_rs</i> : grams of alcohol per day at baseline. Assume an average of 13.03 grams per drink. alcohol = 0 if alcohol_rs = 0 alcohol = 1 if alcohol_rs < 1.86 alcohol = 2 if alcohol_rs ≥ 1.86 and alcohol_rs < 3.72 alcohol = 3 if alcohol_rs ≥ 3.72 and alcohol_rs < 9.3 alcohol = 4 if alcohol_rs ≥ 9.3 and alcohol_rs < 24.18 alcohol = 5 if alcohol_rs ≥ 24.18
bmi Body Mass Index (BMI): computed as kg/m ²	<i>bmi_mros</i> = Body mass index (kg/m ²)	<i>bmi_sof</i> = Body mass index (kg/m ²)	<i>bmi_mm</i> = Body mass index (kg/m ²)	<i>bmi_rs</i> = Body mass index (kg/m ²)
CHF/HA History of congestive heart failure or heart attack 0=No 1=Yes	<i>CHF/HA_mros</i> : Q1: Have you ever had congestive heart failure? Q2: Have you ever had a heart attack? 0: No 1: Yes CHF/HA = 1 if Q1 = 1 or Q2 = 1 CHF/HA = 0 if Q1 = 0 and Q2 = 0	<i>CHF/HA_sof</i> : Q1: Congestive heart failure or enlarged heart? Q2: Heart attack, coronary, or myocardial infarction? 0.No 1.Yes CHF/HA = 1 if Q1 = 1 or Q2 = 1 CHF/HA = 0 if Q1 = 0 and Q2 = 0	<i>CHF/HA_mm</i> : Q1: History of congestive heart failure (CHF) Q2: Have you ever been told by a doctor, nurse, or therapist that you had a heart attack or coronary, coronary thrombosis, coronary occlusion, or myocardial infarction? 0.No 1.Yes CHF/HA = 1 if Q1 = 1 or Q2 = 1 CHF/HA = 0 if Q1 = 0 and Q2 = 0	<i>CHF/HA_rs</i> : Q1: Prevalent or incident heart failure based on continuous monitoring of medical records. 0 = no heart failure 1 = incident heart failure (between enrollment and 2018) 8 = prevalent heart failure at enrollment D1: Date of incident heart failure Q2: Have you ever had a heart attack / have you experienced a heart attack since the last round? 0.No

				1.Yes CHF/HA = 1 if Q1 = 8 or (Q1 = 1 and D1 < baseline visit date) or Q2 = 1 CHF/HA = 0 if Q1 = 0 AND Q2 = 0
stroke History of stroke 0=No 1=Yes	<i>stroke_mros</i> : Have you ever had a stroke? 0: No 1: Yes stroke = <i>stroke_mros</i>	<i>stroke_sof</i> : Has a doctor or other health care provider ever told you that you had stroke? 0. No 1.Yes stroke = <i>stroke_sof</i>	<i>stroke_mm</i> : History of stroke is based on clinician review of self-report questions, neurological exam (when available), cognitive testing, and interview of participant. The clinician is first presented with an algorithmic diagnosis and has the ability to modify if necessary. 0 = no history of stroke 1 = history of stroke stroke = <i>stroke_mm</i>	<i>stroke_rs</i> : Based on continuous monitoring of medical records. Includes ischemic and hemorrhagic strokes. Q1: prevalent stroke at enrollment? Q2: incident stroke between enrollment and 2020? 0: No 1: Yes D1: Date of stroke stroke = 1 if Q1 = 1 or (Q2 = 1 AND D1 < baseline visit date) stroke = 0 if Q1 = 0 and Q2 = 0
diabetes history of diabetes 0=No 1=Yes	<i>diabetes_mros</i> : have you ever had diabetes? 0: No 1: Yes diabetes =1 if <i>diabetes_mros</i> =1 diabetes =0 if <i>diabetes_mros</i> =0	<i>diabetes_sof</i> : Has a doctor or health care provider ever told you that you had diabetes (not borderline)? 0.No 1.Yes diabetes =0 if <i>diabetes_sof</i> = 0 diabetes =1 if <i>diabetes_sof</i> = 1	<i>diabetes_mm</i> : Q1. Have you ever been told by a doctor, nurse, or therapist that you had diabetes, or sugar in the urine, or high blood sugar? Q2. Has a doctor, nurse, or therapist ever told you to take insulin or injections for your high blood sugar? Q3. Has a doctor, nurse, or therapist ever told you to take medicine by mouth for your blood sugar? diabetes =1if answer "no" or	<i>diabetes_rs</i> : Do you have diabetes/Have you been diagnosed with diabetes since the last research visit? 0: No 1: Yes diabetes = 0 if 0 at all reported timepoints diabetes = 1 if 1 at one or more timepoints

			"suspect or possible" to all questions, in all cycles and no diabetes medication inspected diabetes=0 if answered "yes" to one or more questions or participant was taking diabetes medication prior to or in the given cycle	
htn Self-report of hypertension 0=No 1=Yes	<i>htn_mros</i> : Have you ever had hypertension? 0: No 1: Yes htn=0 if <i>htn_mros</i> = 0 htn=1 if <i>htn_mros</i> = 1	<i>htn_sof</i> : High blood pressure? 0.No 1.Yes htn=0 if <i>htn_sof</i> = 0 htn=1 if <i>htn_sof</i> = 1	<i>htn_mm</i> : History of hypertension. Since your interview on [date of last interview], have you been told by a doctor, nurse, or therapist that you had high blood pressure? 0: No history of hypertension 1: History of hypertension - Reported prior to or in the given cycle htn=0 if <i>htn_mm</i> = 0 htn=1 if <i>htn_mm</i> = 1	<i>htn_rs</i> : Have you ever had high blood pressure/ Have you had high blood pressure since the last visit?/Are you currently being treated for a high blood pressure with medication? 0: no 1: yes htn = 0 if 0 at all reported timepoints htn = 1 if 1 at one or more timepoints
thyroid Self-report of thyroid disease 0=No 1=Yes	<i>thyroid_mros</i> : Have you ever had high thyroid/ Graves disease? 0: No 1: Yes thyroid = <i>thyroid_mros</i>	<i>thyroid_sof</i> : Hyperthyroidism? 0: No 1: Yes thyroid = <i>thyroid_sof</i>	<i>thyroid_mm</i> : Have you ever been told by a doctor, nurse, or therapist that you had thyroid disease? 0: No 1: Yes thyroid = <i>thyroid_mm</i>	<i>thyroid_rs</i> : Have you ever/since the last visit had thyroid disease for which you were being treated by a physician or specialist? 0: No 1: Yes thyroid = 0 if 0 at all reported timepoints thyroid = 1 if 1 at one or more timepoints
sed_med Use of sedating medication	<i>sed_med_mros</i> : Any tricyclic antidepressant, mirtazapine,	<i>sed_med_sof</i> Any tricyclic antidepressant, mirtazapine,	<i>sed_med_mm</i> 1: if medication name matched to 'trazadone',	<i>sed_med_rs</i> : Current use of medication based on

0=No 1=Yes	nefazodone, non-benzodiazepine nonbarbituate sedative hypnotic medications or trazodone; coded from list of individual drugs 0: No use 1: Any use sed_med = sed_med _mors	nefazodone, non-benzodiazepine nonbarbituate sedative hypnotic medications or trazodone; coded from list of individual drugs 0: No use 1: Any use sed_med = sed_med sof	'nefazadone', 'tca', 'mirtazapine', 'chloral hydrate', 'dexmedetomidine', 'eszopiclone', 'zopiclone', 'zolpidem', 'zaleplon', 'ramelteon', 'suvorexant', 'tasimelteon', 'hetlioz', 'lemborexant', 'dayvigo', 'daridorexant', 'quviviq', or terms in M1NBANX, tca5c or saris5c 0: no match sed_med = sed_med mm	pharmacy dispensary records. 1: Any use of medication with ATC code: ATC Codes N05CC, N05CF, N05CH, N05CM, N05CX, N06AX, N06AA, N06AX05, N06AX06, or N06AX11 0: No use sed_med = sed_med rs
non_sed_antidep Use of non-sedating antidepressants 0=No 1=Yes	<i>non_sed_antidep_mros:</i> Any antidepressant (except tricyclic antidepressant, mirtazapine, or nefazodone); coded from list of individual drugs. 0: No use 1: Any use non_sed_antidep = non_sed_antidep_mros	<i>non_sed_antidep_sof::</i> Any antidepressant (except tricyclic antidepressant, mirtazapine, or nefazodone); coded from list of individual drugs. 0: No use 1: Any use non_sed_antidep = non_sed_antidep_sof	<i>non_sed_antidep_m</i> 1: if medication name matched to 'bupropion', 'citalopram', 'escitalopram', 'duloxetine', 'fluoxetine', 'fluvoxamine', 'paroxetine', 'phenelzine', 'selegiline', 'sertraline', 'venlafaxine', 'tacrine', or terms in ssris5c, snris5c, maoi5c, or ndri5c 0: No match non_sed_antidep = non_sed_antidep_m	<i>non_sed_antidep_rs:</i> Current use of medication based on pharmacy dispensary records. 1: Any use of medication with ATC Codes N06AB, N06AF, N06AG, and all meds in N06AX01 – N06AX29 EXCEPT 05, 06 and 11 0: No use non_sed_antidep = non_sed_antidep_rs

^aRS-I and RS-II, and RS-III refer to waves of data collection within the RS study.

Supplement C: Computation of the All-Weighted Composite Score

Supplementary Text 1. Technical details.

In the full RS and US samples, we used the R package glmnet to fit regularized ‘Ridge Regression’^{1,2} Generalized Linear Models (GLMs) with a log link to estimate optimized sleep feature weights for the Weighted Sleep Score. Regularized regression allows for a larger number of potentially correlated features within the same model by constraining (i.e., ‘shrinking’) the magnitudes of the coefficients in the model, which ensures the model is not overfit. Ridge Regression is a specific type of regularized model that shrinks groups of correlated features, but still retains non-zero values if the group of features is informative (as opposed to LASSO regression, which tends to select one feature within a correlated group and then shrink the remaining features to zero). Ridge regression was selected to allow for a larger number of features to be included in the Weighted Sleep Score, which we hypothesized would promote generalizability across samples.

These models included 13 sleep indicator variables (see **Table S5**), notated as $\log(Y) = W_1X_1 + W_2X_2 + \dots + W_{13}X_{13} + \varepsilon$. In this equation, $\mathbf{X} = [X_1, X_2, \dots, X_{13}]$ represents each of the 13 sleep indicator variables and the vector $\mathbf{W} = \{W_1, W_2, \dots, W_{13}\}$ represents the optimal scalar weights corresponding to each of the indicator variables. The ‘don’t know’ answers in the snoring and stopping breathing questions were included to generate the full set of weights, although these were not considered potentially adverse response and thus were not summed to compute the Weighted Score. From each of the US and RS Ridge Regression models, we extracted the 11 relevant estimated weights (excluding weights for the two ‘don’t know’ responses), with US estimates denoted by $\hat{\mathbf{W}}^U = \{\hat{W}_1^U, \hat{W}_2^U, \dots, \hat{W}_{11}^U\}$ and RS estimates denoted by $\hat{\mathbf{W}}^R = \{\hat{W}_1^R, \hat{W}_2^R, \dots, \hat{W}_{11}^R\}$. Because unrealistically optimistic estimates are obtained when weights generated within a sample are applied to that same sample, we applied the RS weights $\hat{\mathbf{W}}^R$ to the US sleep indicator data $\mathbf{X}^U = [X_1^U, X_2^U, \dots, X_{11}^U]$ to compute the weighted sleep composite score for the US sample as $WS^U = \hat{W}_1^R X_1^U + \hat{W}_2^R X_2^U + \dots + \hat{W}_{11}^R X_{11}^U$. Similarly, we applied the US weights $\hat{\mathbf{W}}^U$ to the RS sleep indicator data $\mathbf{X}^R = [X_1^R, X_2^R, \dots, X_{11}^R]$ to compute the weighted sleep composite score for the RS sample as $WS^R = \hat{W}_1^U X_1^R + \hat{W}_2^U X_2^R + \dots + \hat{W}_{11}^U X_{11}^R$. The All-Weighted scores were rescaled to the range of 0-9 to match the scale of the All-Unweighted score using the equation $WOS = (WOS - \min(WOS)) / (\max(WOS) - \min(WOS)) * 9$.

Because regularized regression optimizes prediction at the cost of biased estimates⁷⁴, we intentionally refrain from over-interpreting the specific weights of each feature and instead considered the effect size of the overall score.

Supplementary Table 5. Weights from ridge regression in US and RS samples.

Sleep Indicator	Weight Derived in US Sample and Applied in RS Sample	Weight Derived in RS Sample and Applied in US Sample
Snoring Yes	-0.0174	0.0291
Snoring Don't Know ^a	0.0661	-0.0595
Stop Breathing Yes	0.1205	0.0048
Stop Breathing Don't Know ^a	0.0162	0.1178
Difficulty Falling Asleep	0.2956	0.3156
Difficulty Staying Asleep	0.0783	0.0907
Poor Sleep Quality	0.1167	0.1508
Sleepiness / Daytime Impairment	0.2324	0.1164
Early Midpoint	-0.0193	0.0338
Late Midpoint	0.1472	0.0144
Low Efficiency	0.0483	-0.0091
Short Duration	0.1000	0.0839
Long Duration	0.0276	0.0730

^aNot included in All-Weighted Score

Supplement D: Stratified Sample Characteristics

Supplementary Table 6. Sample Characteristics for the harmonized United States sample stratified by sex, age, and race. Cells show %(N) or median (Q1, Q3).

	Men (N=2739)	Women (N=2087)	Age < 75 (N=1529)	Age≥75 (N=3297)	White (N=3963)	Black (N=703)
Age (continuous)	75.0 [72.0, 80.0]	82.0 [78.7, 84.5]	71.0 [69.1, 73.0]	81.0 [78.2, 84.0]	80.0 [74.0, 83.0]	75.4 [71.3, 79.6]
Age < 75	44.4% (1217)	14.9% (312)	100% (1529)	0% (0)	28.6% (1133)	45.7% (321)
Age ≥75	55.6% (1522)	85.1% (1775)	0% (0)	100% (3297)	71.4% (2830)	54.3% (382)
Sex						
Female	0% (0)	100% (2087)	20.4% (312)	53.8% (1775)	39.5% (1566)	72.4% (509)
Male	100% (2739)	0% (0)	79.6% (1217)	46.2% (1522)	60.5% (2397)	27.6% (194)
Race						
Black	7.1% (194)	24.4% (509)	21.0% (321)	11.6% (382)	0% (0)	100% (703)
White	87.5% (2397)	75.0% (1566)	74.1% (1133)	85.8% (2830)	100% (3963)	0% (0)
Other	5.4% (148)	0.6% (12)	4.9% (75)	2.6% (85)	0% (0)	0% (0)
Marital Status						
Married	84.3% (2309)	30.4% (635)	76.8% (1174)	53.7% (1770)	64.6% (2559)	35.7% (251)
Widowed	7.5% (206)	51.8% (1081)	6.8% (104)	35.9% (1183)	26.2% (1037)	34.4% (242)
Other	8.2% (224)	17.8% (371)	16.4% (251)	10.4% (344)	9.3% (367)	29.9% (210)
Education						
≥ College Degree	58.4% (1599)	32.4% (676)	57.0% (871)	42.6% (1404)	48.1% (1907)	38.0% (267)
< College Degree	41.6% (1140)	67.6% (1411)	43.0% (658)	57.4% (1893)	51.9% (2056)	62.0% (436)
Smoking						
Current	2.2% (59)	2.2% (45)	3.3% (51)	1.6% (53)	1.6% (62)	5.8% (41)
Past/Never	97.8% (2680)	97.8% (2042)	96.7% (1478)	98.4% (3244)	98.4% (3901)	94.2% (662)
Alcohol Use	2.00 [0, 4.00]	0 [0, 2.00]	2.00 [0, 3.00]	1.00 [0, 3.00]	1.00 [0, 3.00]	0 [0, 1.50]
Body Mass Index	26.9 [24.7, 29.6]	27.2 [24.2, 30.7]	27.7 [25.2, 30.7]	26.7 [24.2, 29.6]	26.7 [24.4, 29.5]	29.5 [26.3, 32.6]

Number of Medical Conditions						
0	38.6% (1057)	26.6% (556)	36.7% (561)	31.9% (1052)	36.2% (1434)	16.1% (113)
1	40.8% (1118)	42.6% (890)	40.2% (615)	42.3% (1393)	41.4% (1640)	43.7% (307)
2	15.8% (434)	23.4% (488)	18.1% (277)	19.6% (645)	5.2% (208)	30.2% (212)
3+	4.7% (130)	7.3% (153)	5.0% (76)	6.3% (207)	17.2% (681)	10.1% (71)
Nonsedating Antidepressant Use	4.1% (112)	7.7% (160)	4.7% (72)	6.1% (200)	6.3% (251)	2.8% (20)
Sedating Medication use	4.5% (124)	5.8% (122)	5.5% (84)	4.9% (162)	5.3% (211)	4.0% (28)
Follow-up Time	3.43 [3.14, 3.79]	4.89 [4.03, 5.54]	3.49 [3.13, 4.00]	4.00 [3.26, 5.00]	3.70 [3.20, 4.64]	4.84 [3.25, 6.00]
Clinically Relevant Depressive Symptoms at Follow-Up	4.6% (126)	7.7% (161)	4.1% (62)	6.8% (225)	5.8% (231)	7.5% (53)

Supplementary Table 7. Sample characteristics for the Rotterdam Study stratified by sex and age. Cells shown %(N) or median (Q1, Q3)

	Men (N=1634)	Women (N=2029)	Age < 75 (N=2965)	Age≥75 (N=698)
Age (continuous)	67.8 [63.1, 73.0]	68.0 [63.3, 73.6]	66.3 [62.4, 70.1]	78.6 [76.6, 81.4]
Age < 75	81.8% (1337)	80.2% (1628)	100% (2965)	0% (0)
Age ≥75	18.2% (297)	19.8% (401)	0% (0)	100% (698)
Sex				
Male	100% (1634)	0% (0)	45.1% (1337)	42.6% (297)
Female	0% (0)	100% (2029)	54.9% (1628)	57.4% (401)
Marital Status				
Married	88.2% (1441)	61.6% (1250)	77.9% (2310)	54.6% (381)
Widowed	5.8% (94)	22.3% (453)	10.2% (303)	35.0% (244)
Other	6.1% (99)	16.1% (326)	11.9% (352)	10.5% (73)
Education				
≥ College Degree	65.5% (1070)	31.9% (648)	48.7% (1443)	39.4% (275)
< College Degree	34.5% (564)	68.1% (1381)	51.3% (1522)	60.6% (423)
Smoking Status				
Current	17.4% (285)	12.7% (258)	16.6% (491)	7.4% (52)
Past/Never	82.6% (1349)	87.3% (1771)	83.4% (2474)	92.6% (646)
Alcohol Use	4.00 [3.00, 5.00]	3.00 [1.00, 4.00]	3.00 [1.00, 4.00]	3.00 [1.00, 4.00]
Body Mass Index	27.2 [25.2, 29.6]	27.4 [24.8, 30.2]	27.4 [25.1, 30.0]	27.1 [24.9, 29.5]
Number of Medical Conditions				
0	49.7% (812)	45.8% (929)	49.9% (1479)	37.5% (262)
1	35.6% (581)	38.8% (787)	36.4% (1079)	41.4% (289)
2	12.5% (204)	13.0% (264)	11.8% (349)	17.0% (119)
3+	2.3% (37)	2.4% (49)	2.0% (58)	4.0% (28)
Nonsedating Antidepressant Use	1.4% (23)	3.5% (70)	2.7% (79)	2.0% (14)
Sedating Medication Use	2.0% (33)	3.6% (73)	3.0% (88)	2.6% (18)
Follow-up Time	6.39 [6.14, 6.52]	6.38 [6.13, 6.53]	6.37 [6.01, 6.50]	6.45 [6.31, 6.62]
Clinically Relevant Depressive Symptoms at Follow-Up	5.1% (83)	9.3% (188)	6.4% (190)	11.6% (81)

Supplementary Table 8. Clinical and sociodemographic features of individual US cohorts. Cells show N(%) or Median (Q1, Q3).

	MrOS (N=2477)	SOF (N=1198)	MAP (N=690)	MARS (N=461)
Age (continuous)	75.0 [71.0, 79.0]	82.0 [81.0, 85.0]	82.1 [76.3, 86.5]	75.0 [70.3, 79.5]
Age < 75	46.0% (1139)	1.5% (18)	20.1% (139)	50.5% (233)
Age ≥75	54.0% (1338)	98.5% (1180)	79.9% (551)	49.5% (228)
Sex				
Female	0% (0)	100% (1198)	76.7% (529)	78.1% (360)
Male	100% (2477)	0% (0)	23.3% (161)	21.9% (101)
Race				
Black	3.6% (90)	10.9% (130)	3.3% (23)	99.8% (460)
White	90.5% (2241)	88.8% (1064)	95.4% (658)	0% (0)
Other	5.9% (146)	0.3% (4)	1.3% (9)	0.2% (1)
Marital Status				
Married	85.7% (2123)	29.8% (357)	44.8% (309)	33.6% (155)
Widowed	6.7% (166)	59.8% (717)	36.5% (252)	33.0% (152)
Other	7.6% (188)	10.4% (124)	18.7% (129)	33.4% (154)
Education				
≥ College Degree	57.8% (1431)	20.0% (239)	59.0% (407)	43.0% (198)
< College Degree	42.2% (1046)	80.1% (959)	41.0% (283)	57.0% (263)
Smoking Status				
Current	2.0% (49)	2.0% (24)	1.0% (7)	5.2% (24)
Past or Never	98.0% (2428)	98.0% (1174)	99.0% (683)	94.8% (437)
Alcohol Use	2.00 [0, 4.00]	0 [0, 1.00]	1.00 [0, 3.00]	0 [0, 1.00]
Body Mass Index	26.8 [24.7, 29.4]	26.8 [24.1, 30.1]	26.7 [23.9, 30.2]	29.6 [26.3, 33.0]
Number of Medical Conditions				
0	39.6% (981)	31.6% (379)	28.1% (194)	12.8% (59)
	41.0% (1015)	42.7% (512)	41.0% (283)	43.0% (198)

1	15.4% (381)	20.3% (243)	21.0% (145)	33.2% (153)
2	4.0% (100)	5.3% (64)	9.9% (68)	11.1% (51)
3+				
Nonsedating Antidepressant Use	4.0% (99)	6.8% (82)	11.4% (79)	2.6% (12)
Sedating Medication Use	4.4% (108)	4.8% (58)	9.0% (62)	3.9% (18)
Follow-up Time	3.42 [3.16, 3.74]	4.90 [4.45, 5.29]	4.00 [2.00, 6.00]	5.00 [3.00, 6.00]
Clinically Relevant Depressive Symptoms at Follow-Up	4.5% (112)	7.7% (92)	6.8% (47)	7.8% (36)

Supplementary Table 9: Self-Report Sleep Measures in US sample and stratified samples. Cells shown %(N) unless otherwise indicated.

	Men (N=2739)	Women (N=2087)	Age < 75 (N=1529)	Age≥75 (N=3297)	White (N= 3963)	Black (N=703)
Sleep Health (SATED)						
Daytime Sleepiness	9.1% (249)	11.0% (229)	9.1% (139)	10.3% (339)	9.4% (373)	12.5% (88)
Poor Sleep Quality	13.3% (364)	12.7% (265)	12.8% (195)	13.2% (434)	13.1% (518)	11.8% (83)
Sleep Midpoint						
Early	17.5% (480)	13.7% (286)	18.2% (279)	14.8% (487)	15.1% (597)	20.1% (141)
Late	7.3% (199)	9.0% (187)	8.8% (134)	7.6% (252)	7.1% (281)	13.1% (92)
Sleep Duration						
Short (< 6 hours)	9.2% (251)	15.0% (314)	11.9% (182)	11.6% (383)	9.6% (379)	22.5% (158)
Long (> 8 hours)	6.8% (185)	10.2% (212)	6.1% (93)	9.2% (304)	8.1% (322)	9.2% (65)
Low Sleep Efficiency (<85%)	35.0% (959)	48.7% (1017)	37.2% (569)	42.7% (1407)	38.8% (1536)	54.8% (385)
Sleep Disorder Symptoms						
Difficulty Falling Asleep	21.0% (576)	35.5% (741)	22.9% (350)	29.3% (967)	26.4% (1046)	33.1% (233)
Difficulty Staying Asleep	58.3% (1597)	44.0% (919)	52.2% (798)	52.1% (1718)	54.9% (2174)	35.6% (250)
Snoring						

At least once / week	35.0% (959)	9.2% (192)	37.2% (569)	17.7% (582)	25.0% (989)	14.5% (102)
Never/Rarely	35.9% (982)	33.1% (690)	31.7% (484)	36.0%	35.2%	32.9% (231)
Don't Know	29.1% (798)	57.7% (1205)	31.1% (476)	(1188) 46.3% (1527)	(1394) 39.9% (1580)	52.6% (370)
Stops breathing during sleep	11.0% (300)	1.5% (32)	11.0% (168)	5.0% (164)	7.3% (291)	3.3% (23)
Ever reported	47.1%	55.9% (1167)	46.8% (716)	52.8%	50.7%	53.3% (375)
Never	(1290)	42.5% (888)	42.2% (645)	(1741)	(2008)	43.4% (305)
Don't Know	41.9% (1149)			42.2% (1392)	42.0% (1664)	
Composite Sleep Scores						
All-Unweighted	2.00 [1.00, 3.00]	2.00 [1.00, 3.00]	2.00 [1.00, 3.00]	2.00 [1.00, 3.00]	2.00 [1.00, 3.00]	2.00 [1.00, 3.00]
All-Weighted	1.92 [1.28, 3.37]	1.92 [1.12, 4.06]	1.92 [1.23, 3.54]	1.92 [1.12, 3.88]	1.92 [1.12, 3.70]	1.92 [1.12, 3.96]
SATED Score	1.00 [0, 2.00]	1.00 [0, 2.00]	1.00 [0, 2.00]	1.00 [0, 2.00]	1.00 [0, 2.00]	1.00 [1.00, 2.00]
Selected Score	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]
Insomnia with Short Sleep	7.8% (214)	12.0% (251)	9.2% (140)	9.9% (325)	8.2% (326)	16.4% (115)

Supplementary Table 10: Self-Report Sleep Measures in RS sample and stratified samples. Cells shown %(N) unless otherwise indicated.

	Men (N=1634)	Women (N=2029)	Age < 75 (N=2965)	Age≥75 (N=698)
Sleep Health (SATED)				
Daytime Sleepiness	2.3% (38)	3.6% (73)	2.6% (78)	4.7% (33)
Poor Sleep Quality	5.3% (86)	12.7% (258)	9.2% (272)	10.3% (72)
Sleep Midpoint				
Early	3.1% (51)	2.3% (46)	2.7% (79)	2.6% (18)
Late	18.7% (306)	16.0% (325)	18.2% (539)	13.2% (92)
Sleep Duration				
Short (< 6 hours)	11.1% (182)	16.8% (340)	13.7% (405)	16.8% (117)
Long (> 8 hours)	9.7% (159)	8.0% (163)	9.1% (269)	7.6% (53)
Low Sleep Efficiency (<85%)	16.7% (273)	29.8% (604)	22.1% (655)	31.8% (222)
Sleep Disorder Symptoms				
Difficulty Falling Asleep	10.0% (164)	29.2% (592)	19.6% (580)	25.2% (176)
Difficulty Staying Asleep	9.1% (149)	17.1% (347)	12.9% (382)	16.3% (114)
Snoring				
At least once / week	55.1% (901)	34.8% (706)	48.0% (1424)	26.2% (183)
Never/Rarely	39.4% (644)	52.1% (1057)	43.4% (1287)	59.3% (414)
Don't Know	5.4% (89)	13.1% (266)	8.6% (254)	14.5% (101)
Stops breathing during sleep				
Ever reported	22.0% (359)	4.5% (91)	13.5% (399)	7.3% (51)
Never	67.6% (1105)	73.0% (1481)	70.5% (2089)	71.2% (497)
Don't Know	10.4% (170)	22.5% (457)	16.1% (477)	21.5% (150)
Composite Scores				
All-Unweighted	2.00 [1.00, 3.00]	2.00 [1.00, 3.00]	2.00 [1.00, 3.00]	2.00 [1.00, 3.00]
All-Weighted	1.02 [0.302, 1.68]	1.33 [0.311, 3.09]	1.19 [0.311, 2.44]	1.24 [0.311, 2.92]
SATED Score	1.00 [0, 1.00]	1.00 [0, 2.00]	1.00 [0, 1.00]	1.00 [0, 2.00]
Selected Score	0 [0, 0]	0 [0, 1.00]	0 [0, 0]	0 [0, 1.00]
Insomnia with Short Sleep	5.9% (96)	12.4% (252)	8.9% (264)	12.0% (84)

Supplementary Table 11. Self-reported sleep features of individual US cohorts.

	MrOS (N=2477)	SOF (N=1198)	MAP (N=690)	MARS (N=461)
Sleep Health (SATED)				
Excessive Daytime Sleepiness	8.3% (206)	4.9% (59)	21.4% (148)	14.1% (65)
Poor Sleep Quality	13.5% (335)	14.3% (171)	11.0% (76)	10.2% (47)
Sleep Midpoint				
Early	17.7% (438)	11.1% (133)	14.1% (97)	21.3% (98)
Late	7.3% (180)	9.0% (108)	5.7% (39)	12.8% (59)
Sleep Duration				
Short (< 6 hours)	9.0% (224)	16.1% (193)	7.7% (53)	20.6% (95)
Long (> 8 hours)	6.1% (150)	5.9% (71)	18.1% (125)	11.1% (51)
Low Sleep Efficiency (<85%)	35.4% (876)	53.6% (642)	29.7% (205)	54.9% (253)
Sleep Disorders				
Difficulty Falling Asleep	20.5% (507)	35.3% (423)	32.3% (223)	35.6% (164)
Difficulty Staying Asleep	60.5% (1498)	48.2% (577)	44.2% (305)	29.5% (136)
Snoring				
At least once / week	36.8% (912)	10.1% (121)	9.1% (63)	11.9% (55)
Never/Rarely	35.5% (880)	32.8% (393)	36.1% (249)	32.5% (150)
Don't Know	27.7% (685)	57.1% (684)	54.8% (378)	55.5% (256)
Stops breathing during sleep				
Ever reported	11.3% (281)	1.1% (13)	3.3% (23)	3.3% (15)
Never	44.8% (1110)	57.5% (689)	57.5% (397)	56.6% (261)
Don't Know	43.8% (1086)	41.4% (496)	39.1% (270)	40.1% (185)
Composite Scores				
All-Unweighted	2.00 [1.00, 3.00]	2.00 [1.00, 3.00]	2.00 [1.00, 3.00]	2.00 [1.00, 3.00]
All-Weighted	1.92 [1.34, 3.37]	1.89 [1.03, 4.06]	1.93 [1.08, 4.06]	1.92 [1.12, 3.88]
SATED Score	1.00 [0, 2.00]	1.00 [0, 2.00]	1.00 [0, 2.00]	1.00 [1.00, 2.00]
Selected Score	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]	0 [0, 1.00]
Insomnia with Short Sleep	7.7% (191)	13.7% (164)	6.7% (46)	13.9% (64)

Supplement E: Primary Model results

Supplementary Table 12. Relative Risk (95% CI) for each level of each composite score.

Score	All-Unweighted	SATED	All-Weighted	Selected	Insomnia With Short Sleep
US Sample					
0	1 [1, 1]	1 [1, 1]	1 [1, 1]	1 [1, 1]	1 [1, 1]
1	1.22 [1.14, 1.3]	1.27 [1.15, 1.41]	1.18 [1.12, 1.25]	1.82 [1.53, 2.17]	1.67 [1.21, 2.29]
2	1.49 [1.3, 1.7]	1.62 [1.33, 1.98]	1.4 [1.26, 1.56]	3.32 [2.33, 4.73]	
3	1.81 [1.48, 2.22]	2.06 [1.53, 2.78]	1.66 [1.41, 1.96]		
4	2.21 [1.69, 2.9]	2.62 [1.76, 3.9]	1.96 [1.58, 2.45]		
5	2.7 [1.92, 3.78]	3.33 [2.02, 5.49]	2.33 [1.77, 3.06]		
6	3.29 [2.19, 4.93]		2.75 [1.98, 3.83]		
7	4.01 [2.5, 6.43]		3.26 [2.22, 4.78]		
8	4.89 [2.85, 8.39]		3.86 [2.49, 5.98]		
9	5.96 [3.25, 10.94]		4.57 [2.79, 7.48]		
RS Sample					
0	1 [1, 1]	1 [1, 1]	1 [1, 1]	1 [1, 1]	1 [1, 1]
1	1.18 [1.1, 1.26]	1.22 [1.1, 1.36]	1.18 [1.11, 1.25]	1.79 [1.45, 2.2]	1.73 [1.26, 2.38]
2	1.39 [1.21, 1.59]	1.49 [1.21, 1.84]	1.39 [1.24, 1.57]	3.19 [2.11, 4.82]	
3	1.64 [1.33, 2.01]	1.82 [1.33, 2.5]	1.65 [1.37, 1.97]		
4	1.93 [1.47, 2.54]	2.23 [1.46, 3.39]	1.94 [1.53, 2.47]		
5	2.27 [1.61, 3.2]	2.72 [1.61, 4.59]	2.29 [1.7, 3.1]		
6	2.68 [1.78, 4.04]		2.71 [1.89, 3.88]		
7	3.16 [1.96, 5.1]		3.2 [2.1, 4.86]		
8	3.72 [2.15, 6.43]		3.77 [2.33, 6.1]		
9	4.38 [2.37, 8.12]		4.45 [2.59, 7.64]		

Supplementary Table 13. Sensitivity, specificity and accuracy of composite scores and individual features. All models include base covariates.

	US			RS		
	Sensitivity	Specificity	Accuracy	Sensitivity	Specificity	Accuracy
Quality	0.683	0.505	0.672	0.543	0.646	0.551
Daytime Impairment	0.683	0.533	0.674	0.534	0.661	0.543
Duration	0.674	0.509	0.665	0.527	0.690	0.539
Midpoint	0.670	0.509	0.660	0.520	0.679	0.532
Sleep Efficiency	0.667	0.530	0.659	0.521	0.679	0.532
Snoring	0.653	0.516	0.645	0.523	0.683	0.535
Stop Breathing	0.655	0.533	0.647	0.520	0.675	0.532
Difficulty Falling Asleep	0.712	0.519	0.701	0.586	0.642	0.590
Difficulty Staying Asleep	0.674	0.526	0.665	0.525	0.664	0.535
Overall Sleep Score	0.701	0.530	0.691	0.555	0.661	0.563
SATED Score	0.693	0.509	0.682	0.538	0.661	0.547
Weighted Score	0.709	0.537	0.673	0.586	0.657	0.591
Selected Score	0.724	0.519	0.712	0.590	0.635	0.593
Insomnia With Short Sleep	0.683	0.509	0.673	0.537	0.664	0.546
No Sleep*	0.653	0.509	0.644	0.521	0.679	0.532

*Base Covariates Only

Supplement F: Sensitivity Analysis Results

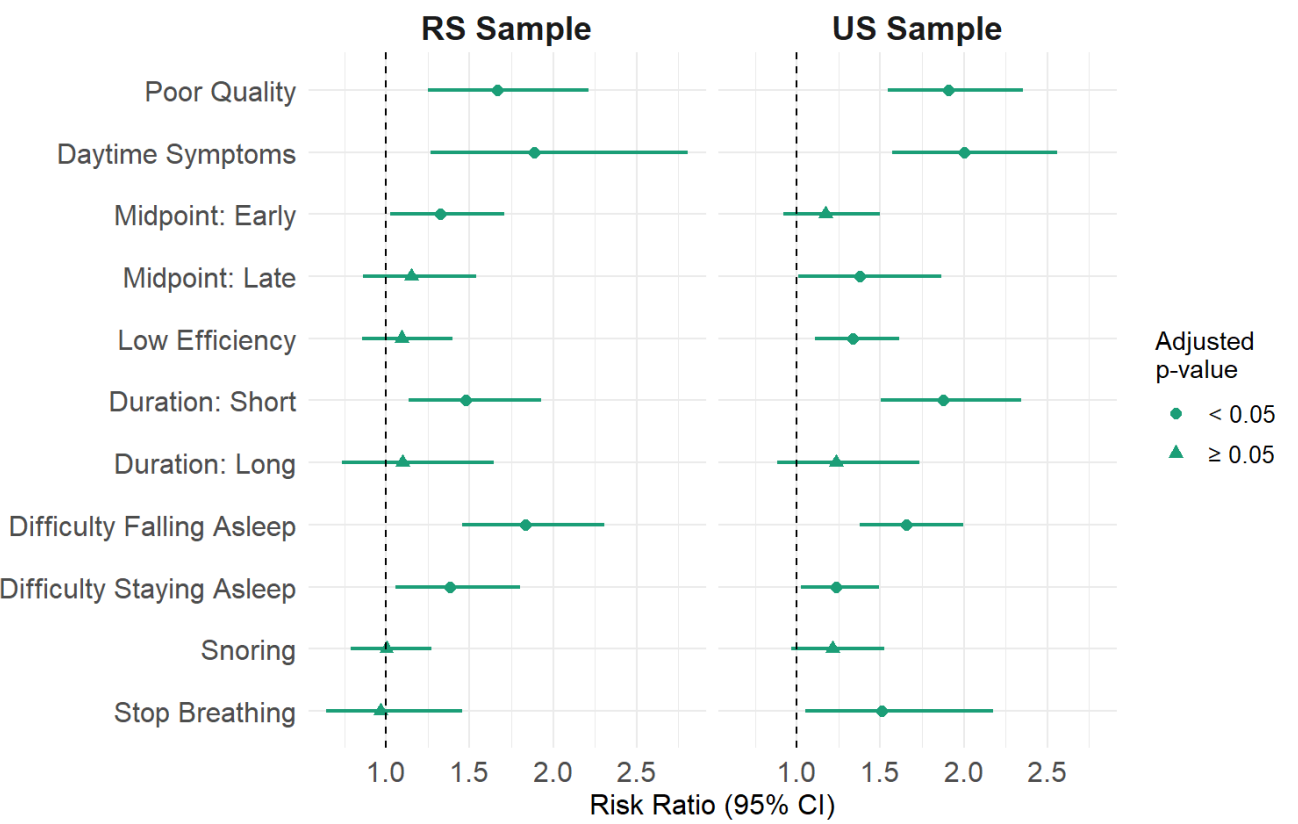
F.1. Sensitivity Analysis 1. Considering New Antidepressant Use

This sensitivity analysis considers new antidepressant use as an index of future depression. Accordingly, it excludes people using antidepressants at the initial visit. The sample size was similar to the primary sample (N=3521 in RS; N=4852 in US). In the US and RS samples, 8.4% and 9.5% of participants were indicated as having clinically relevant depressive symptoms at follow-up.

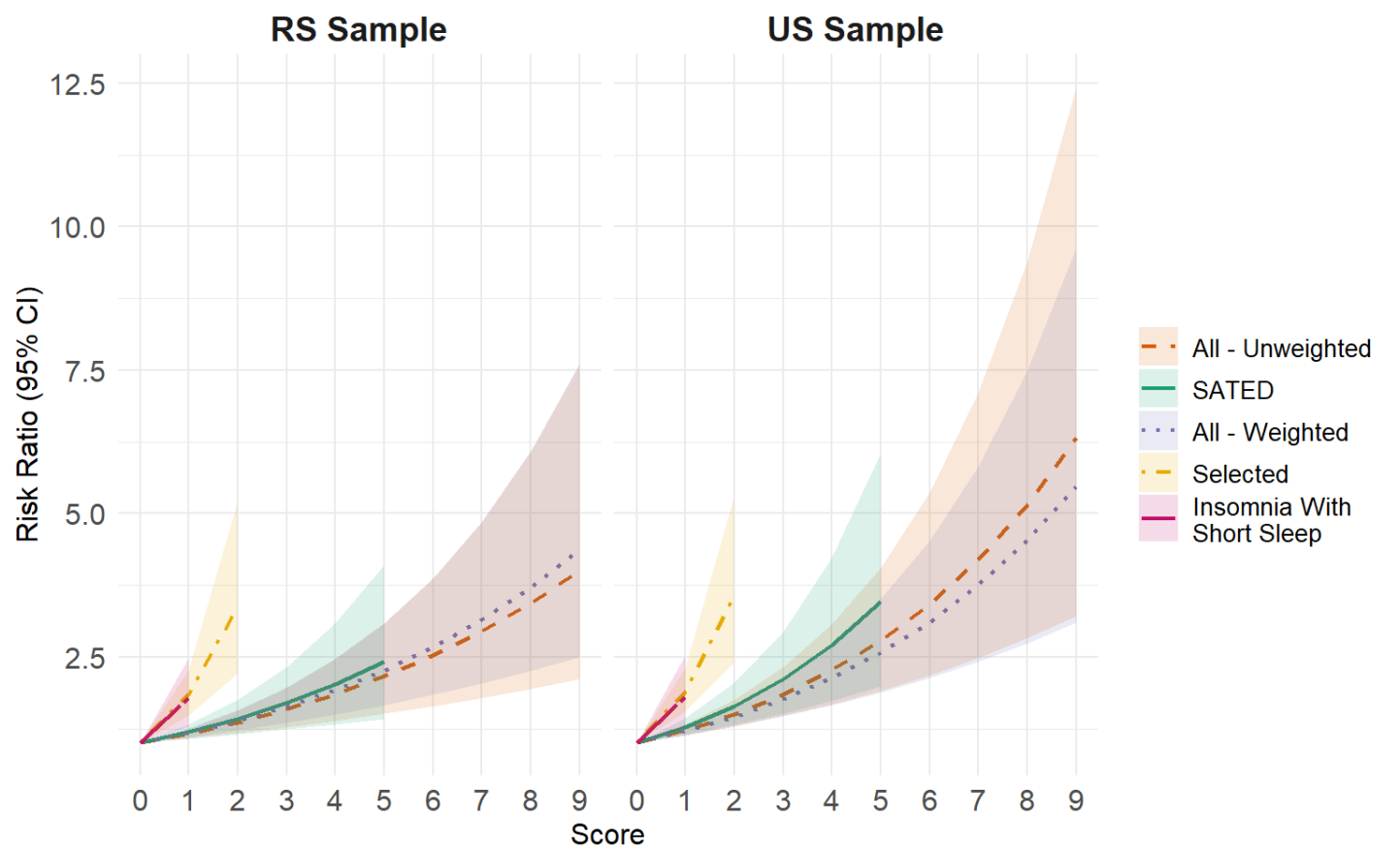
Figure F.1.1 displays risk ratios for individual sleep characteristics. Poor quality, daytime symptoms, short duration, and difficulty falling asleep, had the strongest associations with clinically relevant depressive symptoms at follow-up in the US and RS samples

Figure F.1.2 displays risk ratios for composite sleep scores. Similar to primary sample results, the Selected score provides the most impactful estimates of risk in both the US and RS samples.

Supplementary Figure 2. Risk ratios and 95% CIs for each sleep indicator and future clinically significant depressive symptoms, adjusting for base covariates. (Sensitivity Analysis 1)



Supplementary Figure 3. Risk Ratios and 95% Confidence Intervals for each composite score level, relative to a score of 0. Models adjust for base covariates. (Sensitivity Analysis 1)



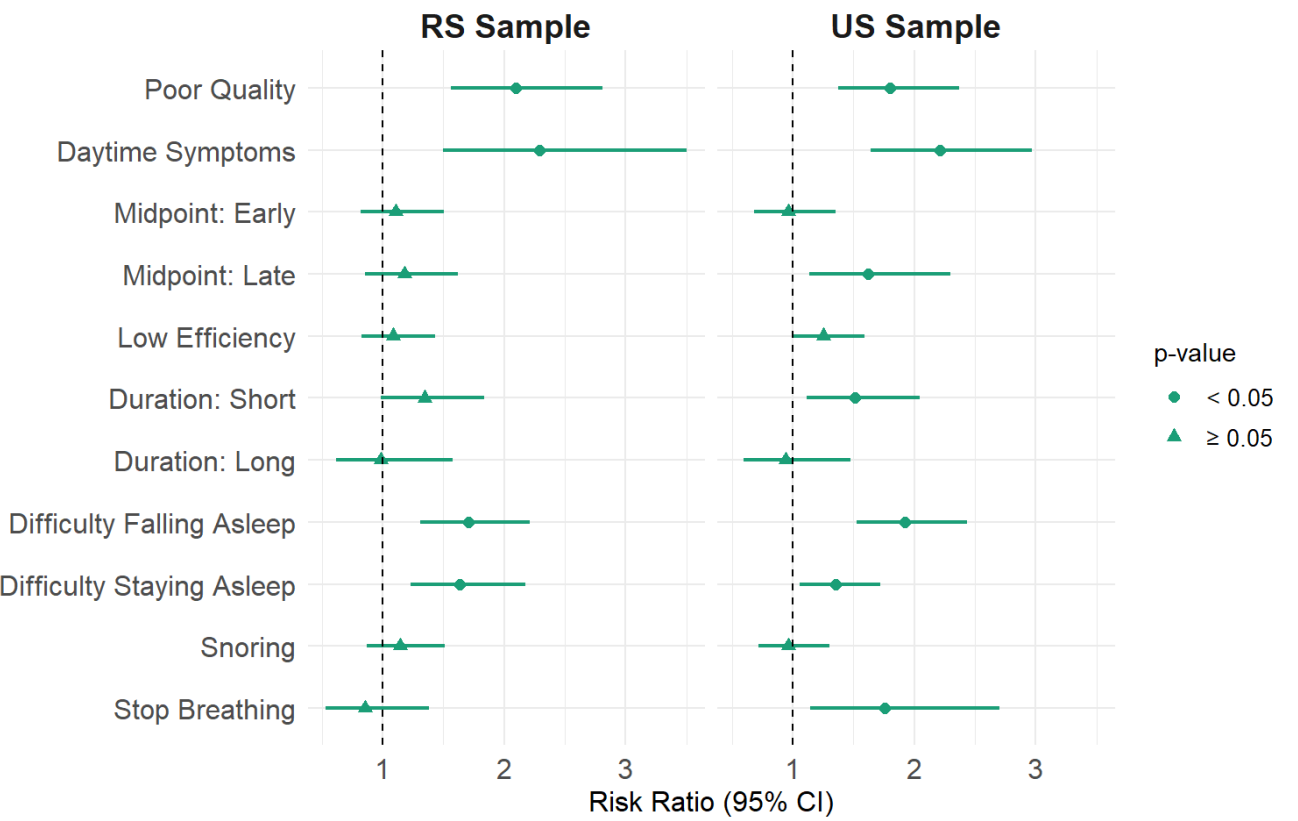
F.2. Sensitivity Analysis 2. Excluding the sleep item in the CES-D

This sensitivity analysis excludes the sleep item in the CES-D (MAP, MARS, and RS cohorts). The GSD (MrOS and SOF does not include a sleep item). The sample size was similar to the primary sample (N=3722 in RS; N=4852 in US). In the US and RS samples, 6.3% and 5.6% were indicated as having clinically relevant depressive symptoms at follow-up.

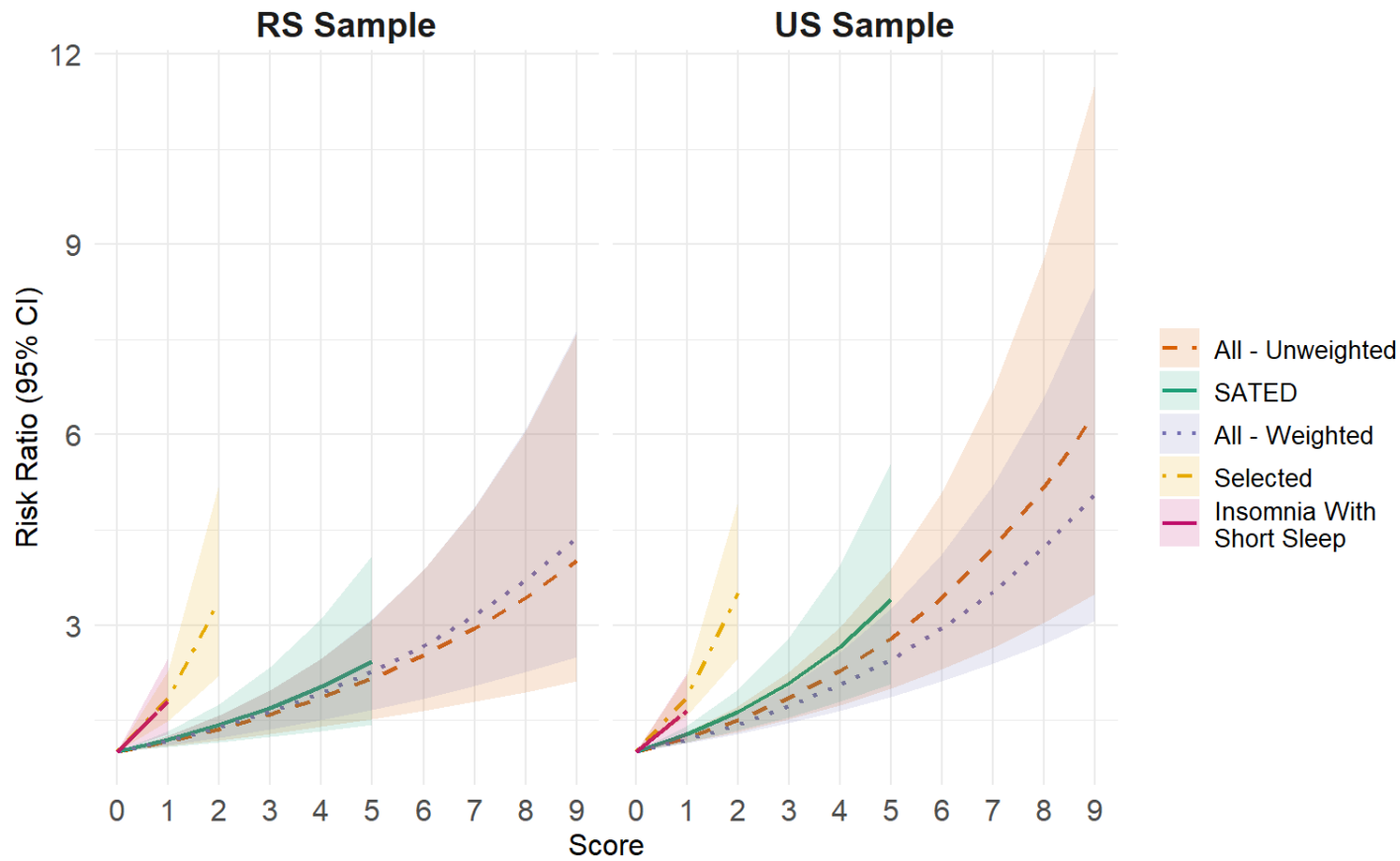
Figure F.2.1 displays risk ratios for individual sleep characteristics. Poor quality, daytime symptoms, difficulty falling asleep, and difficulty staying asleep had the strongest associations with clinically relevant depressive symptoms at follow-up in the US and RS samples.

Figure F.2.2 displays risk ratios for composite sleep scores. Similar to primary sample results, the Selected score provides the most impactful estimates of risk in both the US and RS samples.

Supplementary Figure 4. Risk ratios and 95% CIs for each sleep indicator and future clinically significant depressive symptoms, adjusting for base covariates. (Sensitivity Analysis 2)



Supplementary Figure 5. Risk Ratios and 95% Confidence Intervals for each composite score level, relative to a score of 0. Models adjust for base covariates. (Sensitivity Analysis 2)



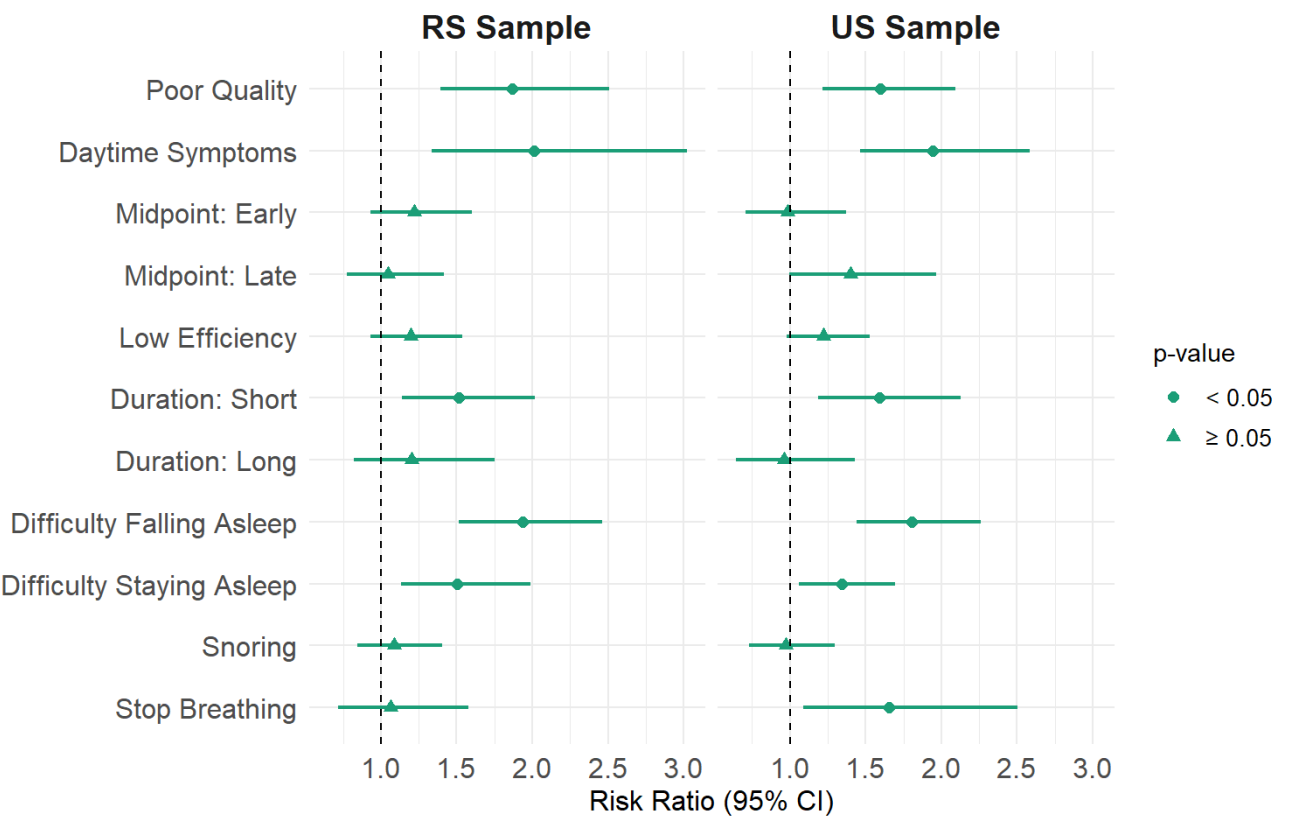
F3. Sensitivity Analysis 3: Adding secondary covariates.

Findings were consistent after adjusting for additional potential confounders or mediators. While effect sizes were dampened slightly with the addition of additional measures, there were no notable changes in either clinical or statistical significance.

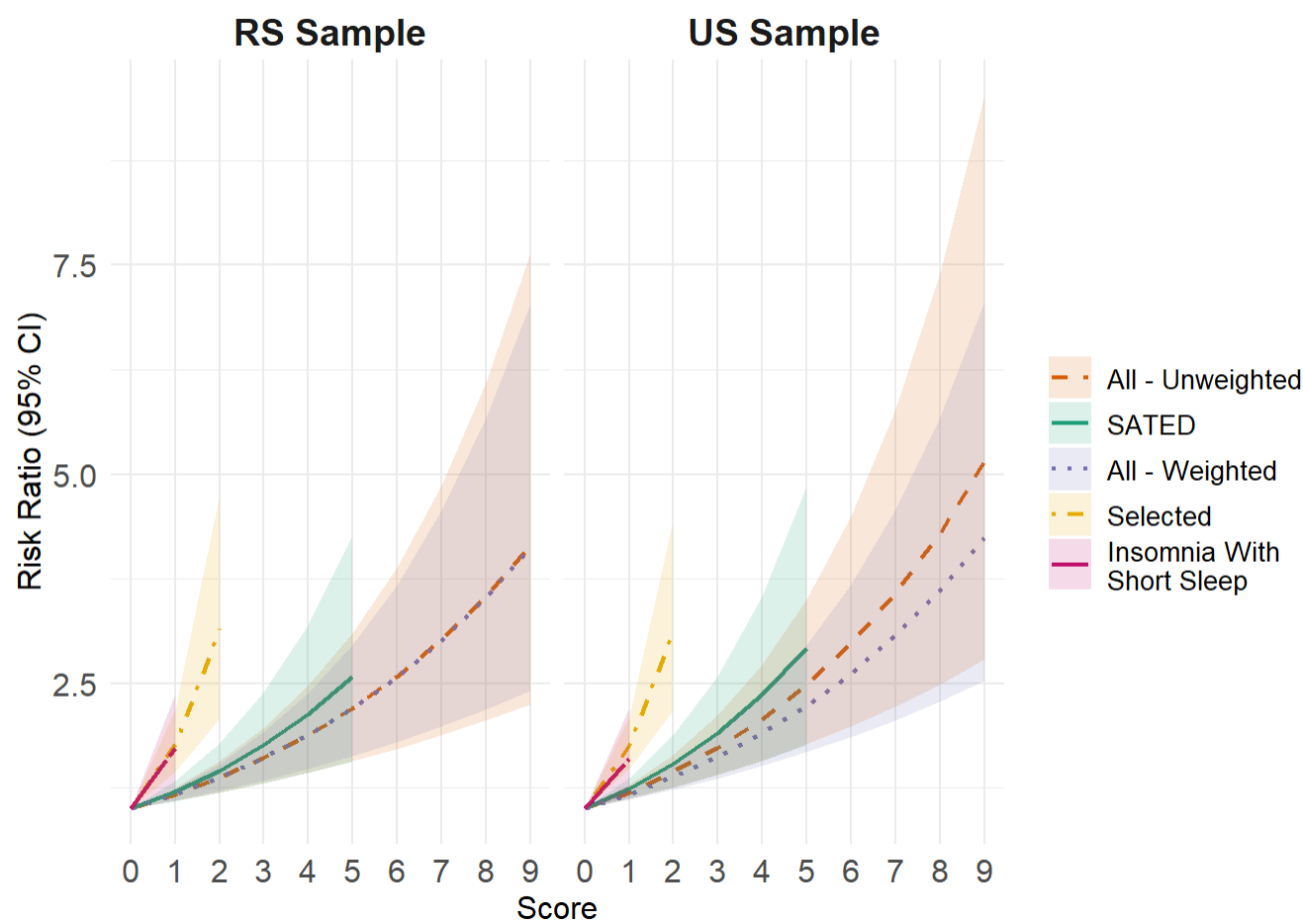
Figure F.3.1 displays risk ratios for individual sleep characteristics. Poor quality, daytime symptoms, short duration, difficulty falling asleep, and difficulty staying asleep had the strongest associations with clinically relevant depressive symptoms at follow-up in the US and RS samples.

Figure F.3.2 displays risk ratios for composite sleep scores. Similar to primary sample results, the Selected score provides the most impactful estimates of risk in both the US and RS samples.

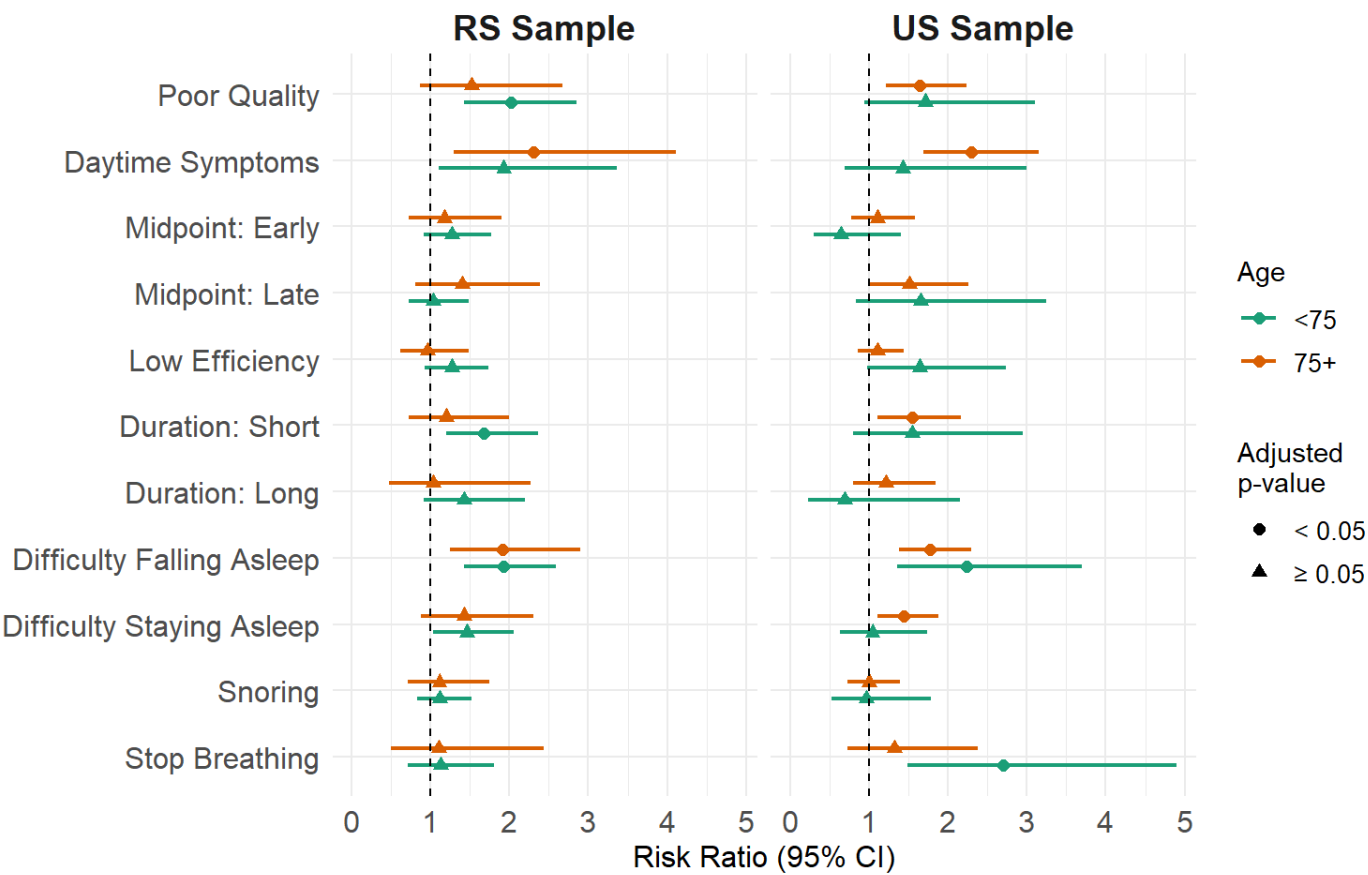
Supplementary Figure 6. Risk ratios and 95% CIs for each sleep indicator and future clinically significant depressive symptoms, adjusting for base covariates. (Sensitivity Analysis 3)



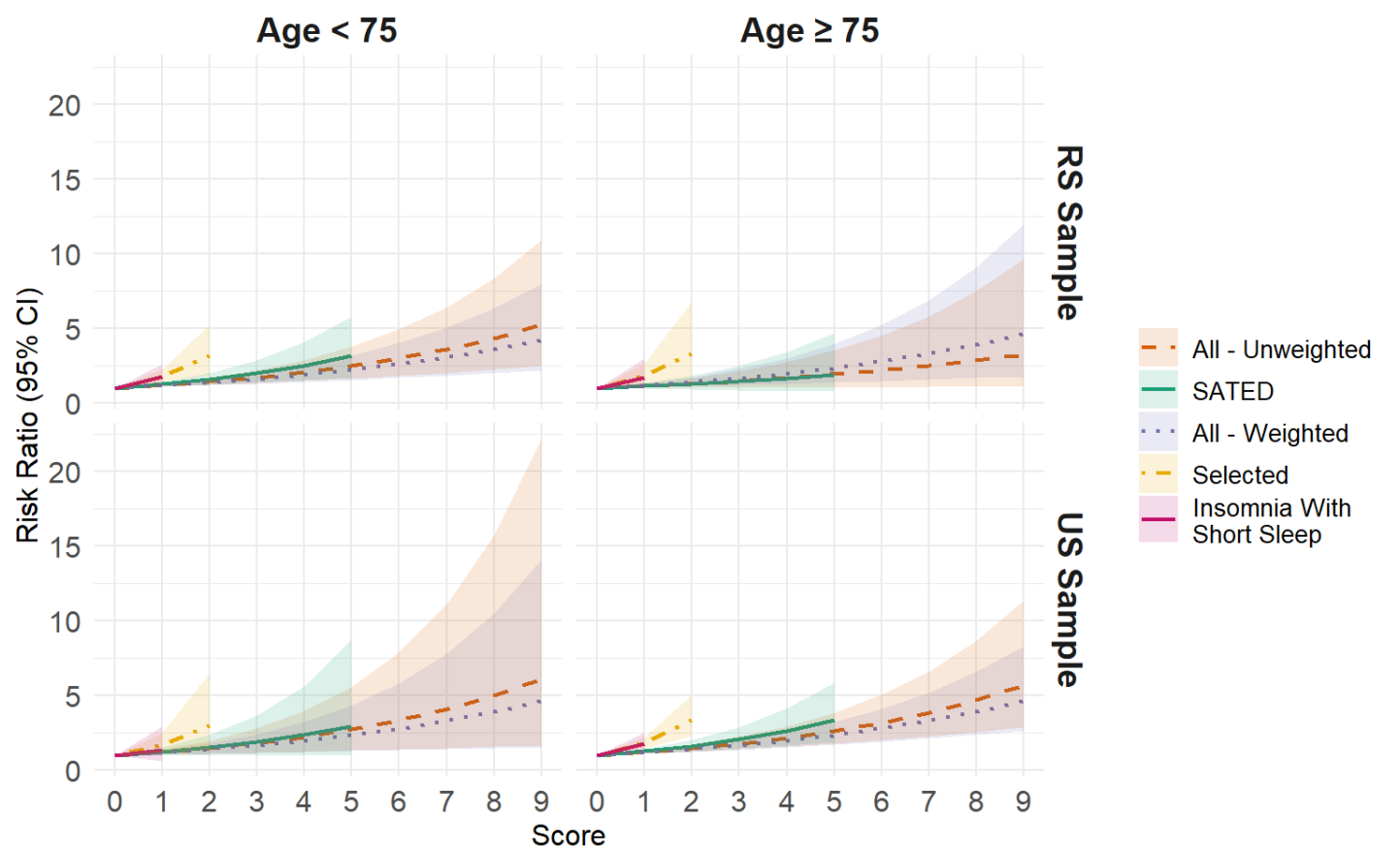
Supplementary Figure 7. Risk Ratios and 95% Confidence Intervals for each composite score level, relative to a score of 0. Models adjust for base covariates. (Sensitivity Analysis 3)



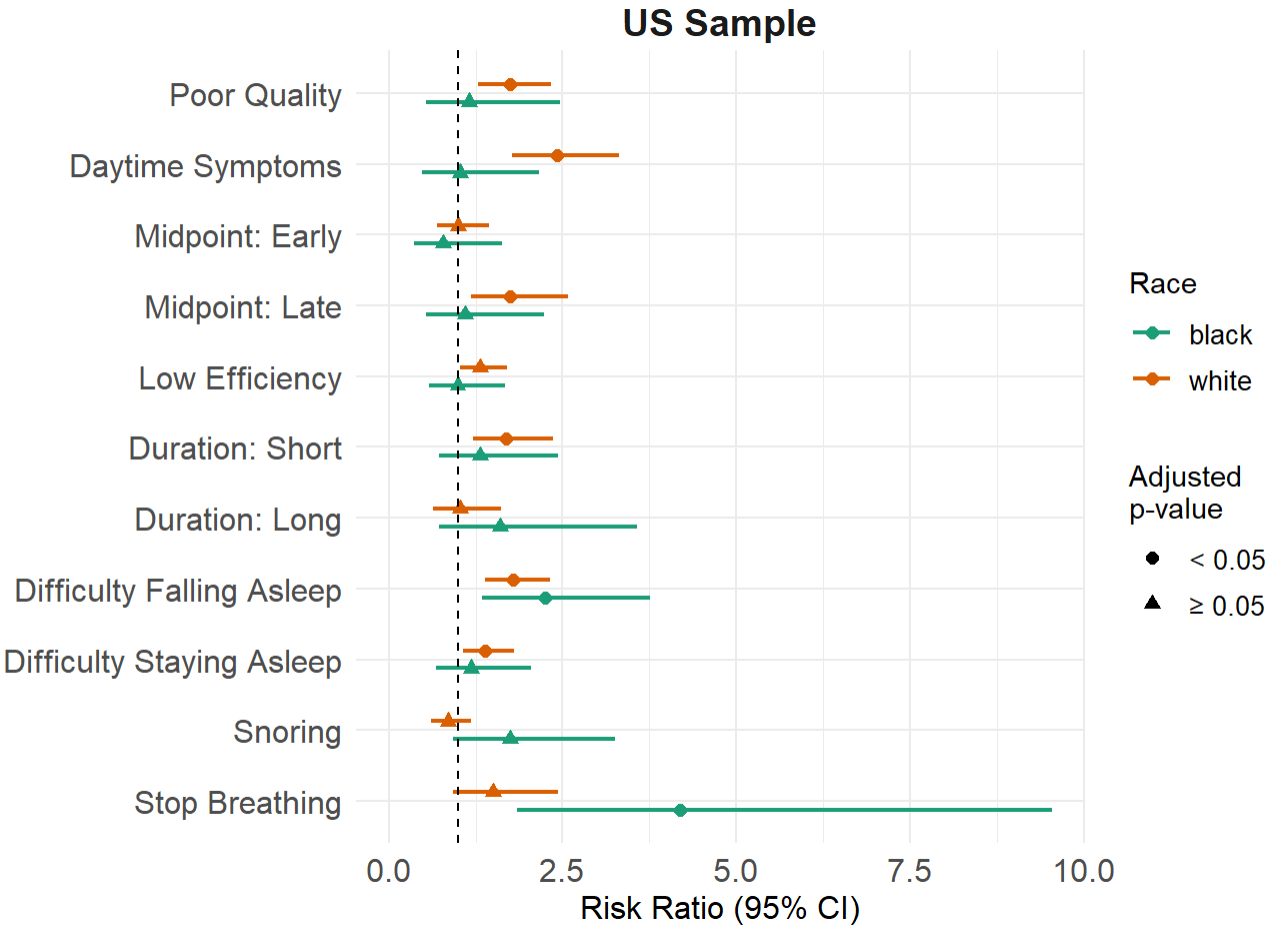
Supplementary Figure 8. Association of individual sleep features and clinically relevant depressive symptoms, stratified by age.



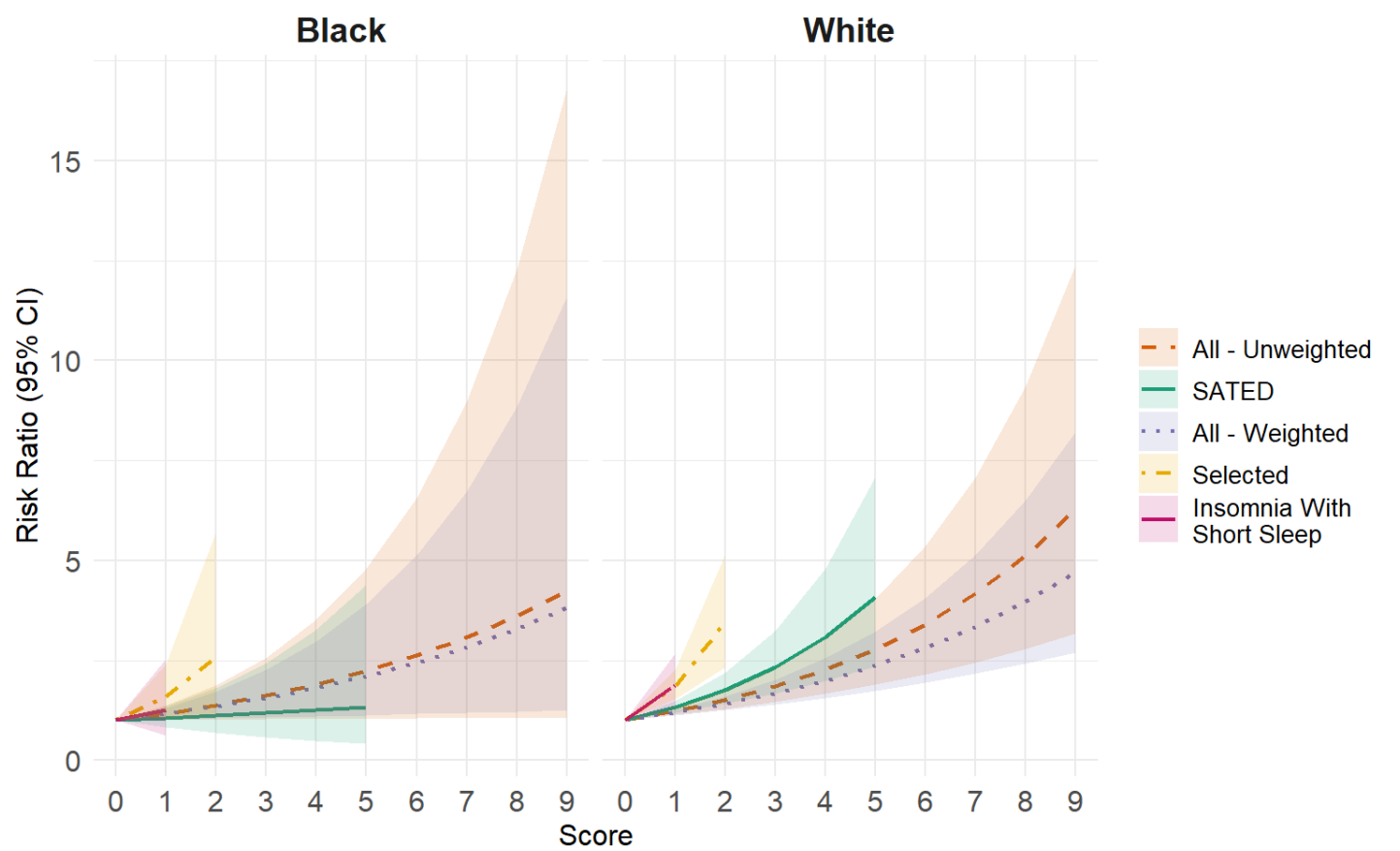
Supplementary Figure 9. Association of composite sleep features and clinically relevant depressive symptoms, stratified by age.



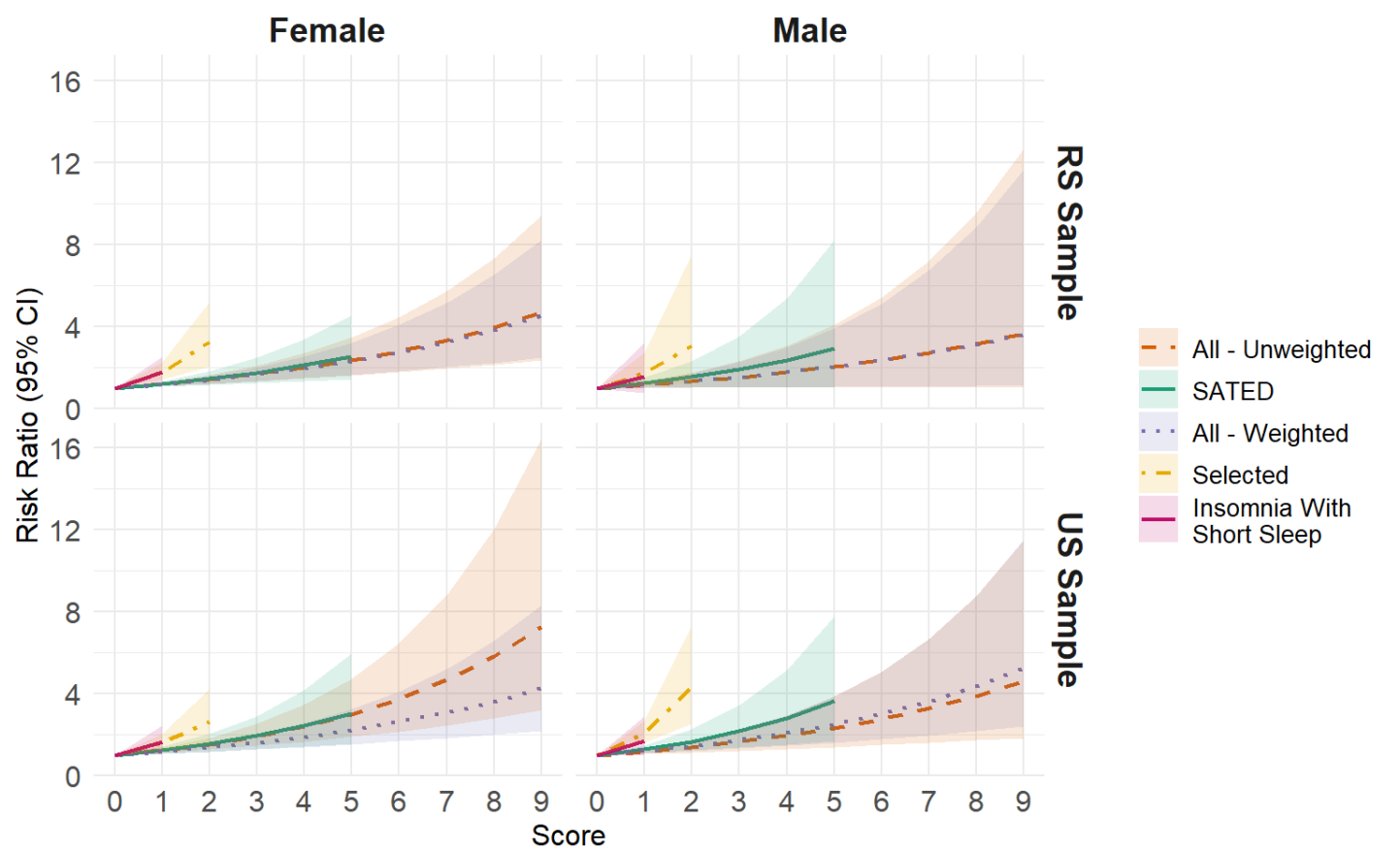
Supplementary Figure 10. Association of individual sleep features and clinically relevant depressive symptoms, stratified by race.



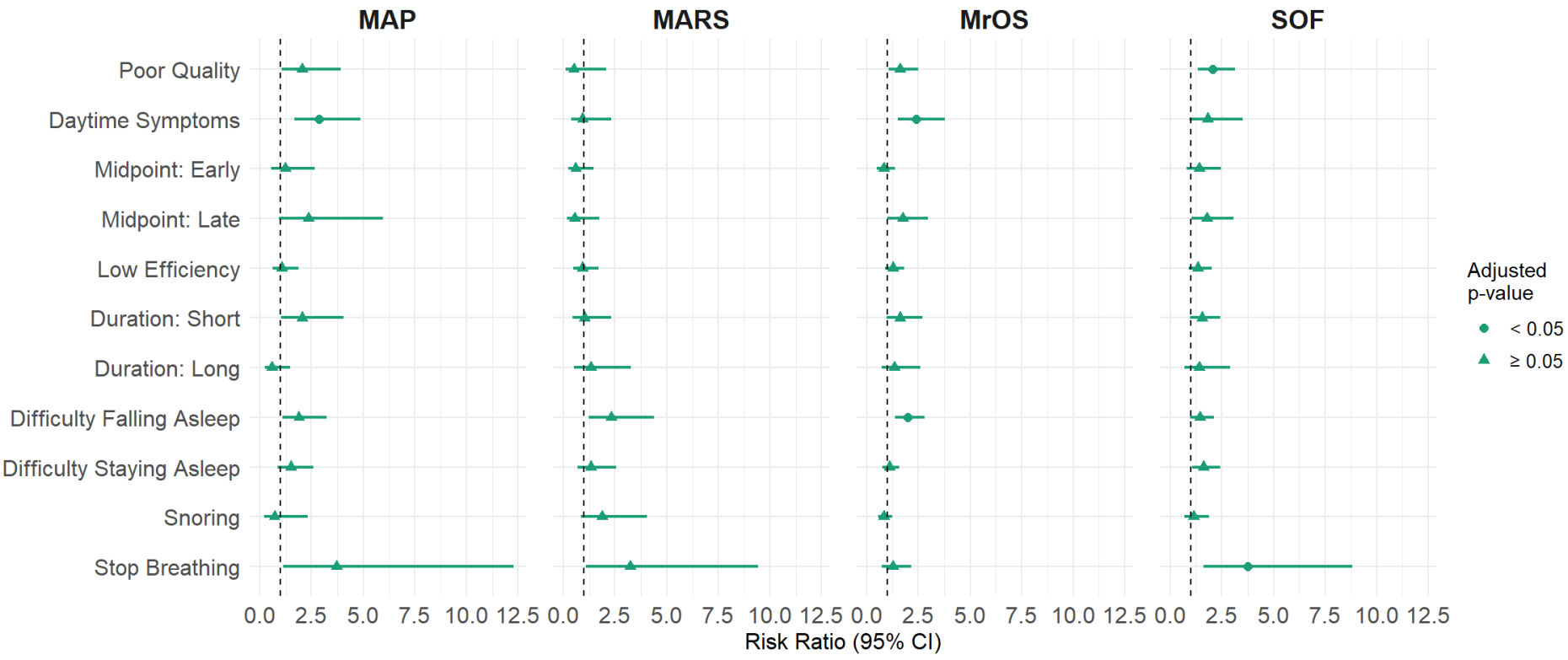
Supplementary Figure 11. Association of composite sleep features and clinically relevant depressive symptoms, stratified by race.



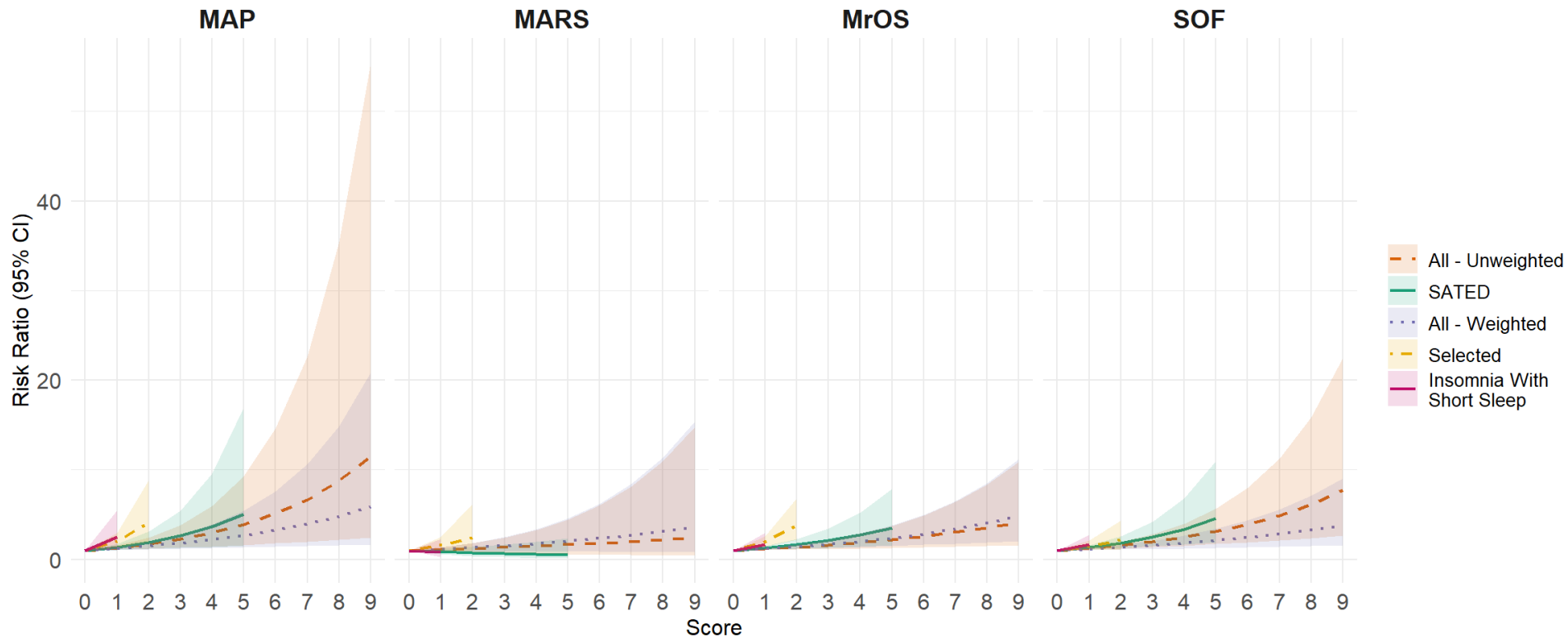
Supplementary Figure 12. Association of composite sleep features and clinically relevant depressive symptoms, stratified by sex.



Supplementary Figure 13. Association of individual sleep features and clinically relevant depressive symptoms, stratified by cohort.



Supplementary Figure 14. Association of composite sleep features and clinically relevant depressive symptoms, stratified by cohort.



Supplement H. References

1. Tibshirani R. Regression shrinkage and selection via the lasso Journal of the Royal Statistical Society, Series B. 1996; 58 (1): 267-288.
2. Zou H, Hastie T. Regularization and variable selection via the elastic net. Journal of the Royal Statistical Society, Series B. 2005; 67 (2): 301-320.