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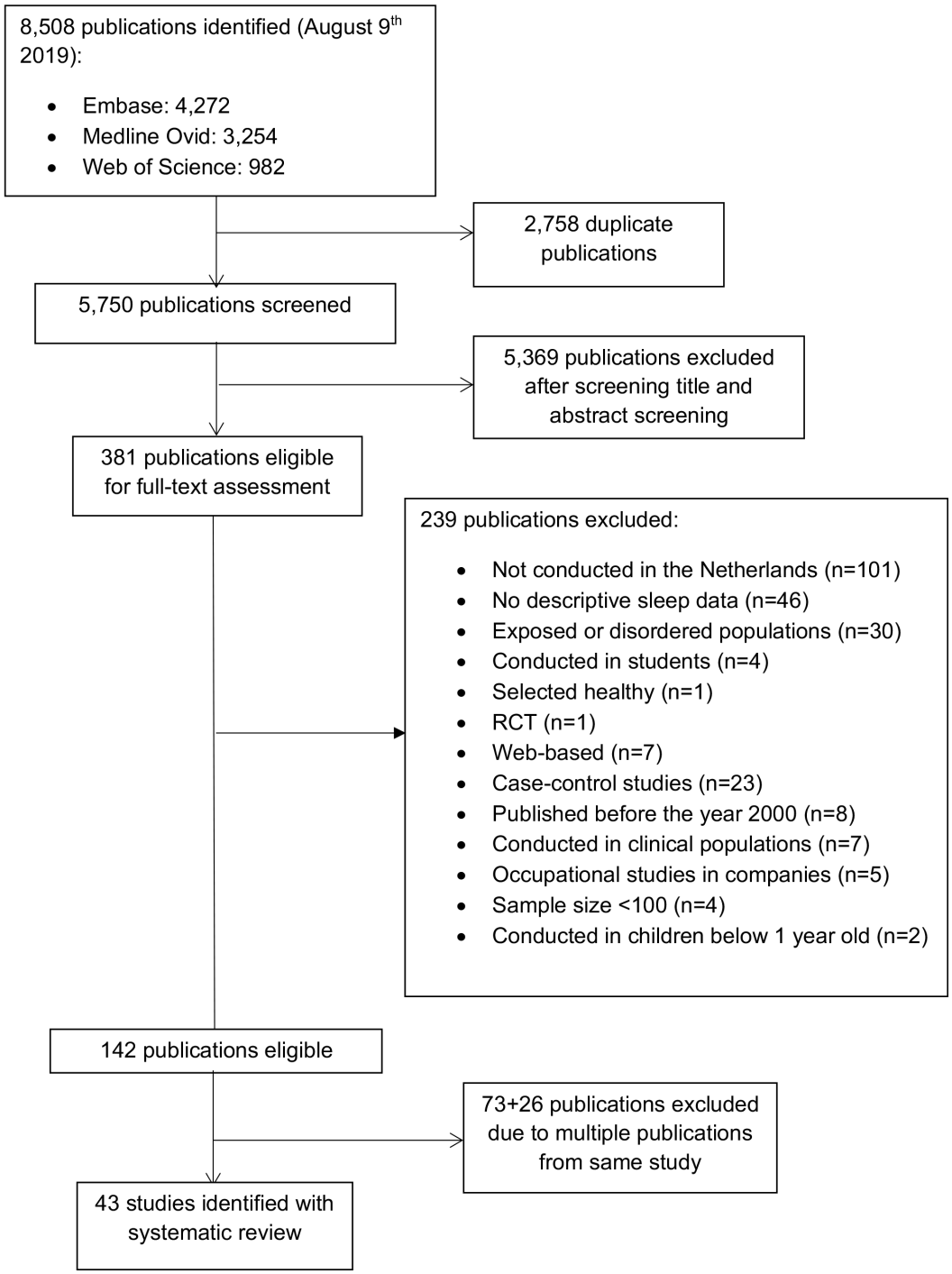
## Supplementary information

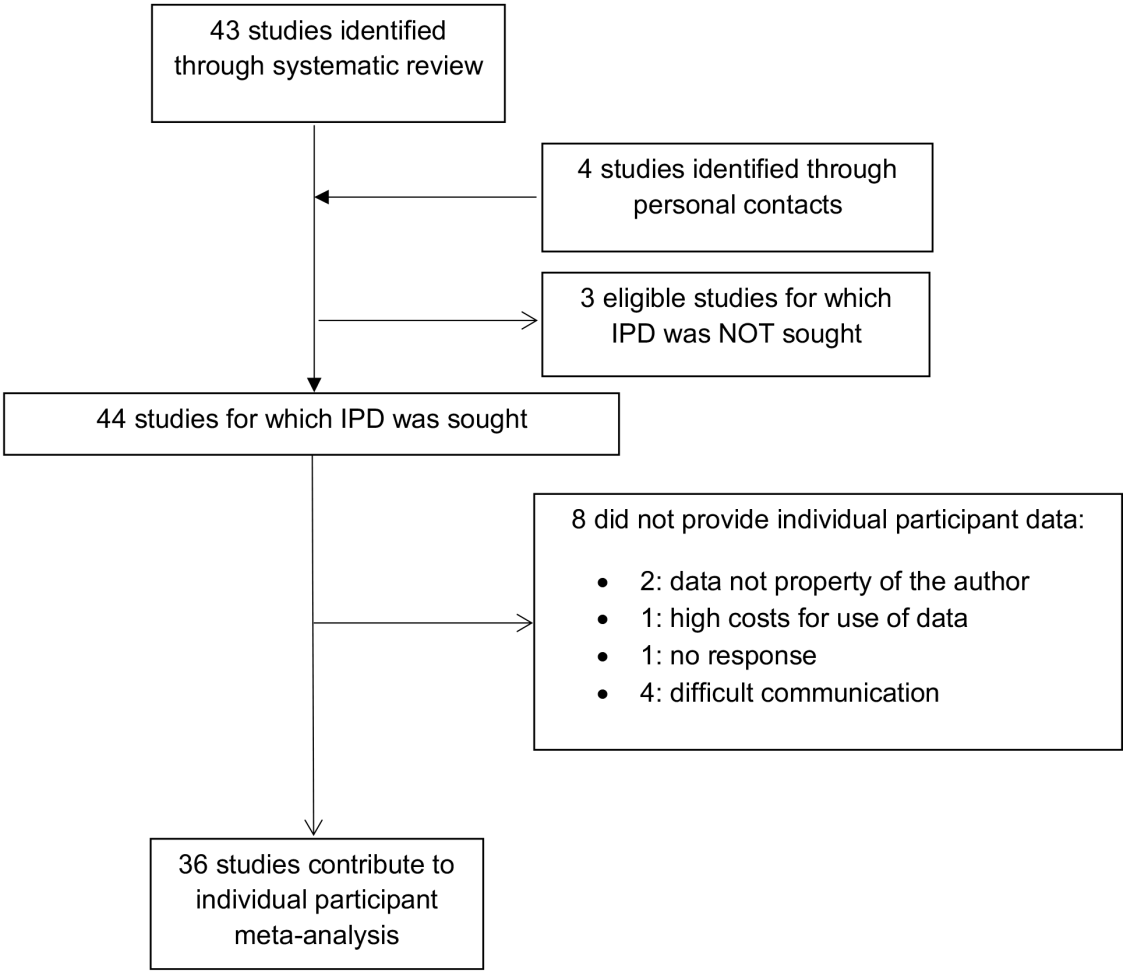
# Sleep characteristics across the lifespan in 1.1 million people from the Netherlands, United Kingdom and United States: a systematic review and meta-analysis

In the format provided by the authors and unedited

Supplementary Figure 1a: Flowchart of systematic literature review and study inclusion



Supplementary Figure 1b: Flowchart of individual participant data (IPD) attainment



## Supplementary Table 1. Baseline Characterustics of the studies from the Netherlands included in the meta-analysis

| Study Name | N | Year of data-collection | Age | | Sex | | Education | | | Ethnic Origin | | | Employment | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | median | [min-max] | male | female | low | middle | high | Dutch | Other Europe | Non Europe | No | Yes |
| **GECKO(20, 21)** | 1,922 | 2009 | 2.1 | [0.99, 3.39 | 51.1 | 48.9 | 9.6 | 19.2 | 71.2 | 71.1 | 12.1 | 16.9 | - | - |
| **Generation R(22-28)** | 5,012 | 2005-2009 | 3.02 | [2.10,4.63] | 47.6 | 52.4 | 17.6 | 42.8 | 39.5 | - | - | - | 7.6 | 92.4 |
| **ABCD(1)** | 3,444 | 2011 | 7.41 | [6.70, 8.59] | 44.2 | 55.8 | 30.6 | 31.2 | 38.2 | 91.1 | 6.6 | 2.3 | 28.2 | 71.8 |
| **ChecKid(4, 5)** | 10,362 | 2006;2009; 2012 | 7.86 | [3.97, 13.2] | 50.1 | 49.9 | 10.9 | 21.2 | 67.9 | 94.4 | 3.3 | 2.3 | - | - |
| **EPHE(18, 19)** | 127 | 2013 | 8 | [6.00,9.00] | 52 | 48 | 11.6 | 31.7 | 56.6 | 93.9 | 2.9 | 3.2 | - | - |
| **CSHQ(6, 7)** | 1,504 | 2006-2007 | 8.5 | [2.16,13.7] | 41.6 | 58.4 | 3.8 | 14.6 | 81.6 | 95.1 | - | - | - | - |
| **INPACT(34)** | 1,914 | 2008-2009 | 8.66 | [7.17,11.2 | 46 | 54 | - | - | - | 52.7 | 0 | 47.3 | - | - |
| **Heijden(31)** | 269 | 2010 | 9.98 | [7.02,12.8] | 41.3 | 58.7 | 10.6 | 41.2 | 48.2 | - | - | - | - | - |
| **Vermeulen(71)** | 100 | 2012 | 10.5 | [8.98,12.2] | 47.3 | 52.7 | 46.1 | 29.9 | 24 | - | - | - | 51.7 | 48.3 |
| **Meijer (37, 38)** | 638 | 2000 | 11 | [9.06, 13.1] | 48.5 | 51.5 | 69.9 | 25 | 5.1 | - | - | - | - | - |
| **PIAMA(52, 53)** | 2,969 | 2007 | 11.3 | [10.4,13.7] | 46.1 | 53.9 | 53.2 | 29.6 | 17.2 | 84.9 | - | - | - | - |
| **ENERGY(12-14)** | 396 | 2010 | 12 | [10.0,14.0] | 47.2 | 52.8 | 9.4 | 38.7 | 51.9 | - | - | - | - | - |
| **Zuid Holland(73)** | 1,706 | 2003 | 12.6 | [5.78,20.0]] | 49.4 | 50.6 | - | - | 37.9 | 94.5 | 1.8 | 3.6 | - | - |
| **Meijer (36)** | 446 | 1998 | 13 | [12.0,15.0] | 50.2 | 49.8 | 15.1 | 27.3 | 57.6 | 65.2 | 9.3 | 25.5 | - | - |
| **Pieters(54, 55)** | 545 | 2008 | 14 | [11.0,16.0] | 48.5 | 51.5 | 60.3 | 22.3 | 17.4 | 95.2 | - | - | - | - |
| **deBruin(8)** | 308 | 2011-2014 | 14.4 | [12.5, 19.8] [11.0, 23.5] | 44.2 | 55.8 | 14.8 | 34.6 | 50.6 | - | - | - | - | - |
| **Dewald(10)** | 954 | 2011 | 14.4 | | 42.6 | 57.4 | 44.1 | 29.9 | 26 | 19.6 | - | 80.2 | 39.9 | 60.1 |
| **Schalkwijk(66)** | 354 | - | 14.6 | [12.6, 16.4] | 49.8 | 50 | 23.1 | 43.8 | 33.1 | 90.1 | 3.2 | 6.7 | - | - |
| **Wolbeek(72)** | 3,445 | - | 14.6 | [11.2,19.4 | 44.8 | 55.2 | 46.6 | 34.1 | 19.3 | 95.4 | 0.3 | 4.4 | 83.5 | 16.5 |
| **deVrijer(9)** | 300 | 2003 | 16 | [15.0, 18.2] | 41.1 | 58.9 | 24.9 | 41.6 | 33.3 | 97.1 | 1.5 | 1.5 | 11.1 | 88.1 |
| **TRAILS(67-70)** | 1,668 | 2008 | 19 | [18.0, 20.9] | 51.1 | 48.9 | - | - | - | - | - | - | - | - |
| **Reijneveld(56)** | 4,394 | 2005-2006 | 28 | [12.0, 40.0] | 49.5 | 50.5 | 8.7 | 53 | 38.3 | 76.8 | - | 17.1 | - | - |
| **AGHLS(2)** | 340 | 2006 | 42 | [41.0, 45.0] | 45.2 | 54.8 | 48.9 | 27.5 | 23.6 | - | - | - | 39 | 61 |
| **Enschede(15-17)** | 806 | 2001-2002 | 43 | [19.0,96.0] | 49.8 | 50.2 | 6.9 | 63.5 | 29.6 | 84.8 | 6 | 9.2 | 28.2 | 71.8 |
| **MORGEN(39, 40)** | 22,847 | 1993-1997 | 43.4 | [20.1, 65.8] | 46.9 | 53.1 | 25.1 | 45.5 | 29.5 | - | - | - | 35.4 | 64.6 |
| **Lifelines** | 63,446 | - | 44 | [20.0, 68.0] | 38.9 | 61.1 | 13.6 | 36.2 | 50.2 | 94.5 | 1.8 | 3.8 | - | - |
| **HELIUS(32, 33)** | 23,563 | 2011-2015 | 45 | [18.0,73.0] | 47.4 | 52.6 | 37.6 | 32.1 | 30.3 | 99.1 | 0 | 0.9 | - | - |
| **NESDA Controls(43-49)** | 601 | 2008 | 47 | [20.0, 67.0] | 50.7 | 49.3 | 20.3 | 41.4 | 38.3 | 92.7 | 4.3 | 3 | - | - |
| **AMIGO(3)** | 14,670 | 2011-2012 | 51 | [23.0,80.0] | 47.5 | 52.5 | 28.8 | 60.9 | 10.3 | 90.4 | 0.4 | 9.6 | - | - |
| **GLOBE(29, 30)** | 4,122 | 1997 | 51 | [14.0,74.0] | 48.7 | 51.3 | 36.1 | 37.8 | 26.2 | 90.9 | 1.5 | 7.6 | - | - |
| **NEMESIS-2 (41)** | 4,618 | 2013-2015 | 51 | | 41.7 | 58.3 | 12.1 | 69.5 | 18.4 | - | - | - | 72.6 | 27.4 |
| **NEO(42)** | 5,808 | 2011 | 56 | [44.0, 66.0] | 55.2 | 44.8 | 14.7 | 32 | 53.3 | 96 | - | - | - | - |
| **Doetinchem(11)** | 4,014 | 2007-2013 | 59.5 | [40.9,80.7] | 44.9 | 55.1 | 1.4 | 86.3 | 12.3 | 89.4 | 2.8 | 7.8 | 30.2 | 69.8 |
| **New Hoorn(50, 51)** | 1,678 | 2013-2015 | 61 | [45.0,73.0] | 42 | 58 | 10 | 38 | 52 | 99 | - | - | - | - |
| **Rotterdam Study (57-65)** | 9,818 | 2002-2008 | 65.8 | [45.5,98.9] | 49.5 | 50.5 | - | - | - | - | - | - | - | - |
| **LASA(35)** | 1,535 | 2008-2009 | 72 | [60.0,100] | 49.1 | 50.9 | 39.2 | 36.2 | 24.6 | 84.3 | 3.1 | 12.6 | - | - |

Footnote: numbers do not add up to 100% due to missings. Parental education is reported for pediatric cohorts. References are provided on the following page.

Supplementary Table 1: reference list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## Supplementary Table 2. Study-specific sleep estimates

| Study Name | N | TST, hrs | Bedtime | Wake time | TIB, hrs | DIS | DMS | EMA | NA | Med | NRS | Sleepy | Snore | PSQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **GECKO(20, 21)** | 1,922 | - | 19.3±0.5 | 7.1±0.6 | 11.9±0.6 | - | - | - | - | - | - | - | - | - |
| **Generation R(22-28)** | 5,012 | - | 19.9±0.7 | 7.3±0.7 | 11.4±0.7 | 4.1 | - | - | 3.5 | - | - | - | - | - |
| **ABCD(1)** | 3,444 | 10.6±0.7 | 20.0±0.5 | 7.1±0.4 | 11.2±0.6 | 11.4 | - | - | 8.0 | - | 6.8 | 4.5 | 18.8 | 2.7 |
| **ChecKid(4, 5)** | 10,362 | 11.2±0.6 | 19.8±0.6 | 7.0±0.4 | 11.2±0.6 | 10.5 | 4.1 | 29.3 | - | - | - | 1.3 | - | - |
| **EPHE(18, 19)** | 127 | 10.1±1.0 | 19.9±6.0 | 7.0±0.4 | 11.1±0.6 | - | - | - | - | - | - | - | - | - |
| **CSHQ(6, 7)** | 1,504 | 10.6±0.9 | 20.0±0.7 | 7.1±0.4 | 11.1±0.7 | 7.3 | - | - | 10.4 | - | 7.2 | 2.5 | 20.7 | - |
| **INPACT(34)** | 1,914 | - | 20.1±0.4 | 7.2±0.3 | 11.1±0.5 | - | - | - | - | - | - | - | - | - |
| **Heijden(31)** | 269 | - | 21.1±0.7 | 7.2±0.4 | 10.1±0.7 | - | - | - | - | - | - | - | - | - |
| **Vermeulen(71)** | 100 | - | - | - | 9.9±0.6 | - | - | - | - | - | - | - | - | - |
| **Meijer (37, 38)** | 638 | - | 21.8±0.7 | 6.8±0.5 | 9.0±0.8 | 15.4 | 23.7 | - | 8.4 | - | 26.8 | 8.4 | - | 4.2 |
| **PIAMA(52, 53)** | 2,969 | - | 20.7±0.5 | 7.2±0.4 | 10.5±0.5 | 16.0 | 7.9 | - | 4.3 | - | 18.1 | 5.0 | - | - |
| **ENERGY(12-14)** | 396 | 9.6±0.9 | - | - | - | - | - | - | 34.9 | - | - | - | - | - |
| **Zuid Holland(73)** | 1,706 | - | - | - | - | - | 9.5 | - | - | - | - | - | - | - |
| **Meijer (36)** | 446 | - | 20.9±0.5 | 7.2±0.5 | 10.3±0.7 | 20.3 | 33.6 | - | 18.7 | - | 43.8 | 25.0 | - | 4.7 |
| **Pieters(54, 55)** | 545 | - | - | - | - | 21.6 | - | - | - | - | - | - | - | - |
| **deBruin(8)** | 308 | - | 22.2±0.8 | 7.1±0.4 | 8.9±0.8 | 18.4 | 29.2 | - | 3.9 | 3.2 | 36.8 | 12.4 | - | 7.2 |
| **Dewald(10)** | 954 | 7.9±1.2 | 22.2±0.9 | 6.8±0.5 | 8.6±0.9 | - | 26.1 | - | 10.0 | 7.2 | 25.6 | 22.4 | - | 6.1 |
| **Schalkwijk(66)** | 354 | - | - | - | - | - | - | - | - | - | 32.7 | 12.8 | - | - |
| **Wolbeek(72)** | 3,445 | - | 21.9±0.8 | 7.0±0.4 | 9.0±0.8 | - | - | - | - | - | 53.7 | - | - | - |
| **deVrijer(9)** | 300 | - | 22.5±0.9 | 7.1±0.6 | 8.5±0.8 | 14.5 | 18.7 | - | 7.3 | - | 26.1 | 16.0 | - | 7.0 |

Numbers represent mean ± standard deviation, or percentages.
Abbreviations: Total Sleep Time, TST, Time in Bed (TIB), hours difficulty initiating sleep (DIS), difficulty maintaining sleep (DMS), early morning awakening (EMA), nighttime awakenings (NA), sleep medication use (Med), Non-restorative sleep (NSR, Sleepiness (Sleepy), Poor Sleep Quality (PSQ)

## Supplementary Table 2 (continued). Study-specific sleep estimates

| Study Name | N | TST, hrs | Bedtime | Wake time | TIB, hrs | DIS | DMS | EMA | NA | Med | NRS | Sleepy | Snore | PSQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **TRAILS(67-70)** | 1,668 | - | - | - | - | 27.9 | - | 10.3 | - | 2.0 | - | - | - | 14.1 |
| **Reijneveld(56)** | 4,394 | - | 22.8±1.1 | 6.9±1.0 | 8.2±1.2 | - | - | - | - | - | - | - | - | - |
| **AGHLS(2)** | 340 | 7.7±1.1 | - | - | - | 4.7 | 13.9 | 14.2 | 13.3 | - | 9.7 | 10.0 | - | - |
| **Enschede(15-17)** | 806 | - | - | - | - | 11.7 | 25.6 | 4.8 | - | - | 68.2 | - | - | 18.1 |
| **MORGEN(39, 40)** | 22,847 | 7.3±0.9 | - | - | - | - | - | - | - | - | - | - | - | - |
| **Lifelines** | 63,446 | 7.1±0.9 | 22.8±0.7 | 6.6±0.8 | 7.8±8.4 | 7.1 | - | - | 21.8 | 9.3 | - | 5.6 | 28.3 | 13.0 |
| **HELIUS(32, 33)** | 23,563 | 6.9±1.3 | - | - | - | - | - | - | - | - | - | - | - | - |
| **NESDA Controls(43-49)** | 601 | 7.4±0.9 | 23.2±0.9 | 7.1±1.1 | 8.1±1.0 | 5.7 | 7.8 | 15.7 | 29.3 | - | - | - | - | 7.9 |
| **AMIGO(3)** | 14,670 | 7.0±1.0 | - | - | - | 13.3 | 15.4 | - | 8.9 | 8.4 | 11.6 | 11.2 | 25.3 | 11.6 |
| **GLOBE(29, 30)** | 4,122 | - | - | - | - | 11.2 | - | 32.6 | 8.2 | 7.5 | - | - | - | 15.0 |
| **NEMESIS-2 (41)** | 4,618 | 7.0±1.1 | - | - | - | 8.2 | 12.7 | 20.8 | 31.2 | - | - | - | - | - |
| **NEO(42)** | 5,808 | 6.9±1.1 | 23.3±0.9 | 7.3±1.2 | 8.0±1.1 | 14.0 | - | - | 32.7 | 28.8 | - | 10.5 | 45.0 | 14.2 |
| **Doetinchem(11)** | 4,014 | - | - | - | - | 15.0 | 15.0 | 16.7 | 34.7 | - | - | - | - | - |
| **New Hoorn(50, 51)** | 1,678 | - | 23.2±0.9 | 7.4±1.1 | 8.2±1.1 | - | - | - | 48.8 | 4.5 | - | 4.2 | - | 30.0 |
| **Rotterdam Study (57-65)** | 9,818 | 6.8±-1.3 | 23.5±0.9 | 7.1±1.1 | 7.8±1.1 | 13.3 | - | - | 17.2 | 9.8 | - | 0.7 | 48.1 | 13.8 |
| **LASA(35)** | 1,535 | 7.5±1.3 | 23.7±0.9 | - | - | 17.2 | 25.3 | 24.6 | 6.8 | - | - | - | - | 15.8 |

Numbers represent mean ± standard deviation for times, or percentages.
Abbreviations: Total Sleep Time, TST, hours difficulty initiating sleep (DIS), difficulty maintaining sleep (DMS), early morning awakening (EMA), nighttime awakenings (NA), sleep medication use (Med), Non-restorative sleep (NSR), Sleepiness (Sleepy), Poor Sleep Quality (PSQ)

**Supplementary Text**:

**Search Strategies**

1. **Embase**

(sleep/de OR 'sleep medicine'/de OR 'night sleep'/de OR 'nonREM sleep'/de OR 'REM sleep'/de OR 'sleep pattern'/de OR 'sleep quality'/de OR 'sleep stage'/de OR 'sleep time'/de OR 'sleep waking cycle'/de OR 'slow wave sleep'/de OR 'sleep induction'/de OR 'circadian rhythm'/de OR wakefulness/de OR insomnia/de OR 'sleep disorder'/de OR 'sleep parameters'/de OR 'sleep deprivation'/de OR 'polysomnography'/de OR ((sleep* NEAR/10 (night OR nonrem OR rem OR pattern* OR qualit* OR quantit* OR stage* OR time OR cycle* OR induc* OR registrat* OR measure* OR habit* OR distur* OR durat* OR architect* OR consolidate* OR parameter* OR disrupt* OR efficien* OR nocturn* OR medicat* OR drug* OR assess* OR lack OR problem* OR poor)) OR ((circadian* OR diurnal* OR ultradian* OR Nyctohemer*) NEAR/3 rhythm*) OR wakeful* OR insomnia* OR Dyssomnia* OR polysomnogra*):ab,ti) AND (Netherlands/de OR (Netherland* OR dutch*):ab,ti,ca,ta,cy,ad) AND ('cohort analysis'/de OR 'longitudinal study'/de OR 'population research'/de OR population/de OR 'epidemiological data'/de OR 'prospective study'/de OR 'retrospective study'/de OR prevalence/de OR questionnaire/de OR psychometry/de OR (cohort* OR longitudinal* OR prospectiv* OR retrospective* OR (population NEAR/3 (general* OR based* OR research* OR healthy)) OR (epidemiolog* NEAR/3 data) OR prevalen* OR questionnaire* OR psychometr*):ab,ti) NOT ([animals]/lim NOT [humans]/lim) NOT (hospital/exp OR 'hospital care'/exp OR (hospital* OR 'intensive care' OR ward OR icu ):ab,ti) NOT (('disorders of higher cerebral function'/exp OR (patient* OR case*):ab,ti) NOT ('controlled study'/exp OR (control* OR group*):ab,ti)) NOT ([Conference Abstract]/lim OR [Letter]/lim OR [Note]/lim OR [Editorial]/lim)

2. **Medline ovid**

(exp Sleep/ OR "Sleep Medicine Specialty"/ OR exp "Sleep Wake Disorders"/ OR "Circadian Rhythm"/ OR wakefulness/ OR Polysomnography/ OR ((sleep* ADJ10 (night OR nonrem OR rem OR pattern* OR qualit* OR quantit* OR stage* OR time OR cycle* OR induc* OR registrat* OR measure* OR habit* OR distur* OR durat* OR architect* OR consolidate* OR parameter* OR disrupt* OR efficien* OR nocturn* OR medicat* OR drug* OR assess* OR lack OR problem* OR poor)) OR ((circadian* OR diurnal* OR ultradian* OR Nyctohemer*) ADJ3 rhythm*) OR wakeful* OR insomnia* OR Dyssomnia* OR polysomnogra*).ab,ti.) AND (Netherlands/ OR (Netherland* OR dutch*).ab,ti,jn,cp,in.) AND (exp "Cohort Studies"/ OR population/ OR "Epidemiologic Studies"/ OR prevalence/ OR questionnaires/ OR Psychometrics/ OR (cohort* OR longitudinal* OR prospectiv* OR retrospective* OR (population ADJ3 (general* OR based* OR research* OR healthy)) OR (epidemiolog* ADJ3 data) OR prevalen* OR questionnaire* OR psychometr*).ab,ti.) NOT (exp animals/ NOT humans/) NOT (exp hospitals/ OR exp "Hospital Units"/ OR (hospital* OR "intensive care" OR ward OR icu ).ab,ti.) NOT ((exp "Mental Disorders"/ OR (patient* OR case*).ab,ti.) NOT (exp "Controlled Clinical Trial"/ OR (control* OR group*).ab,ti.)) NOT (letter OR news OR comment OR editorial OR congresses OR abstracts).pt.

3. **Web of science**

TS=((((sleep* NEAR/10 (night OR nonrem OR rem OR pattern* OR qualit* OR quantit* OR stage* OR time OR cycle* OR induc* OR registrat* OR measure* OR habit* OR distur* OR durat* OR architect* OR consolidate* OR parameter* OR disrupt* OR efficien* OR nocturn* OR medicat* OR drug* OR assess* OR lack OR problem* OR poor)) OR ((circadian* OR diurnal* OR ultradian* OR Nyctohemer*)

NEAR/2 rhythm*) OR wakeful* OR insomnia* OR Dyssomnia* OR polysomnogra*)) AND ((cohort* OR longitudinal* OR prospectiv* OR retrospective* OR (population NEAR/2 (general* OR based* OR research* OR healthy)) OR (epidemiolog* NEAR/2 data) OR prevalen* OR questionnaire* OR psychometr*)) NOT ((animal* OR rat OR rats OR mouse OR mice OR murine) NOT (human*)) NOT ((hospital* OR "intensive care" OR ward OR icu )) NOT (((patient* OR case*)) NOT ((control* OR group*)))) AND DT=(article) AND (TS=((Netherland* OR dutch*)) OR AD=((Netherland* OR dutch*))

**Coding steps and protocol**

First, the sleep constructs were defined based on expert knowledge and exploration of the datasets included in our study. Two raters (D.K. and T.S.L.) coded all datasets in two phases. We first trained using the coding protocol on datasets from three adult cohorts (Rotterdam Study, NEMESIS, LASA) and three pediatric cohorts (Generation R, ChecKid, PIAMA), for which interrater performance was monitored and calculated by a third rater (M.P.C.M.L.). Agreement on the selection of variables measuring a certain construct (sleep characteristic) over these 6 cohorts was excellent (kappa coefficient 0.83). Interrater reliability of the coded values (e.g. recoding categories) per construct was good to excellent (for continuous/ordinal variable: median intraclass correlation coefficient 1.00 [interquartile range=0.92-1.00]; for nominal variables: median kappa coefficient 1.00 [interquartile range 0.52-1.00], median percentage of agreement 88% [interquartile range=75-98%]). Consensus for disagreements on which constructs to code, and how to code them, was achieved by discussion and final decision of a third rater. No changes to the coding protocol were made after training.

Interrater reliability of coding in the next phase was further assessed for 25 random cohorts. Agreement on which constructs to code in this stage was excellent (kappa coefficient= 0.98). Disagreement of how the agreed-upon constructs had to be coded (74 out of 475) were discussed between raters after coding all datasets. Consensus was reached for all disagreements without a third rater decision.

**Coding protocol**

**General instructions**

- Always recode into different variables, with consistent variable names, and keep the original variables provided by the cohorts.
- Keep the original question in the variable label.
- Try to code each construct using one, best fitting variable that measures this symptom/construct. When discrepancies in the choice of question happen, we will solve them with consensus.
- Compute a meta-analysis participant ID.
- Compute a meta-analysis study ID

Socio-demographic data

1. **Sex:**
   - ✓ Variable name sex_studyname
   - ✓ Variable labels 0="male", 1="female"

2. **Age**: exact age in years
   - ✓ Variable name age_studyname

3. **Ethnic origin** is based on country of birth indicator or self-report
   - Dutch
   - European origin – other (e.g. other European, USA, Canada, Australia)
   - non-European origin (e.g. Dutch Antilles, Suriname, Turkey, Morocco, Indonesia, Ghana)

   ***Children's ethnic origin** can be based on parent's country of birth:
   - ➢ If one parent is Dutch, the child is Dutch.
   - ➢ If two parents are of non-Dutch origin, the ethnicity of the mother is used.

- ✓ Variable name ethnicity_studyname
- ✓ Variable labels 0="Dutch", 1="other Western", 2=" nonWestern"

4. **Education** will be based on the highest educational level finished for persons (>18 years old) or parents (persons <18 years old). The categorization is:
    - High: university degree, higher vocational training
    - Medium: more than 3 years general secondary school, intermediate vocational training or first year of higher vocational training
    - Low: no education, primary school, lower vocational training, intermediate general school or 3 years or less at general secondary school
    - ✓ Variable name education_studyname
    - ✓ Variable labels 0="high", 1="medium", 2="low"

5. **Employment**: does the participant have a paid job (yes/no).
    - ✓ Variable name employment_studyname
    - ✓ Variable labels 0="no", 1="yes"

Sleep variables

1. **TST:** self- or caregiver-reported hours of sleep.
    - Minutes are coded as decimals.
    - When reported in categories, we will code it as numerical values to the closest quarter-hour.
    - Values ≤2h or ≥20h are considered implausible and are excluded
    - ✓ Variable name: TST_studyname

2. **Clock bedtime:** scheduled/usual time to go to bed.
    - Code it as a numerical value where minutes are coded as decimals.
    - When bedtime is reported in categories, we will code it as numerical values to the closest quarter-hour.
    - Values <17:00h and >12:00h are considered implausible, and are excluded. Add 24 to values after midnight (e.g. 1AM=25h).
    - When weekend and weekday data is available, reports for weekdays are used.
    - Code a separate variable for weekend times (BedtimeWE_studyname).
    - ✓ Variable name: Bedtime_studyname
    - ✓ Variable name: BedtimeWE_studyname

3. **Wake up time:** scheduled/usual wake up time
    - Code it as a numerical value where minutes are coded as decimals.
    - When wake time is reported in categories, we will code it as numerical values to the closest quarter-hour.
    - Values before 01:00 and after 17:00 are considered implausible, and are excluded.
    - When weekend and weekday data is available, reports for weekdays are used.
        a. Code a separate variable for weekend times
    - ✓ Variable name: Waketime_studyname
    - ✓ Variable name: WaketimeWE_studyname

4. **TIB:** time between usual bedtime and wake up time
    - Numerical value in hours.
    - When reported in categories, we will code it as numerical values to the closest quarter-hour.
    - When weekend and weekday data is available, reports for weekdays are used.
        - Code a separate variable for the weekend times.

✓ Variable name: TIB_studyname
✓ Variable name: TIBwe_studyname

5. **Daytime napping**: sleeping during the day
    - **Adults:**

**-**Does the participant usually nap (no/yes).
-Regular napping for ≥30min per day.
-Frequent napping

✓ Variable name: Nap_studyname: 0="no", 1="yes"

6. **Sleep consolidation: nighttime awakenings (yes/no)**

**-YES= "**Frequently"/"Often"/" ≥3x per week" awakes at night
**-YES=** ≥2x awakening/night (>2x/night for children below 6 years old)

✓ Variable name: AWAKE_studyname
✓ Variable label "AWAKE_studyname": 0="no", 1="yes"

Insomnia

**A) Presence of insomnia symptoms:** These symptoms will be coded as yes/no. Frequency-coded answer categories will fall into yes if the symptom occurs often/frequently/≥3 times per week.

1. **Difficulty initiating sleep:** difficulty falling asleep
    ✓ Variable name: INS1_studyname,
    ✓ Variable label "INS1_studyname": 0="no", 1="yes"
2. **Difficulty maintaining sleep:** Participant wakes up at night and has trouble going back to sleep (e.g. "Last month problems waking up at night and not going back to sleep", "Regulary waking up and cannot go back to sleep")
    ✓ Variable name: INS2_studyname
    ✓ Variable label "INS2_studyname": 0="no", 1="yes"
3. **Early morning awakenings**
    ✓ Variable name: INS3_studyname
    ✓ Variable label "INS3_studyname": 0="no", 1="yes"

Other sleep quality

1. **"Poor quality":** Question, or answer categories, containing words like: "quality", "satisfaction", "good", "bad", or an opinion on sleep otherwise.
    ✓ Variable name: SQbad_studyname
    ✓ Variable label: SQbad_studyname": 0="no", 1="yes"

2. **Non-Restorative sleep,** "yes" indicates "non-restorative" sleep, e.g.:
    - Get enough sleep to feel rested upon waking in the morning (code reversed)
    - Feel non-rested after a normal night
    - Needs long in the morning to wake up

- Not rested when waking up
  - ✓ Variable name: rest_studyname
  - ✓ Variable label: rest_studyname": 0="no", 1="yes"

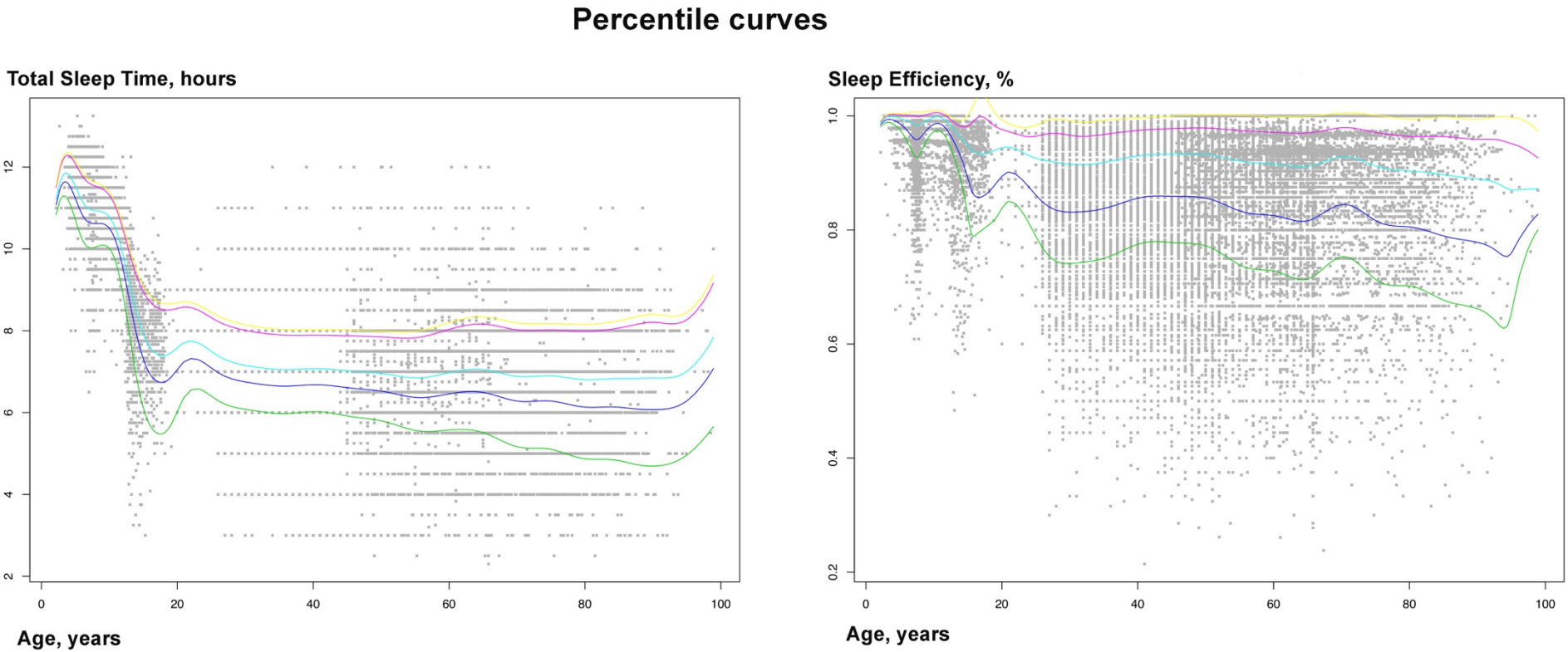
3. **Feeling sleepy during the day**
   - How often during the past month did you have difficulty staying awake during car rides, eating or social activities?
   - Sleepy during watching television
   - Feel drowsy or sleepy during the day
     - ✓ Variable name: sleepy_studyname
     - ✓ Variable label: sleepy_studyname": 0="no", 1="yes"

4. **Habitual snoring:** Snore=1 is considered if the participant snores at least once a week. Here we are more lenient on coding 'yes' if the frequency of snoring is described over a different time frame (e.g. sometimes=yes)
   - ✓ Variable name: Snore_studyname
   - ✓ Variable label: Snore_studyname": 0="no", 1="yes"

5. **Sleep medication:** A user (Med=1) is considered if the participant uses sleep medication at least once a week. Here we are more lenient on coding 'yes' if the frequency of medication use is described over a different time frame (e.g. sometimes=yes)
   - ✓ Variable name: MED_studyname

Variable label: MED_studyname": 0="no", 1="yes"

**Supplementary Figure 2. Percentile curves of total sleep time and sleep efficinecy for continous age between 1 and 100 years**




Note: The left panel represents percentiles of sleep duration per age. The right pabel represents percentiles of sleep efficiency (% of sleep within time in bed: (TST/TIB)*100) per age. The 10$^{th}$ (green), 25$^{th}$(dark blue), 50$^{th}$(light blue), 75$^{th}$,(pink) and 90$^{th}$ (yellow) percentiles are plotted.

**Supplementary Table 3. Sleep duration according to recommendations**

| Age group | N | Recommended | Sleeping less, % | Sleeping more, % | Acceptable | Sleeping less, % | Sleeping more, % |
|---|---|---|---|---|---|---|---|
| 1-2 yrs | 9 | 11-14 hrs | - | - | 9-16 hrs | - | - |
| 3-5 yrs | 1,266 | 10-13 hrs | 1.0 | 0.1 | 8-14 hrs | 0 | 0 |
| 6-13 yrs | 8,377 | 9-11 hrs | 5.4 | 24.3 | 7-12 hrs | 0.6 | 1.3 |
| 14-17 yrs | 513 | 8-10 hrs | 51.5 | 0.4 | 7-11 hrs | 17.9 | 0 |
| 18-25 yrs | 5,192 | 7-9 hrs | 14.3 | 3.1 | 6-11 hrs | 2.8 | 0.3 |
| 26-40 yrs | 38,635 | 7-9 hrs | 20.1 | 0.7 | 6-10 hrs | 3.7 | 0.1 |
| 41-64 yrs | 93,837 | 7-9 hrs | 27.8 | 0.8 | 6-10 hrs | 7.1 | 0.1 |
| >65 yrs | 8,195 | 7-8 hrs | 35.4 | 10.6 | 5-9 hrs | 4.7 | 2.0 |
| Total | 156,025 | - | 24.5 | 2.6 | - | 5.6 | 0.2 |

Recommendations are by the American National Sleep Foundatuion.

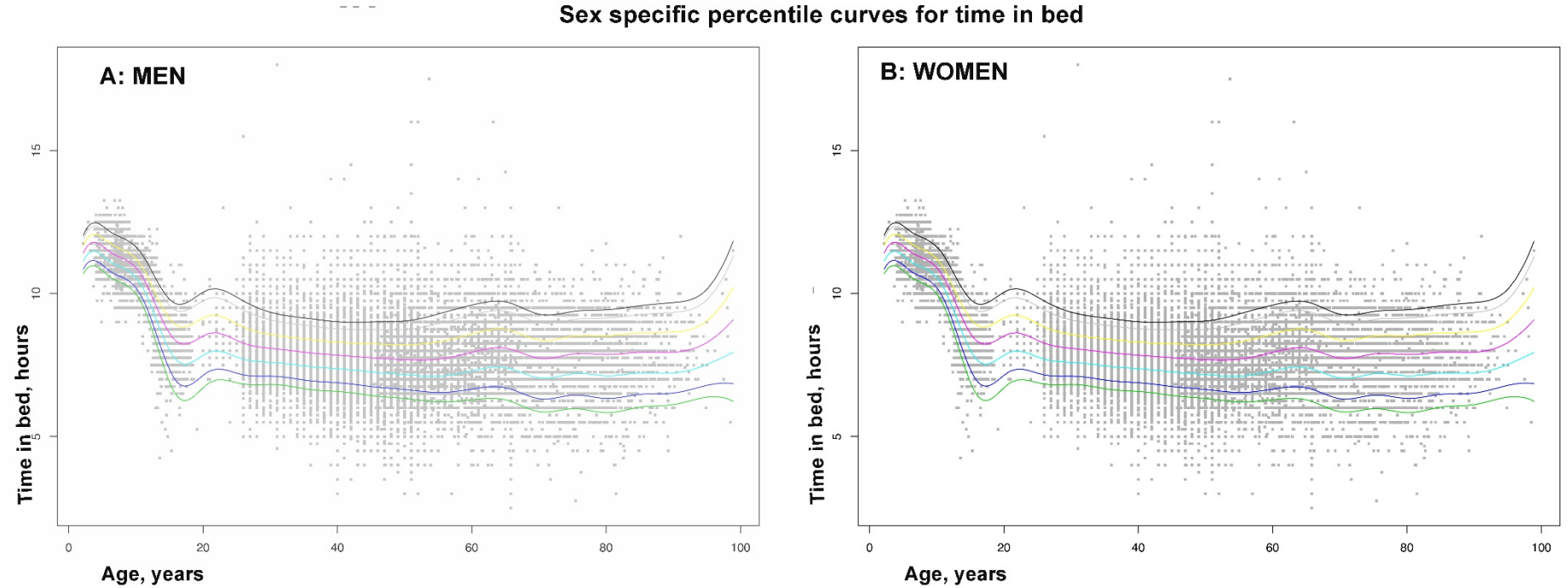
**Supplementary Table 4. Determinants of sleep duration and sleep efficiency in persons ≥18 years old**

| | Self-reported sleep duration, hrs | | | Sleep efficiency, % | | |
|---|---|---|---|---|---|---|
| | N=145,858 from 11 studies | | | N=75,752 from 5 studies | | |
| | B | 95% CI | P | B | 95% CI | P |
| **Demographic determinants model** | | | | | | |
| Age, years | -0.01 | -0.0008;-0.007 | <0.001 | 0.0003 | -0.0001;-0.0004 | <0,001 |
| Sex | | | | | | |
| Male | | reference | | | reference | |
| Female | 0.14 | 0.18; 0.21 | <0.001 | -0.02 | -0.03;-0.02 | <0.001 |
| Education | | | | | | |
| High | | reference | | | reference | |
| Middle | -0.02 | -0.04; -0,01 | 0.001 | -0.001 | -0.003;-0.001 | 0.207 |
| Low | -0.01 | -0.02; 0.004 | 0.191 | -0.01 | -0.03;-0.003 | <0.001 |
| Ethnic origin | | | | | | |
| European origin - Dutch | | reference | | | reference | |
| European origin - other | -0.07 | -0.12;-0.03 | 0.001 | -0.01 | -0.01;0.001 | 0.022 |
| non-European origin | -0.30 | -0.34;-0.30 | <0.001 | -0.03 | -0.03;-0.02 | <0.001 |
| **Social determinants model** | | | | | | |
| Employment | | | | | | |
| Yes | | reference | | | reference | |
| No | 0.24 | 0.23;0.25 | <0.001 | -0.02 | -0.03;-0.02 | <0,001 |
| Has a partner | | | | | | |
| Yes | | reference | | | reference | |
| No | -0.06 | -0.08;-0.05 | <0.001 | -0.01 | -0.03;-0.02 | 0.005 |
| **Health risk indicators model** | | | | | | |
| BMI | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Underweight | 0.08 | -0.02;0.14 | 0.010 | -0.01 | -0.02;-0.01 | 0.002 |
| Normal weight | | reference | | | reference | |
| Overweight | -0.04 | -0.06;-0.03 | 0.002 | -0.001 | -0.003;-0.001 | 0.229 |
| Obese | -0.11 | -0.12;-0.09 | <0.001 | -0.004 | -0.01;-0.002 | <0.001 |
| Smoking | | | | | | |
| nonsmoker | | reference | | | reference | |
| former smoker | -0.03 | -0.04;-0.02 | <0.001 | -0.003 | -0.01;-0.001 | <0.001 |
| current smoker | -0.06 | -0.07;-0.04 | <0.001 | -0.001 | -0.004;0.0001 | 0.078 |

Note: All estimates are adjusted for age, sex, education and ethnic origin. Betas are estimated using a linear mixed model with random effects for study

**Supplementary Figure 3. Sex-specific percentile curves for time in bed**




Note: Panel A represents percentiles of time in bed per age group in males. Panel B represents percentiles of time in bed per age group in females. The 5$^{th}$ (green), 10$^{th}$ (dark blue), 25$^{th}$ (light blue), 50$^{th}$ (pink), 75$^{th}$ (yellow), 90$^{th}$ (grey), and 95$^{th}$ (black) percentiles are plotted.

**Supplementary Table 5. Time in bed, total sleep time and sleep efficiency estimates based on variance weighted random effects meta-analysis, stratified by age and sex**

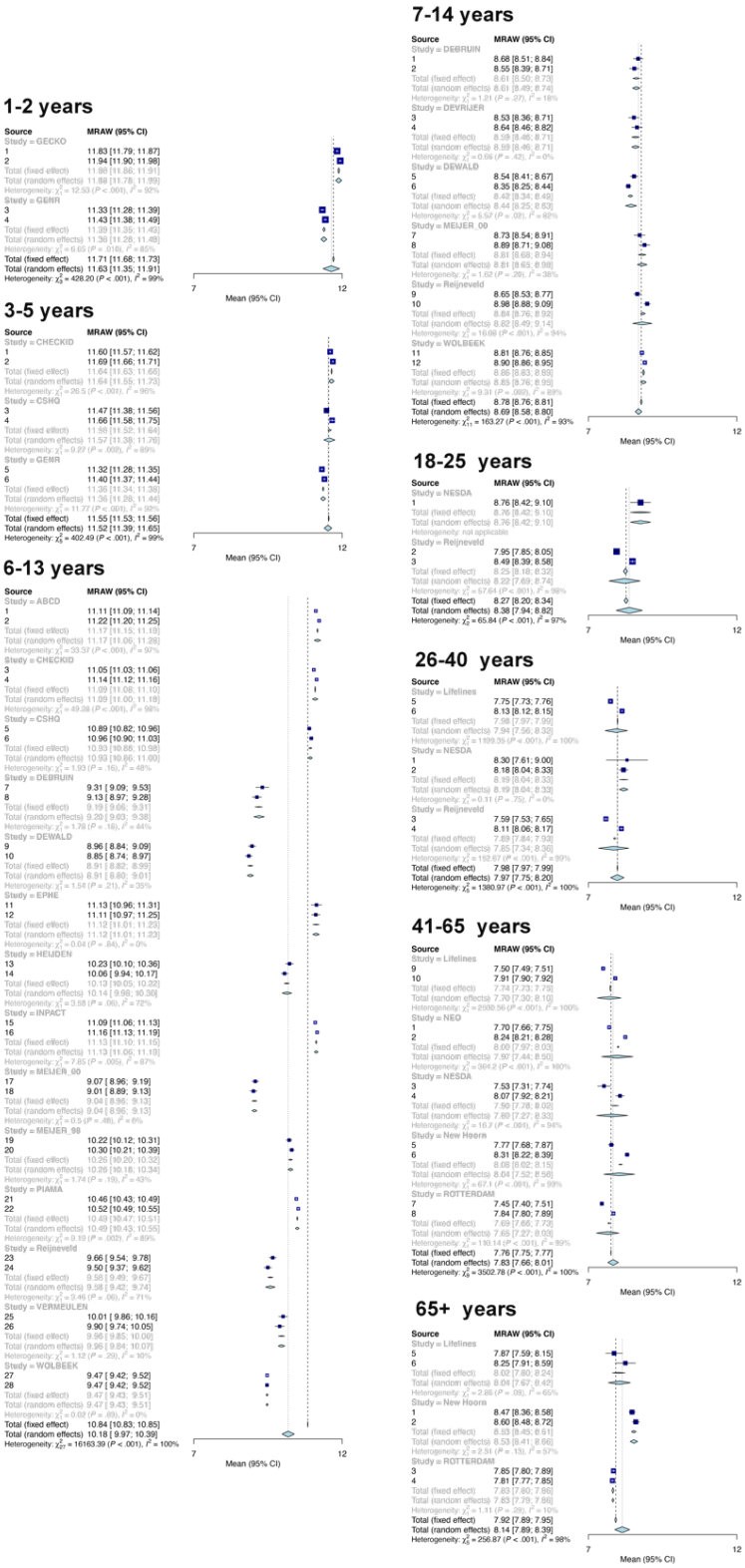
| | Time in bed, hours | | | | Total sleep time, hours | | | | Sleep efficiency, % | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Strata by age and sex | n | N | Mean (95%CI) | $I^2$ | n | N | Mean (95%CI) | $I^2$ | n | N | Mean (95%CI) | $I^2$ |
| 1 to 2 years | | | | | | | | | | | | |
| Total | 3,240 | 4 | 11.6 (11.4; 11.9) | 99.3 | - | | - | | - | | - | |
| Male | 1,593 | 2 | 11.6 (11.2; 12.2) | 99.5 | - | | - | | - | | - | |
| Female | 1,644 | 2 | 11.7 (11.1; 12.1) | 99.6 | - | | - | | - | | - | |
| 3 to 5 years | | | | | | | | | | | | |
| Total | 6,415 | 6 | 11.5 (11.4;11.7) | 98.8 | 1,266 | 4 | 11.5 (11.3;11.6) | 96.5 | 1,183 | 4 | 99 (99;100) | 96.6 |
| Male | 3,237 | 3 | 11.5 (11.3;11.7) | 98.8 | 653 | 2 | 11.4 (11.0;11.8) | 97.8 | 604 | 2 | 99 (95;100) | 98.5 |
| Female | 3,178 | 3 | 11.6 (11.4;11.8) | 98.9 | 613 | 2 | 11.5 (11.2;11.9) | 95.1 | 579 | 2 | 99 (96;100) | 96.4 |
| 6 to 13 years | | | | | | | | | | | | |
| Total | 18,905 | 28 | 10.2 (10.0;10.4) | 99.8 | 8,374 | 12 | 10.0 (9.7;10.3) | 99.7 | 6,929 | 10 | 96 (96;97) | 99.7 |
| Male | 9,477 | 14 | 10.2 (9.8;10.5) | 99.8 | 4,185 | 6 | 10.0 (9.6;10.5) | 99.7 | 3,461 | 5 | 95 (91;98) | 98.7 |
| Female | 9,420 | 14 | 10.2 (9.9;10.5) | 99.9 | 4,189 | 6 | 9.9 (9.5;10.4) | 99.8 | 3,468 | 5 | 94 (91;97) | 99.8 |
| 14 to 17 years | | | | | | | | | | | | |
| Total | 3,745 | 12 | 8.7 (8.6;88) | 93.3 | 509 | 2 | 7.8 (7.6;7.8) | n/a | 509 | 2 | 92 (90;93) | n/a |
| Male | 1,746 | 6 | 8.7 (8.5;8.8) | 79.9 | 186 | 1 | 7.9 (7.8;8.1) | n/a | 186 | 1 | 92 (91;93) | n/a |
| Female | 2,000 | 6 | 8.7 (8.5;8.9) | 96.2 | 323 | 1 | 7.6 (7.5;7.7) | n/a | 323 | 1 | 90 (89;92) | n/a |

**Supplementary Table 5 (continued). Time in bed, total sleep time and sleep efficiency estimates based on variance weighted random effects meta-analysis, stratified by age and sex**

| Strata by age and sex | Time in bed, hours | | | | Total sleep time, hours | | | | Sleep efficiency, % | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | N | Mean (95%CI) | $I^2$ | n | N | Mean (95%CI) | $I^2$ | n | N | Mean (95%CI) | $I^2$ |
| 18 to 25 years | | | | | | | | | | | | |
| Total | 1,073 | 3 | 8.4 (7.9;8.8) | 97 | 5,131 | 8 | 7.5 (7.4;7.6) | 90.5 | - | - | - | - |
| Male | 523 | 1 | 7.9 (7.8;8.1) | n/a | 2,032 | 4 | 7.4 (7.3;7.5) | 89.7 | - | - | - | - |
| Female | 550 | 2 | 8.6 (8.3;8.8) | 56.1 | 3,099 | 4 | 7.6 (7.5;7.8) | 54.1 | - | - | - | - |
| 26 to 40 years | | | | | | | | | | | | |
| Total | 23,896 | 6 | 8.0 (7.7;8.2) | 99.6 | 38,635 | 12 | 7.2 (7.1;7.3) | 98.9 | 21,174 | 3 | 90 (88;92) | 99.0 |
| Male | 9,938 | 3 | 7.7 (7.5;7.9) | 92 | 16,182 | 6 | 7.1 (7.0;7.1) | 94.1 | 8,648 | 1 | 90 (90;91) | n/a |
| Female | 13,931 | 3 | 8.1 (8.0;8.14) | 0 | 22,453 | 6 | 7.3 (7.2;7.4) | 98.4 | 12,526 | 2 | 90 (87;92) | 88.6 |
| 41 to 65 years | | | | | | | | | | | | |
| Total | 51,086 | 10 | 7.8 (7.7;8.0) | 99.7 | 93,837 | 20 | 7.1 (7.0;7.2) | 99.1 | 49,513 | 8 | 90 (88;91) | 99.5 |
| Male | 21,235 | 5 | 7.6 (7.5;7.7) | 96.6 | 40,603 | 10 | 7.0 (6.9;7.1) | 98.6 | 20,570 | 4 | 91 (91;92) | 97.8 |
| Female | 29,851 | 5 | 8.1 (7.9;8.3) | 99.0 | 53,234 | 10 | 7.2 (7.0;7.3) | 99.1 | 28,943 | 4 | 89 (89;90) | 88.3 |
| >65 years | | | | | | | | | | | | |
| Total | 5,448 | 6 | 8.1 (7.9;8.4) | 98.1 | 8,135 | 13 | 7.2 (7.0;7.4) | 97.0 | 4,890 | 4 | 89 (85;92) | 98.2 |
| Male | 2,288 | 3 | 8.1 (7.6;8.5) | 98.0 | 3,461 | 6 | 7.2 (7.1;7.2) | 94.0 | 2,002 | 2 | 90 (89;91) | 0 |
| Female | 3,192 | 3 | 8.2 (7.6;8.8) | 98.7 | 4,674 | 7 | 6.8 (6.8;6.9) | 96.3 | 2,888 | 2 | 86 (85;86) | 0 |

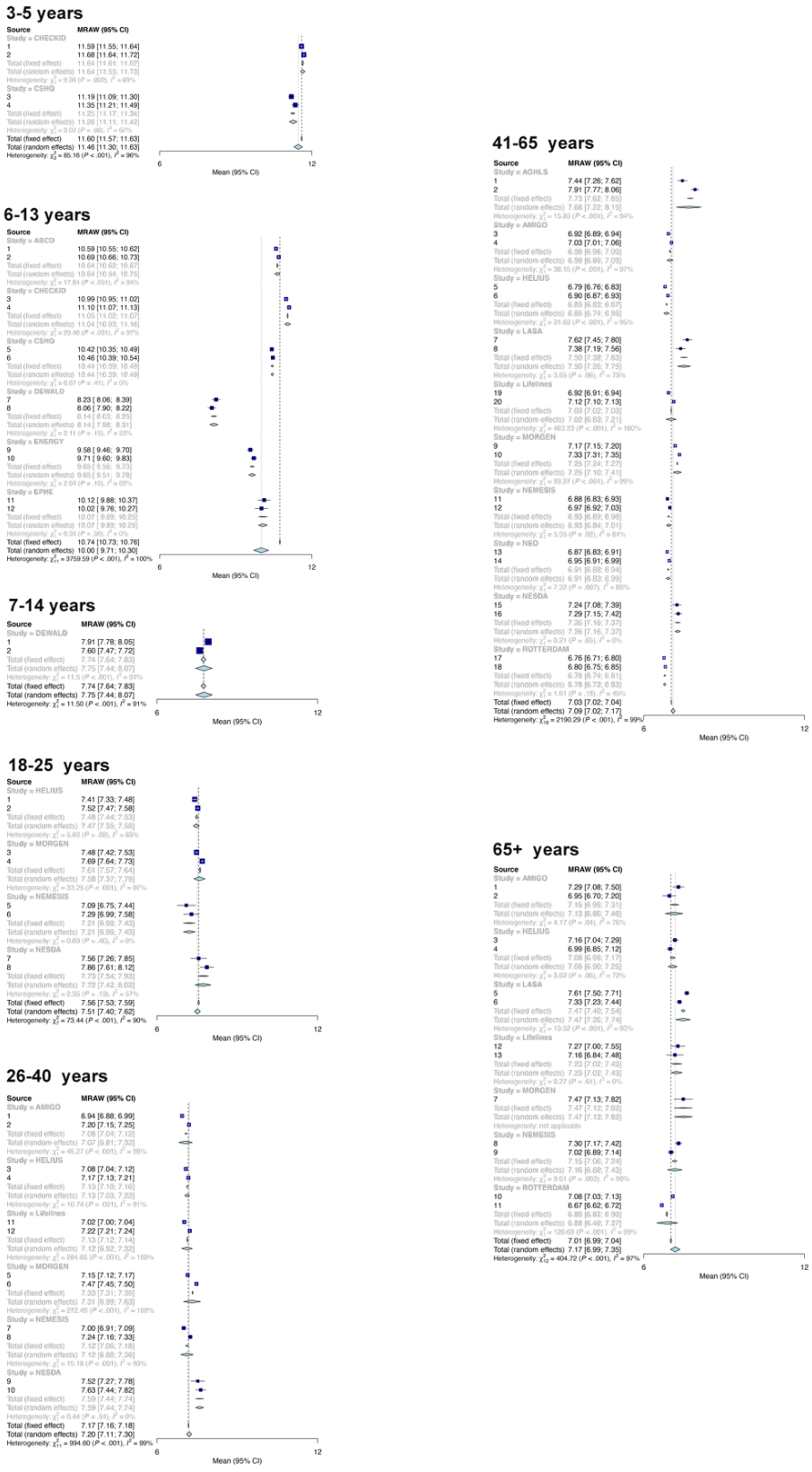
Note: Prevalence was not calculated if <200 participants in a cell. Abbreviations: N=sample size; SD=standard deviation.

**Supplementary Figure 4a. Forest plots of Time in Bed (hours) estimates, stratified by sex and age group**



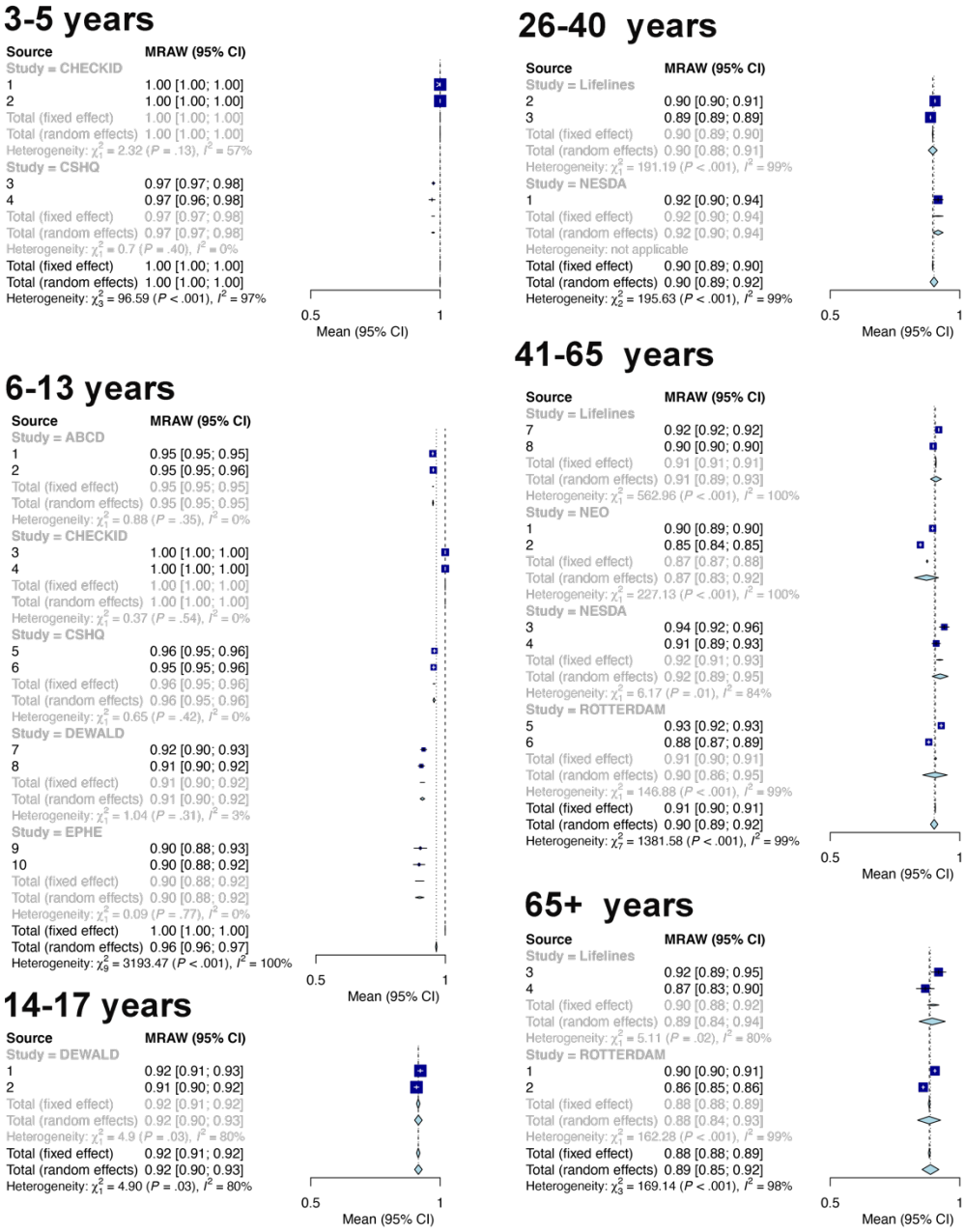

Footnote: Odd numbers represent male strata, even numbers represent female strata

**Supplementary Figure 4b. Forest plots of Total Sleep Time (hours) estimates,stratified by sex and age group**




Footnote: Odd numbers represent male strata, even numbers represent female strata

**Supplementary Figure 4c. Forest plots of Sleep Efficiency (hours) estimates,stratified by sex and age group**




Footnote: Odd numbers represent male strata, even numbers represent female strata

**Supplementary Table 6. Determinants of insomnia symptoms in persons ≥18 years old**

| | Difficulty Initiating Sleep | | | Difficulty Maintaining Sleep | | | Early Morning Awakenings | | |
|---|---|---|---|---|---|---|---|---|---|
| | N=108,447 from 15 studies | | | N=28,051 from 11 studies | | | N=15,436 from 8 studies | | |
| | OR | 95% CI | P | OR | 95% CI | P | OR | 95% CI | P |
| **Demographic determinants model** | | | | | | | | | |
| Age | 1.01 | 1.01;1.01 | <0.001 | 1.02 | 1.01;1.02 | <0.001 | 1.02 | 1.01;1.02 | <0.001 |
| Sex | | | | | | | | | |
| Male | | Reference | | | Reference | | | Reference | |
| Female | 2.26 | 2.16;2.36 | <0.001 | 2.05 | 1.91;2.19 | <0.001 | 1.49 | 1.37;1.62 | <0.001 |
| Education | | | | | | | | | |
| High | | Reference | | | Reference | | | Reference | |
| Middle | 1.38 | 1.31;1.46 | <0.001 | 1.07 | 0.99;1.17 | 0.077 | 1.10 | 0.99;1.23 | 0.069 |
| Low | 2.01 | 1.90;2.13 | <0.001 | 1.32 | 1.21;1.44 | <0.001 | 1.30 | 1.37;1.75 | <0.001 |
| non-European origin | | | | | | | | | |
| European origin - Dutch | | Reference | | | Reference | | | Reference | |
| European origin - other | 1.37 | 1.21;2.56 | <0.001 | 1.17 | 1.003;1.37 | 0.045 | 1.24 | 0.92;1.66 | 0.160 |
| non-European origin | 1.75 | 1.53;2.02 | <0.001 | 1.35 | 1.12;1.63 | 0.002 | 1.09 | 0.87;1.37 | 0.436 |
| **Social determinants model, additionally adjusted** | | | | | | | | | |
| Employment | | | | | | | | | |
| Yes | | Reference | | | Reference | | | Reference | |
| No | 1.77 | 1.68;1.86 | <0.001 | 1.22 | 1.13;1.33 | <0.001 | 1.01 | 0.91;1.14 | 0.801 |
| Partner | | | | | | | | | |
| Yes | | Reference | | | Reference | | | Reference | |
| No | 1.37 | 1.24;1.51 | <0.001 | 1.11 | 0.98;1.24 | 0.078 | 1.20 | 1.09;1.32 | <0.001 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Health risk indicators model** | | | | | | | | | |
| BMI | | | | | | | | | |
| Underweight | 1.47 | 1.14;1.90 | 0.003 | 1.53 | 0.86;2.70 | 0.144 | 1.14 | 0.72;1.81 | 0.587 |
| Normal weight | | Reference | | | Reference | | | Reference | |
| Overweight | 0.97 | 0.92;1.02 | 0.281 | 0.97 | 0.85;1.09 | 0.598 | 1.02 | 0.93;1.13 | 0.610 |
| Obese | 1.09 | 1.02;1.17 | 0.008 | 1.01 | 0.86;1.17 | 0.981 | 1.13 | 0.99;1.29 | 0.056 |
| Smoking | | | | | | | | | |
| nonsmoker | | Reference | | | Reference | | | Reference | |
| former smoker | 1.03 | 0.97;1.09 | 0.289 | 1.02 | 0.91;1.16 | 0.671 | 1.11 | 1.01;1.23 | 0.036 |
| smoker | 1.32 | 1.25;1.41 | <0.001 | 0.79 | 0.66;0.95 | 0.012 | 0.95 | 0.82;1.11 | 0.511 |

Note: Odds ratios are estimated using a linear mixed model adjusted for age, sex, education and ethnic origin, using random effects for study. BMI=body mass index; CI=confidence interval; N=total number of participants; OR=odds ratio.

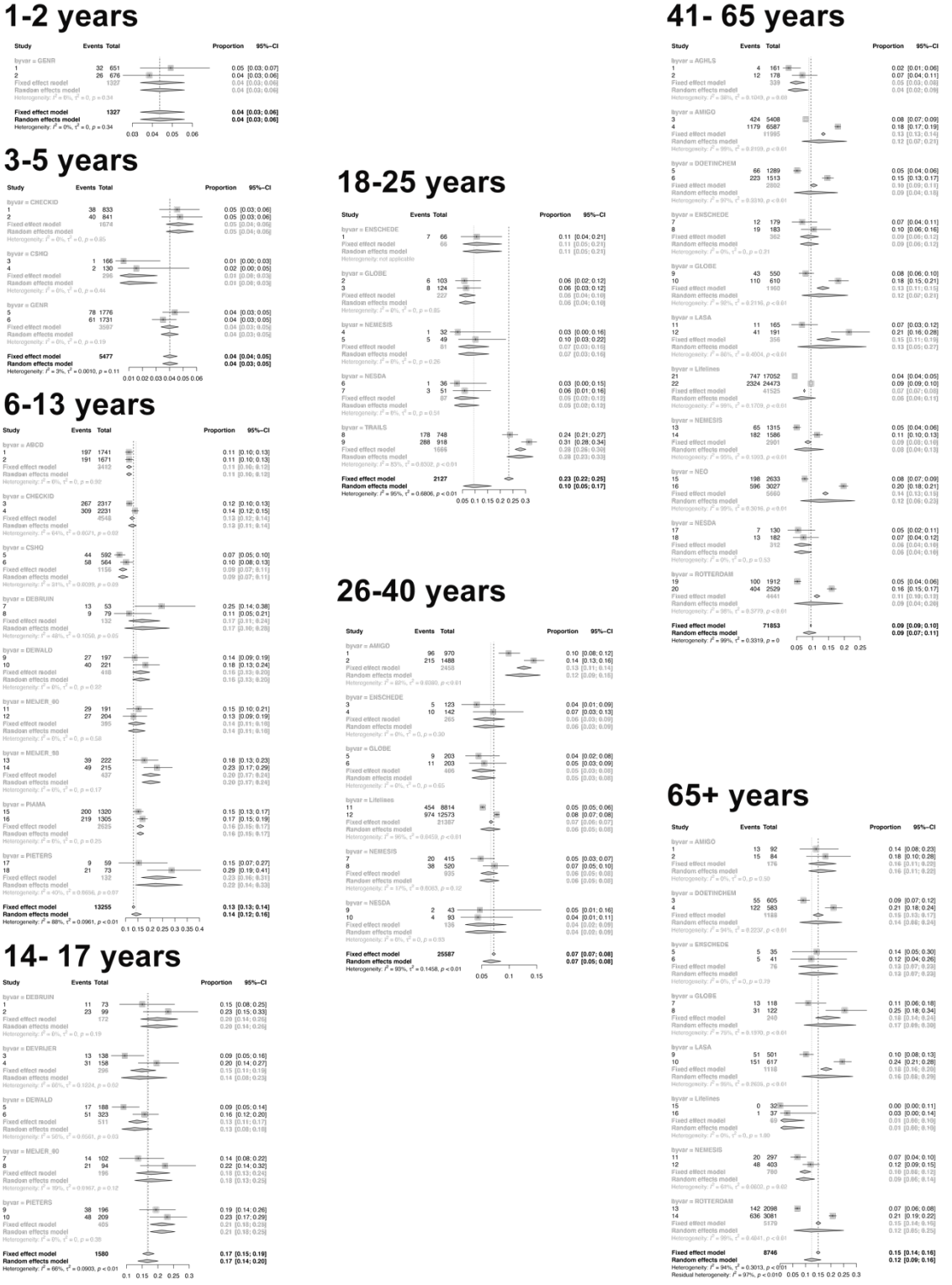
**Supplementary Table 7. Prevalence of insomnia symptoms based on variance weighted random effects meta-analysis, stratified by age and sex**

| Strata by age and sex | Insomnia symptoms | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Difficulty initiating sleep | | | | Difficulty maintaining sleep | | | | Early morning awakenings | | | |
| | n | N | % | $I^2$,% | n | N | % | $I^2$,% | n | N | % | $I^2$,% |
| 1 to 2 years | | | | | | | | | | | | |
| Total | 1,327 | 2 | 4.4 (3.3;5.6) | 0.0 | - | | - | | - | | - | |
| Male | 651 | 1 | 4.9 (3.5;6.9) | 0.0 | - | | - | | - | | - | |
| Female | 676 | 1 | 3.8 (2.6;5.6) | 0.0 | - | | - | | - | | - | |
| 3 to 5 years | | | | | | | | | | | | |
| Total | 5,477 | 6 | 4.0 (3.5;4.6) | 3.1 | 1,678 | 2 | 6.1 (5.1;7.4) | 0.0 | ND | | ND | |
| Male | 2,775 | 3 | 4.2 (3.5;5.0) | 0.0 | 834 | 1 | 6.6 (5.1;8.5) | n/a | ND | | ND | |
| Female | 2,702 | 3 | 3.8 (3.2;4.6) | 0.0 | 844 | 1 | 5.7 (4.3;7.5) | n/a | ND | | ND | |
| 6 to 13 years | | | | | | | | | | | | |
| Total | 13,255 | 18 | 14.3 (12.4;16.5) | 88.3 | 7,203 | 12 | 16.9 (10.2;9.7) | 97.7 | ND | | ND | |
| Male | 6,692 | 9 | 13.3 (10.1;16.0) | 83.9 | 3,601 | 6 | 14.9 (7.4;27.8) | 97.2 | ND | | ND | |
| 14 to 17 years | | | | | | | | | | | | |
| Total | 1,580 | 10 | 16.6 (13.6;20.0) | 65.7 | 1,377 | 9 | 22.7 (18.7;27.4) | 72.1 | - | | - | |
| Male | 697 | 5 | 12.9 (9.6;17.2) | 52.9 | 498 | 4 | 17.4 (12.8;23.2) | 56.2 | - | | - | |
| Female | 883 | 5 | 19.9 (16.9;23.4) | 25.1 | 879 | 5 | 27.0 (24.1;29.9) | 0.0 | - | | - | |

**Supplementary Table 7 (continued). Prevalence of insomnia symptoms based on variance weighted random effects meta-analysis, stratified by age and sex**

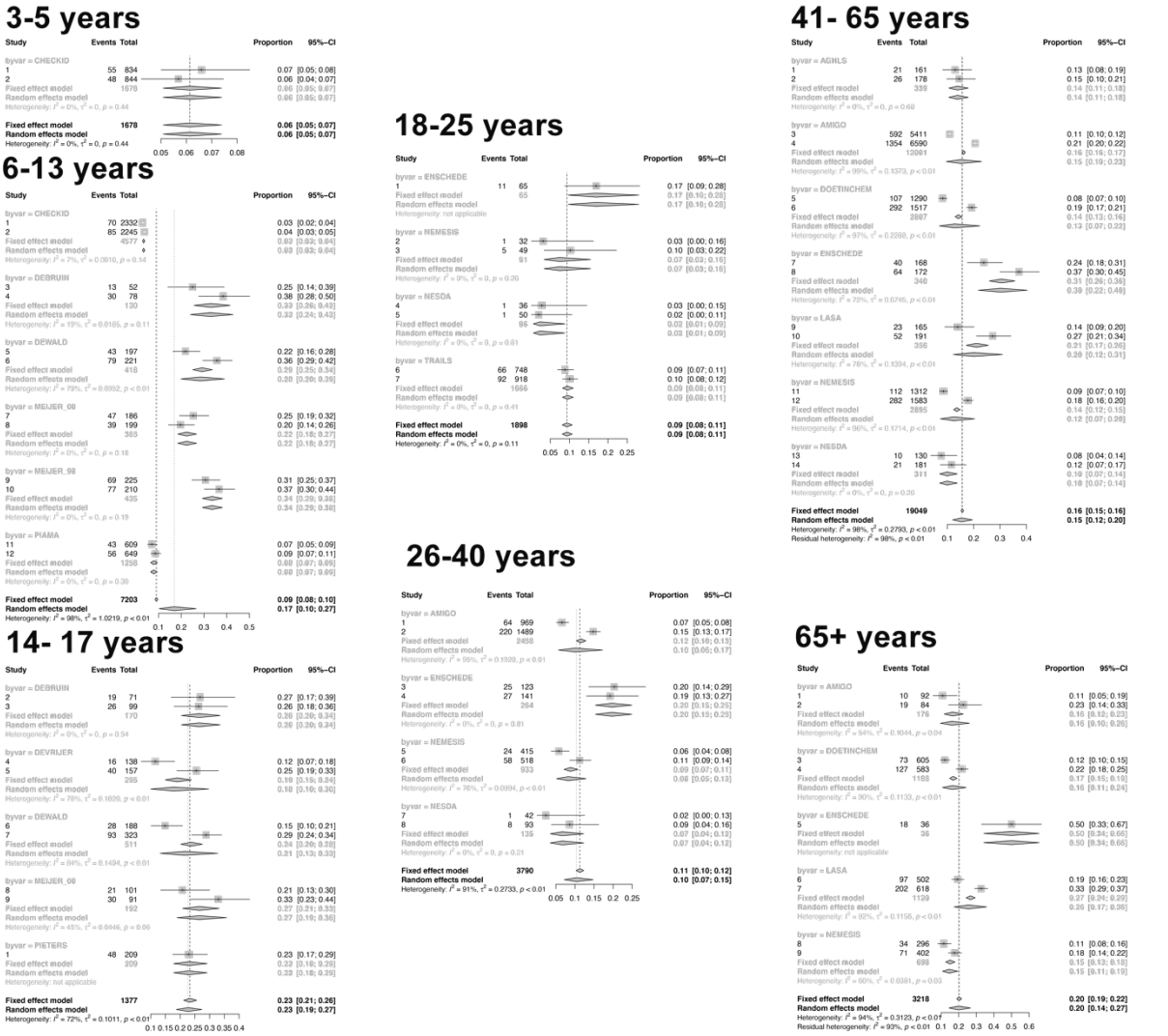
| Strata by age and sex | Insomnia symptoms | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Difficulty initiating sleep | | | | Difficulty maintaining sleep | | | | Early morning awakenings | | | |
| | n | N | % | $I^2$,% | n | N | % | $I^2$,% | n | N | % | $I^2$,% |
| 18 to 25 years | | | | | | | | | | | | |
| Total | 2,127 | 9 | 9.5 (5.3;16.5) | 94.5 | 1,898 | 7 | 9.3 (8.1;10.7) | 0.0 | 1,988 | 9 | 10.6 (8.8;12.7) | 17.0 |
| Male | 969 | 4 | 7.1 (2.4;19.5) | 81.4 | 816 | 3 | 8.3 (6.6;10.4) | 0.0 | 892 | 4 | 9.5 (7.7;11.7) | 0.0 |
| Female | 1,252 | 5 | 11.3 (5.7;21.2) | 84.4 | 1,082 | 4 | 10.1 (8.4;12.0) | 0.0 | 1,131 | 5 | 11.3 (9.6;13.3) | 70.2 |
| 26 to 40 years | | | | | | | | | | | | |
| Total | 25,587 | 9 | 9.5 (5.3;16.5) | 94.5 | 3,790 | 8 | 10.4 (7.1;14.8) | 90.9 | 1,631 | 8 | 11.3 (7.7;16.4) | 85.9 |
| Male | 10,568 | 4 | 7.1 (2.3;19.5) | 81.4 | 1,549 | 4 | 7.7 (3.9;14.7) | 89.2 | 721 | 4 | 11.2 (7.8;17.14) | 64.7 |
| Female | 15,019 | 5 | 11.3 (5.7;21.2) | 84.4 | 2,241 | 4 | 13.5 (11.0;16.5) | 54.2 | 910 | 4 | 10.8 (5.5;20.1) | 88.9 |
| 41 to 65 years | | | | | | | | | | | | |
| Total | 71,853 | 22 | 8.8 (7.0;11.1) | 98.7 | 19,049 | 14 | 15.4 (12.0;19.6) | 97.5 | 8,410 | 14 | 17.0 (12.5;22.6) | 97.4 |
| Male | 30,794 | 11 | 5.8 (5.0;6.8) | 85.3 | 8,637 | 7 | 11.4 (8.6;15.0) | 96.2 | 3,901 | 7 | 14.1 (9.2;21.3) | 96.3 |
| Female | 41,059 | 11 | 13.6 (11.0;16.6) | 97.8 | 10,412 | 7 | 20.3 (15.6;26.0) | 91.2 | 4,509 | 7 | 20.2 (13.7;28.7) | 97.2 |
| 65+ years 5 | | | | | | | | | | | | |
| Total | 8,746 | 16 | 12.4 (9.4;16.1) | 94.1 | 3,218 | 9 | 19.9 (14.4;26.8) | 94.1 | 3,376 | 10 | 22.8 (16.6;30.1) | 95.2 |
| Male | 3,778 | 8 | 7.9 (7.1;8.8) | 48.5 | 1,527 | 4 | 13.6 (10.5;17.5) | 70.1 | 1,579 | 5 | 18.3 (11.9;27.0) | 91.7 |
| Female | 4,968 | 8 | 20.3 (19.2;21.5) | 88.6 | 1,728 | 5 | 26.7 (19.2;35.7) | 91.3 | 1,797 | 5 | 28.3 (19.4;39.2) | 94.5 |

**Supplementary Figure 5a. Forest plots of the prevalence of Difficulty Initiating Sleep (%), stratified by sex and age group**



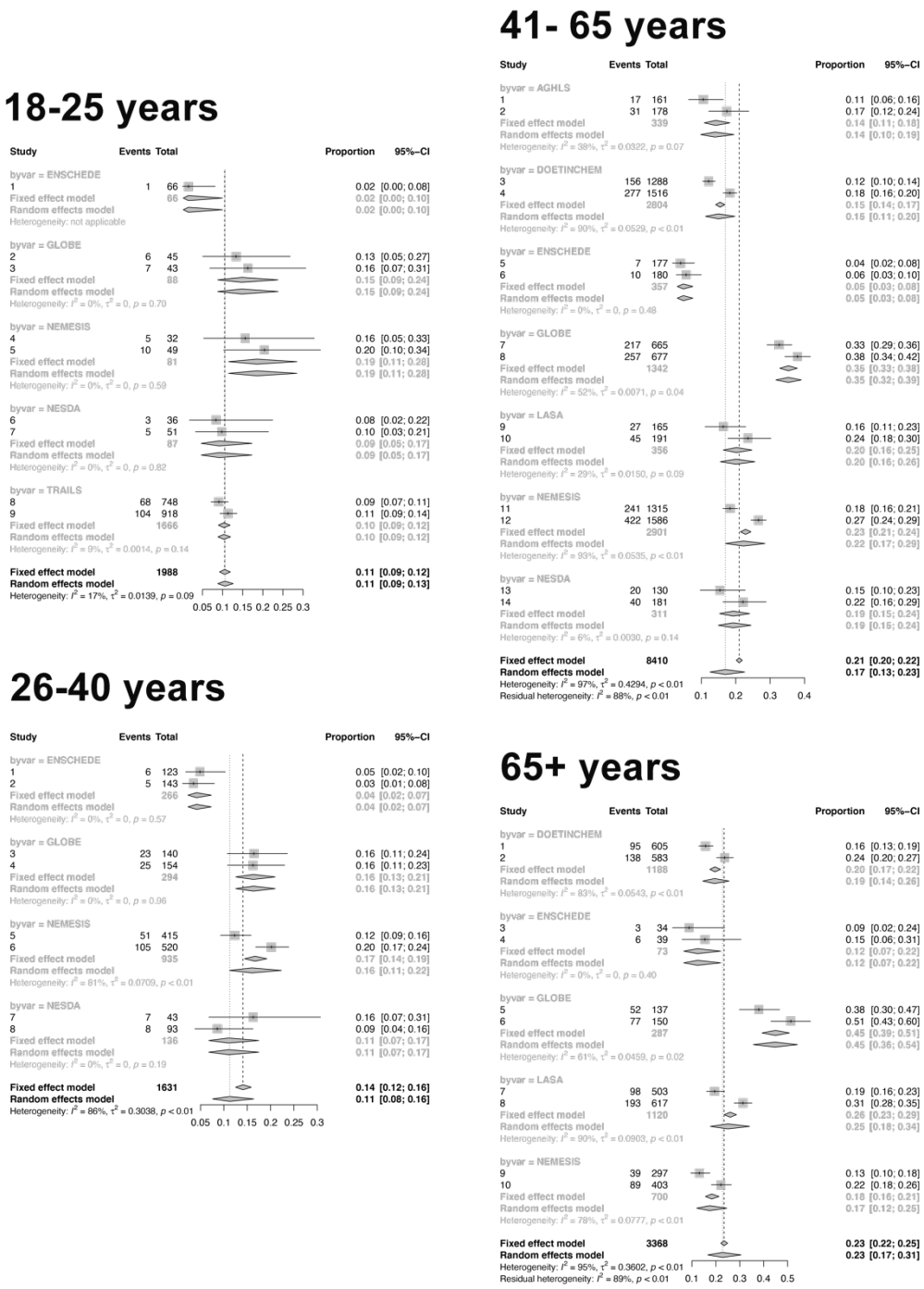

Footnote: Odd numbers represent male strata, even numbers represent female strata

**Supplementary Figure 5b. Forest plots of the prevalence of Difficulty Maintaining Sleep (%),stratified by sex and age group**




Footnote: Odd numbers represent male strata, even numbers represent female strata

**Supplementary Figure 5c. Forest plots of the prevalence of Early Morning Awakenings (%),stratified by sex and age group**




Footnote: Odd numbers represent male strata, even numbers represent female strata

## Supplementary Table 8. Prevalence of sleep complaints

| | **Nighttime awakenings** 20 studies 1998 to 2013 | | | | **Sleep medication** 7 studies 1997 to 2013 | | **Non-Restorative Sleep** 14 studies 1998 to 2013 | | **Sleepiness** 14 studies 1998 to 2012 | | **Snoring** 5 studies 2002 to 2011 | | **Poor sleep quality** 14 studies 1997 to 2011 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % Never | % Sometimes | % Often | N | % | N | % | N | % | N | % | N | % |
| 3 to 5 years | | | | | | | | | | | | | | |
| Total | 3,854 | 76.1 | 20.5 | 3.4 | - | - | 288 | 2.8 | 1,962 | 2.3 | 286 | 25.9 | - | - |
| Male | 1,964 | 75.4 | 20.5 | 4.1 | - | - | 157 | 3.8 | 993 | 3.0 | 160 | 21.9 | - | - |
| Female | 1,890 | 76.8 | 20.5 | 2.6 | - | - | 131 | 1.5 | 969 | 1.5 | 126 | 31.0 | - | - |
| 6 to 13 years | | | | | | | | | | | | | | |
| Total | 7,535 | 72.3 | 24.5 | 3.1 | 466 | 7.3 | 9,864 | 18.3 | 13,068 | 4.4 | 4,468 | 19.0 | 4,790 | 3.3 |
| Male | 3,817 | 73.6 | 23.3 | 3.1 | 216 | 7.4 | 4,961 | 15.7 | 6,592 | 4.3 | 2,293 | 19.4 | 2,411 | 3.4 |
| Female | 3,712 | 71.1 | 25.8 | 3.1 | 250 | 7.2 | 4,893 | 20.8 | 6,466 | 4.5 | 2,172 | 18.6 | 2,374 | 3.3 |
| 14 to 17 years | | | | | | | | | | | | | | |
| Total | 472 | 27.3 | 66.3 | 6.4 | 671 | 5.5 | 3,608 | 47.9 | 1,417 | 17.8 | - | - | 1,211 | 6.4 |
| Male | 213 | 35.2 | 61.5 | 3.3 | 256 | 4.3 | 1,720 | 40.0 | 641 | 14.5 | - | - | 519 | 4.0 |
| Female | 259 | 20.8 | 70.3 | 8.9 | 415 | 6.3 | 1,885 | 54.8 | 773 | 20.4 | - | - | 690 | 8.1 |
| 18 to 25 years | | | | | | | | | | | | | | |
| Total | 209 | 43.5 | 43.1 | 13.4 | 2,040 | 1.9 | - | - | - | - | - | - | 2,005 | 13.2 |
| Male | 77 | 54.5 | 39.0 | 6.5 | 913 | 1.2 | - | - | - | - | - | - | 878 | 9.3 |
| Female | 132 | 37.1 | 45.5 | 17.4 | 1,127 | 2.5 | - | - | - | - | - | - | 1,127 | 16.2 |
| 26 to 40 years | | | | | | | | | | | | | | |
| Total | 25,573 | 30.1 | 51.5 | 18.4 | 25,160 | 7.2 | 2,724 | 21.1 | 24,403 | 7.1 | 21,814 | 20.8 | 25,177 | 13.4 |
| Male | 10,514 | 34.9 | 52.1 | 15.5 | 10,396 | 5.2 | 1,092 | 19.3 | 10,031 | 6.2 | 8,891 | 29.3 | 10,369 | 10.0 |
| Female | 15,059 | 26.7 | 51.2 | 22.1 | 14,764 | 8.6 | 1,631 | 22.2 | 14,372 | 7.8 | 12,923 | 14.9 | 14,807 | 15.8 |
| 41 to 65 years | | | | | | | | | | | | | | |
| Total | 72,049 | 30.7 | 47.7 | 21.7 | 65,716 | 10.2 | 15,494 | 12.5 | 61,530 | 6.0 | 58,020 | 33.6 | 64,128 | 12.9 |
| Male | 30,897 | 3.0 | 47.1 | 15.9 | 27,638 | 6.2 | 7,035 | 11.2 | 26,010 | 6.3 | 25,221 | 43.6 | 27,126 | 9.1 |
| Female | 41,152 | 26.0 | 48.0 | 26.0 | 38,078 | 13.0 | 8,459 | 13.7 | 35,520 | 5.8 | 32,799 | 25.9 | 37,002 | 15.7 |
| >65 years | | | | | | | | | | | | | | |
| Total | 8,557 | 46.1 | 32.1 | 21.8 | 6,556 | 12.8 | 1,437 | 14.3 | 5,975 | 1.2 | 4,755 | 39.2 | 7,467 | 15.0 |
| Male | 3,689 | 53.3 | 29.4 | 17.2 | 2,789 | 6.3 | 731 | 11.9 | 2,518 | 1.4 | 2,105 | 48.5 | 3,197 | 8.8 |
| Female | 4,868 | 40.7 | 34.1 | 25.2 | 3,767 | 17.6 | 706 | 16.7 | 3,457 | 1.0 | 2,650 | 31.7 | 4,270 | 19.6 |

**Supplementary Table 10a. Descriptive statistics of Time in bed, total sleep Time Sleep efficiency, Difficulty Initiating Sleep, Difficulty Maintaining Sleep, Early Morning Awakenings, stratified by age and ethnic origin and education**

| **Educational level: High** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **1-3 yrs** | **3-5 yrs** | **6-13 yrs** | **14-17 yrs** | **18-25 yrs** | **26-40 yrs** | **41-65 yrs** | **65 yrs** |
| | **(n=1518)** | **(n=3897)** | **(n=10892)** | **(n=820)** | **(n=1391)** | **(n=16282)** | **(n=28142)** | **(n=1781)** |
| **Total Sleep Time, hours** | | | | | | | | |
| Mean (SD) | 12.4 (1.07) | 11.6 (0.521) | 10.7 (0.829) | 7.82 (0.945) | 7.52 (0.911) | 7.20 (0.855) | 7.03 (0.919) | 7.20 (1.15) |
| Missing | 1511 (99.5%) | 2856 (73.3%) | 5046 (46.3%) | 592 (72.2%) | 527 (37.9%) | 931 (5.7%) | 1708 (6.1%) | 448 (25.2%) |
| **Time in Bed, Hours** | | | | | | | | |
| Mean (SD) | 11.5 (0.660) | 11.5 (0.567) | 10.9 (0.722) | 8.63 (0.851) | 8.32 (1.03) | 8.02 (0.766) | 7.74 (0.817) | 7.94 (1.04) |
| Missing | 21 (1.4%) | 91 (2.3%) | 1473 (13.5%) | 294 (35.9%) | 1089 (78.3%) | 6681 (41.0%) | 13175 (46.8%) | 1053 (59.1%) |
| **Sleep Efficiency, %** | | | | | | | | |
| Mean (SD) | 0.939 (0.0600) | 0.997 (0.0179) | 0.977 (0.0417) | 0.927 (0.0635) | 0.896 (0.0954) | 0.893 (0.0888) | 0.906 (0.0893) | 0.903 (0.110) |
| Missing | 1515 (99.8%) | 2905 (74.5%) | 5937 (54.5%) | 594 (72.4%) | 1352 (97.2%) | 7364 (45.2%) | 13605 (48.3%) | 1176 (66.0%) |
| **Difficulty Initiating Sleep** | | | | | | | | |
| Yes | 39 (2.6%) | 112 (2.9%) | 879 (8.1%) | 61 (7.4%) | 52 (3.7%) | 627 (3.9%) | 1421 (5.0%) | 118 (6.6%) |
| Missing | 709 (46.7%) | 921 (23.6%) | 4339 (39.8%) | 415 (50.6%) | 1113 (80.0%) | 5534 (34.0%) | 6329 (22.5%) | 370 (20.8%) |
| **Difficulty Maintaining Sleep** | | | | | | | | |
| Yes | 0 (0%) | 57 (1.5%) | 194 (1.8%) | 96 (11.7%) | 11 (0.8%) | 196 (1.2%) | 908 (3.2%) | 114 (6.4%) |
| Missing | 1518 (100%) | 2987 (76.6%) | 7768 (71.3%) | 429 (52.3%) | 1147 (82.5%) | 14528 (89.2%) | 21482 (76.3%) | 1047 (58.8%) |
| **Early Morning Awakenings** | | | | | | | | |
| Yes | 0 (0%) | 338 (8.7%) | 636 (5.8%) | 0 (0%) | 17 (1.2%) | 92 (0.6%) | 443 (1.6%) | 127 (7.1%) |
| Missing | 1518 (100%) | 2990 (76.7%) | 8558 (78.6%) | 820 (100%) | 1152 (82.8%) | 15653 (96.1%) | 25618 (91.0%) | 1070 (60.1%) |
| **Educational level: Middle** | | | | | | | | |
| | **(n=1474)** | **(n=1587)** | **(n=5782)** | **(n=989)** | **(n=4934)** | **(n=16446)** | **(n=35905)** | **(n=5207)** |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Total Sleep Time, hours** | | | | | | | | |
| Mean (SD) | 12.3 (3.18) | 11.4 (0.678) | 10.4 (1.12) | 7.54 (1.04) | 7.53 (1.06) | 7.14 (0.950) | 6.99 (1.02) | 6.91 (1.30) |
| Missing | 1472 (99.9%) | 1412 (89.0%) | 4271 (73.9%) | 822 (83.1%) | 1884 (38.2%) | 1392 (8.5%) | 2160 (6.0%) | 551 (10.6%) |
| **Time in Bed, Hours** | | | | | | | | |
| Mean (SD) | 11.8 (0.714) | 11.5 (0.673) | 10.8 (0.824) | 8.67 (0.885) | 8.30 (1.16) | 7.95 (0.863) | 7.77 (0.892) | 7.82 (1.14) |
| Missing | 20 (1.4%) | 55 (3.5%) | 1021 (17.7%) | 547 (55.3%) | 4497 (91.1%) | 6326 (38.5%) | 14058 (39.2%) | 1539 (29.6%) |
| **Sleep Efficiency, %** | | | | | | | | |
| Mean (SD) | NA (NA) | 0.989 (0.0260) | 0.958 (0.0623) | 0.903 (0.0825) | 0.910 (0.0874) | 0.895 (0.0935) | 0.901 (0.0999) | 0.877 (0.127) |
| Missing | 1474 (100%) | 1439 (90.7%) | 4609 (79.7%) | 823 (83.2%) | 4879 (98.9%) | 7363 (44.8%) | 14612 (40.7%) | 1712 (32.9%) |
| **Difficulty Initiating Sleep** | | | | | | | | |
| Yes | 13 (0.9%) | 54 (3.4%) | 478 (8.3%) | 99 (10.0%) | 359 (7.3%) | 806 (4.9%) | 2686 (7.5%) | 691 (13.3%) |
| Missing | 1141 (77.4%) | 141 (8.9%) | 2080 (36.0%) | 455 (46.0%) | 3392 (68.7%) | 5606 (34.1%) | 6488 (18.1%) | 370 (7.1%) |
| **Difficulty Maintaining Sleep** | | | | | | | | |
| Yes | 0 (0%) | 25 (1.6%) | 168 (2.9%) | 64 (6.5%) | 122 (2.5%) | 141 (0.9%) | 1015 (2.8%) | 198 (3.8%) |
| Missing | 1474 (100%) | 1150 (72.5%) | 3689 (63.8%) | 718 (72.6%) | 3522 (71.4%) | 14947 (90.9%) | 29158 (81.2%) | 4149 (79.7%) |
| **Early Morning Awakenings** | | | | | | | | |
| Yes | 0 (0%) | 166 (10.5%) | 320 (5.5%) | 0 (0%) | 149 (3.0%) | 96 (0.6%) | 676 (1.9%) | 214 (4.1%) |
| Missing | 1474 (100%) | 1149 (72.4%) | 4522 (78.2%) | 987 (99.8%) | 3481 (70.6%) | 15727 (95.6%) | 32583 (90.7%) | 4145 (79.6%) |
| **Educational level: Low** | | | | | | | | |
| | **(n=168)** | **(n=808)** | **(n=2969)** | **(n=756)** | **(n=1866)** | **(n=9466)** | **(n=36961)** | **(n=3569)** |
| **Total Sleep Time, hours** | | | | | | | | |
| Mean (SD) | NA (NA) | 11.3 (0.899) | 10.4 (1.11) | 7.53 (1.24) | 7.53 (1.20) | 7.18 (1.07) | 7.04 (1.15) | 7.04 (1.43) |
| Missing | 168 (100%) | 761 (94.2%) | 2431 (81.9%) | 708 (93.7%) | 619 (33.2%) | 1350 (14.3%) | 3702 (10.0%) | 1435 (40.2%) |
| **Time in Bed, Hours** | | | | | | | | |
| Mean (SD) | 11.5 (0.975) | 11.5 (0.818) | 10.8 (0.758) | 8.68 (1.05) | 8.15 (1.24) | 7.89 (1.02) | 7.82 (0.978) | 8.10 (1.17) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Missing | 10 (6.0%) | 33 (4.1%) | 681 (22.9%) | 480 (63.5%) | 1471 (78.8%) | 5388 (56.9%) | 22860 (61.8%) | 2553 (71.5%) |
| **Sleep Efficiency, %** | | | | | | | | |
| Mean (SD) | NA (NA) | 0.975 (0.0602) | 0.951 (0.0696) | 0.898 (0.0916) | 0.853 (0.119) | 0.896 (0.0991) | 0.898 (0.105) | 0.858 (0.140) |
| Missing | 168 (100%) | 768 (95.0%) | 2566 (86.4%) | 709 (93.8%) | 1851 (99.2%) | 6307 (66.6%) | 23429 (63.4%) | 2807 (78.6%) |
| **Difficulty Initiating Sleep** | | | | | | | | |
| Yes | 8 (4.8%) | 36 (4.5%) | 201 (6.8%) | 40 (5.3%) | 19 (1.0%) | 396 (4.2%) | 2639 (7.1%) | 491 (13.8%) |
| Missing | 11 (6.5%) | 58 (7.2%) | 1187 (40.0%) | 508 (67.2%) | 1717 (92.0%) | 5527 (58.4%) | 16538 (44.7%) | 1106 (31.0%) |
| **Difficulty Maintaining Sleep** | | | | | | | | |
| Yes | 0 (0%) | 14 (1.7%) | 61 (2.1%) | 18 (2.4%) | 8 (0.4%) | 89 (0.9%) | 1068 (2.9%) | 347 (9.7%) |
| Missing | 168 (100%) | 606 (75.0%) | 1883 (63.4%) | 684 (90.5%) | 1815 (97.3%) | 8935 (94.4%) | 31330 (84.8%) | 2113 (59.2%) |
| **Early Morning Awakenings** | | | | | | | | |
| Yes | 0 (0%) | 65 (8.0%) | 192 (6.5%) | 2 (0.3%) | 15 (0.8%) | 40 (0.4%) | 636 (1.7%) | 449 (12.6%) |
| Missing | 168 (100%) | 607 (75.1%) | 2204 (74.2%) | 722 (95.5%) | 1784 (95.6%) | 9191 (97.1%) | 34431 (93.2%) | 1988 (55.7%) |
| **Ethnic Origin: Dutch** | | | | | | | | |
| | **(n=2762)** | **(n=5060)** | **(n=17559)** | **(n=2612)** | **(n=3530)** | **(n=28502)** | **(n=61202)** | **(n=3423)** |
| **Total Sleep Time, hours** | | | | | | | | |
| Mean (SD) | 12.6 (1.35) | 11.6 (0.557) | 10.7 (0.967) | 7.73 (1.06) | 7.63 (0.912) | 7.15 (0.892) | 7.04 (0.947) | 7.34 (1.20) |
| Missing | 2755 (99.7%) | 3849 (76.1%) | 10884 (62.0%) | 2132 (81.6%) | 2949 (83.5%) | 3355 (11.8%) | 4358 (7.1%) | 1122 (32.8%) |
| **Time in Bed, Hours** | | | | | | | | |
| Mean (SD) | 11.7 (0.681) | 11.5 (0.551) | 10.9 (0.782) | 8.63 (0.922) | 8.28 (1.13) | 7.96 (0.848) | 7.75 (0.847) | 8.47 (0.927) |
| Missing | 36 (1.3%) | 139 (2.7%) | 2334 (13.3%) | 1184 (45.3%) | 2489 (70.5%) | 5559 (19.5%) | 20037 (32.7%) | 2883 (84.2%) |
| **Sleep Efficiency, %** | | | | | | | | |
| Mean (SD) | 0.939 (0.0600) | 0.995 (0.0220) | 0.973 (0.0484) | 0.916 (0.0758) | 0.899 (0.0952) | 0.895 (0.0920) | 0.907 (0.0923) | 0.892 (0.0977) |
| Missing | 2759 (99.9%) | 3928 (77.6%) | 11669 (66.5%) | 2135 (81.7%) | 3420 (96.9%) | 7965 (27.9%) | 21469 (35.1%) | 3356 (98.0%) |
| **Difficulty Initiating Sleep** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Yes | 40 (1.4%) | 157 (3.1%) | 1470 (8.4%) | 216 (8.3%) | 450 (12.7%) | 1696 (6.0%) | 4761 (7.8%) | 341 (10.0%) |
| Missing | 1760 (63.7%) | 1001 (19.8%) | 6463 (36.8%) | 1272 (48.7%) | 1531 (43.4%) | 4050 (14.2%) | 5318 (8.7%) | 1175 (34.3%) |
| **Difficulty Maintaining Sleep** | | | | | | | | |
| Yes | 0 (0%) | 96 (1.9%) | 455 (2.6%) | 224 (8.6%) | 150 (4.2%) | 348 (1.2%) | 2265 (3.7%) | 437 (12.8%) |
| Missing | 2762 (100%) | 3455 (68.3%) | 11348 (64.6%) | 1669 (63.9%) | 1786 (50.6%) | 25149 (88.2%) | 46823 (76.5%) | 1489 (43.5%) |
| **Early Morning Awakenings** | | | | | | | | |
| Yes | 0 (0%) | 605 (12.0%) | 1107 (6.3%) | 2 (0.1%) | 181 (5.1%) | 197 (0.7%) | 1170 (1.9%) | 522 (15.2%) |
| Missing | 2762 (100%) | 3460 (68.4%) | 13306 (75.8%) | 2577 (98.7%) | 1724 (48.8%) | 27078 (95.0%) | 56403 (92.2%) | 1373 (40.1%) |
| **Ethnic Origin other: Western** | | | | | | | | |
| | **1-3 yrs** | **3-5 yrs** | **6-13 yrs** | **14-17 yrs** | **18-25 yrs** | **26-40 yrs** | **41-65 yrs** | **65 yrs** |
| | **(n=152)** | **(n=421)** | **(n=948)** | **(n=26)** | **(n=73)** | **(n=568)** | **(n=1580)** | **(n=48)** |
| **Total Sleep Time, hours** | | | | | | | | |
| Mean (SD) | 12.5 (NA) | 11.2 (0.754) | 10.7 (0.693) | NA (NA) | 6.60 (0.894) | 7.19 (0.964) | 6.92 (1.08) | 6.73 (1.09) |
| Missing | 151 (99.3%) | 393 (93.3%) | 428 (45.1%) | 26 (100%) | 68 (93.2%) | 46 (8.1%) | 11 (0.7%) | 0 (0%) |
| **Time in Bed, Hours** | | | | | | | | |
| Mean (SD) | 11.3 (0.667) | 11.3 (0.688) | 10.9 (0.635) | 8.46 (0.714) | 8.27 (1.85) | 8.01 (0.889) | 7.84 (0.973) | 8.00 (NA) |
| Missing | 4 (2.6%) | 11 (2.6%) | 156 (16.5%) | 20 (76.9%) | 59 (80.8%) | 189 (33.3%) | 966 (61.1%) | 47 (97.9%) |
| **Sleep Efficiency, %** | | | | | | | | |
| Mean (SD) | NA (NA) | 0.988 (0.0359) | 0.965 (0.0444) | NA (NA) | NA (NA) | 0.899 (0.0913) | 0.888 (0.100) | 0.875 (NA) |
| Missing | 152 (100%) | 394 (93.6%) | 525 (55.4%) | 26 (100%) | 73 (100%) | 231 (40.7%) | 973 (61.6%) | 47 (97.9%) |
| **Difficulty Initiating Sleep** | | | | | | | | |
| Yes | 7 (4.6%) | 14 (3.3%) | 76 (8.0%) | 0 (0%) | 9 (12.3%) | 55 (9.7%) | 221 (14.0%) | 6 (12.5%) |
| Missing | 40 (26.3%) | 36 (8.6%) | 216 (22.8%) | 24 (92.3%) | 21 (28.8%) | 43 (7.6%) | 11 (0.7%) | 0 (0%) |
| **Difficulty Maintaining Sleep** | | | | | | | | |
| Yes | 0 (0%) | 6 (1.4%) | 12 (1.3%) | 0 (0%) | 3 (4.1%) | 25 (4.4%) | 170 (10.8%) | 7 (14.6%) |
| Missing | 152 (100%) | 376 (89.3%) | 715 (75.4%) | 26 (100%) | 21 (28.8%) | 383 (67.4%) | 630 (39.9%) | 1 (2.1%) |
| **Early Morning Awakenings** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Yes | 0 (0%) | 10 (2.4%) | 58 (6.1%) | 0 (0%) | 6 (8.2%) | 7 (1.2%) | 37 (2.3%) | 11 (22.9%) |
| Missing | 152 (100%) | 376 (89.3%) | 765 (80.7%) | 26 (100%) | 21 (28.8%) | 518 (91.2%) | 1442 (91.3%) | 12 (25.0%) |
| **Ethnic Origin: Other non-Western** | | | | | | | | |
| | **(n=298)** | **(n=1081)** | **(n=1266)** | **(n=310)** | **(n=2688)** | **(n=5769)** | **(n=11771)** | **(n=650)** |
| **Total Sleep Time, hours** | | | | | | | | |
| Mean (SD) | 10.0 (NA) | 11.3 (0.708) | 10.5 (1.01) | NA (NA) | 7.45 (1.26) | 7.07 (1.21) | 6.78 (1.36) | 6.91 (1.57) |
| Missing | 297 (99.7%) | 1056 (97.7%) | 644 (50.9%) | 310 (100%) | 247 (9.2%) | 221 (3.8%) | 87 (0.7%) | 7 (1.1%) |
| **Time in Bed, Hours** | | | | | | | | |
| Mean (SD) | 11.3 (0.913) | 11.3 (0.875) | 10.8 (0.905) | 8.73 (1.20) | 7.96 (1.28) | 8.04 (1.13) | 7.74 (1.06) | 8.00 (NA) |
| Missing | 12 (4.0%) | 38 (3.5%) | 378 (29.9%) | 113 (36.5%) | 2594 (96.5%) | 5253 (91.1%) | 11295 (96.0%) | 649 (99.8%) |
| **Sleep Efficiency, %** | | | | | | | | |
| Mean (SD) | NA (NA) | 0.999 (0.00262) | 0.953 (0.0689) | NA (NA) | NA (NA) | 0.862 (0.113) | 0.885 (0.109) | NA (NA) |
| Missing | 298 (100%) | 1059 (98.0%) | 797 (63.0%) | 310 (100%) | 2688 (100%) | 5469 (94.8%) | 11319 (96.2%) | 650 (100%) |
| **Difficulty Initiating Sleep** | | | | | | | | |
| Yes | 13 (4.4%) | 49 (4.5%) | 85 (6.7%) | 37 (11.9%) | 43 (1.6%) | 71 (1.2%) | 149 (1.3%) | 4 (0.6%) |
| Missing | 83 (27.9%) | 91 (8.4%) | 416 (32.9%) | 89 (28.7%) | 2543 (94.6%) | 5279 (91.5%) | 10855 (92.2%) | 572 (88.0%) |
| **Difficulty Maintaining Sleep** | | | | | | | | |
| Yes | 0 (0%) | 1 (0.1%) | 22 (1.7%) | 35 (11.3%) | 27 (1.0%) | 30 (0.5%) | 79 (0.7%) | 13 (2.0%) |
| Missing | 298 (100%) | 1062 (98.2%) | 1053 (83.2%) | 137 (44.2%) | 2543 (94.6%) | 5584 (96.8%) | 11320 (96.2%) | 572 (88.0%) |
| **Early Morning Awakenings** | | | | | | | | |
| Yes | 0 (0%) | 6 (0.6%) | 30 (2.4%) | 0 (0%) | 21 (0.8%) | 20 (0.3%) | 46 (0.4%) | 16 (2.5%) |
| Missing | 298 (100%) | 1062 (98.2%) | 1159 (91.5%) | 310 (100%) | 2545 (94.7%) | 5683 (98.5%) | 11549 (98.1%) | 572 (88.0%) |

**Supplementary Table 10b. Descriptive statistics of Time in bed, total sleep Time Sleep efficiency, Difficulty Initiating Sleep, Difficulty Maintaining Sleep, Early Morning Awakenings, stratified by age and and employment status and having a partner**

| | Employment, no | | | | Employment, yes | | | |
|---|---|---|---|---|---|---|---|---|
| | **18-25 yrs (n=2645)** | **26-40 yrs (n=5938)** | **41-65 yrs (n=25867)** | **65 yrs (n=9005)** | **18-25 yrs (n=3624)** | **26-40 yrs (n=32484)** | **41-65 yrs (n=70558)** | **65 yrs (n=466)** |
| **Total Sleep Time, hours** | | | | | | | | |
| Mean (SD) | 7.60 (1.13) | 7.34 (1.18) | 7.15 (1.26) | 6.98 (1.32) | 7.46 (1.02) | 7.14 (0.888) | 6.97 (0.943) | 7.07 (1.17) |
| Missing | 434 (16.4%) | 27 (0.5%) | 1129 (4.4%) | 1317 (14.6%) | 999 (27.6%) | 124 (0.4%) | 2418 (3.4%) | 31 (6.7%) |
| **Time in Bed, Hours** | | | | | | | | |
| Mean (SD) | 8.63 (0.666) | 8.39 (0.968) | 8.22 (1.07) | 7.84 (1.13) | 8.71 (1.01) | 7.94 (0.792) | 7.67 (0.818) | 7.60 (1.13) |
| Missing | 2639 (99.8%) | 4088 (68.8%) | 17580 (68.0%) | 4159 (46.2%) | 3596 (99.2%) | 13276 (40.9%) | 29481 (41.8%) | 312 (67.0%) |
| **Sleep Efficiency, %** | | | | | | | | |
| Mean (SD) | 0.878 (0.0737) | 0.871 (0.111) | 0.873 (0.120) | 0.877 (0.128) | 0.883 (0.115) | 0.897 (0.0900) | 0.907 (0.0925) | 0.897 (0.117) |
| Missing | 2639 (99.8%) | 4107 (69.2%) | 17674 (68.3%) | 4240 (47.1%) | 3596 (99.2%) | 13342 (41.1%) | 29747 (42.2%) | 312 (67.0%) |
| **Difficulty Initiating Sleep** | | | | | | | | |
| Yes | 132 (5.0%) | 367 (6.2%) | 2410 (9.3%) | 1211 (13.4%) | 272 (7.5%) | 1420 (4.4%) | 4121 (5.8%) | 36 (7.7%) |
| Missing | 2189 (82.8%) | 3639 (61.3%) | 11378 (44.0%) | 1002 (11.1%) | 2534 (69.9%) | 10132 (31.2%) | 15422 (21.9%) | 70 (15.0%) |
| **Difficulty Maintaining Sleep** | | | | | | | | |
| Yes | 46 (1.7%) | 73 (1.2%) | 1079 (4.2%) | 577 (6.4%) | 76 (2.1%) | 293 (0.9%) | 1775 (2.5%) | 39 (8.4%) |
| Missing | 404 (15.3%) | 338 (5.7%) | 4456 (17.2%) | 2312 (25.7%) | 985 (27.2%) | 2686 (8.3%) | 11066 (15.7%) | 193 (41.4%) |
| **Early Morning Awakenings** | | | | | | | | |
| Yes | 50 (1.9%) | 27 (0.5%) | 418 (1.6%) | 595 (6.6%) | 109 (3.0%) | 129 (0.4%) | 793 (1.1%) | 40 (8.6%) |
| Missing | 2195 (83.0%) | 5840 (98.3%) | 23980 (92.7%) | 6277 (69.7%) | 2564 (70.8%) | 31646 (97.4%) | 66057 (93.6%) | 247 (53.0%) |
| | **Partner, no** | | | | **Partner, yes** | | | |
| | **(n=4203)** | **(n=6272)** | **(n=11914)** | **(n=1668)** | **(n=635)** | **(n=7676)** | **(n=26194)** | **(n=2956)** |
| **Total Sleep Time, hours** | | | | | | | | |
| Mean (SD) | 7.51 (1.08) | 7.22 (1.07) | 6.90 (1.29) | 7.05 (1.46) | 7.59 (1.14) | 7.21 (0.975) | 7.06 (1.09) | 7.37 (1.19) |
| Missing | 207 (4.9%) | 217 (3.5%) | 1112 (9.3%) | 557 (33.4%) | 165 (26.0%) | 749 (9.8%) | 4648 (17.7%) | 1250 (42.3%) |
| **Time in Bed, Hours** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mean (SD) | NA (NA) | NA (NA) | 7.98 (1.17) | 7.92 (1.10) | NA (NA) | NA (NA) | 8.00 (1.07) | 8.28 (1.21) |
| Missing | 4203 (100%) | 6272 (100%) | 10810 (90.7%) | 1661 (99.6%) | 635 (100%) | 7676 (100%) | 21642 (82.6%) | 2931 (99.2%) |
| **Sleep Efficiency, %** | | | | | | | | |
| Mean (SD) | NA (NA) | NA (NA) | 0.860 (0.134) | 0.889 (0.0629) | NA (NA) | NA (NA) | 0.873 (0.118) | 0.865 (0.129) |
| Missing | 4203 (100%) | 6272 (100%) | 10826 (90.9%) | 1661 (99.6%) | 635 (100%) | 7676 (100%) | 21658 (82.7%) | 2931 (99.2%) |
| **Difficulty Initiating Sleep** | | | | | | | | |
| Yes | 20 (0.5%) | 53 (0.8%) | 416 (3.5%) | 214 (12.8%) | 6 (0.9%) | 39 (0.5%) | 1148 (4.4%) | 289 (9.8%) |
| Missing | 3965 (94.3%) | 5623 (89.7%) | 8977 (75.3%) | 577 (34.6%) | 504 (79.4%) | 6723 (87.6%) | 15915 (60.8%) | 705 (23.8%) |
| **Difficulty Maintaining Sleep** | | | | | | | | |
| Yes | 14 (0.3%) | 52 (0.8%) | 248 (2.1%) | 251 (15.0%) | 3 (0.5%) | 79 (1.0%) | 721 (2.8%) | 375 (12.7%) |
| Missing | 4080 (97.1%) | 5721 (91.2%) | 10319 (86.6%) | 695 (41.7%) | 590 (92.9%) | 7034 (91.6%) | 21409 (81.7%) | 867 (29.3%) |
| **Early Morning Awakenings** | | | | | | | | |
| Yes | 22 (0.5%) | 87 (1.4%) | 481 (4.0%) | 315 (18.9%) | 5 (0.8%) | 128 (1.7%) | 1177 (4.5%) | 471 (15.9%) |
| Missing | 4041 (96.1%) | 5651 (90.1%) | 10019 (84.1%) | 577 (34.6%) | 549 (86.5%) | 6806 (88.7%) | 20348 (77.7%) | 692 (23.4%) |

**Supplementary Table 10a. Descriptive statistics of Time in bed, total sleep Time Sleep efficiency, Difficulty Initiating Sleep, Difficulty Maintaining Sleep, Early Morning Awakenings, stratified by age and BMI**

| | Underweight | | | | Normalweight | | | | Overweight | | | | Obese | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 18-25 yrs (n=220) | 26-40 yrs (n=497) | 41-65 yrs (n=446) | 65 yrs (n=57) | 18-25 yrs (n=3148) | 26-40 yrs (n=19543) | 41-65 yrs (n=33230) | 65 yrs (n=2733) | 18-25 yrs (n=1461) | 26-40 yrs (n=12385) | 41-65 yrs (n=37314) | 65 yrs (n=5489) | 18-25 yrs (n=341) | 26-40 yrs (n=4425) | 41-65 yrs (n=17743) | 65 yrs (n=2112) |
| **Total Sleep Time, hours** | | | | | | | | | | | | | | | | |
| Mean | 7.72 | 7.30 | 7.06 | 7.35 | 7.56 | 7.23 | 7.09 | 6.98 | 7.44 | 7.13 | 7.00 | 7.00 | 7.46 | 7.06 | 6.94 | 6.96 |
| (SD) | (1.06) | (1.11) | (1.18) | (1.27) | (1.01) | (0.900) | (0.971) | (1.31) | (1.11) | (0.953) | (1.04) | (1.31) | (1.36) | (1.04) | (1.16) | (1.35) |
| | 6 | 10 | 45 | 13 | 182 | 493 | 2941 | 781 | 76 | 273 | 3078 | 1172 | 21 | 70 | 1154 | 421 |
| Missing | (2.7%) | (2.0%) | (10.1%) | (22.8%) | (5.8%) | (2.5%) | (8.9%) | (28.6%) | (5.2%) | (2.2%) | (8.2%) | (21.4%) | (6.2%) | (1.6%) | (6.5%) | (19.9%) |
| **Time in Bed, Hours** | | | | | | | | | | | | | | | | |
| Mean | 9.75 | 8.21 | 8.01 | 7.95 | 8.56 | 8.03 | 7.81 | 7.88 | 8.89 | 7.91 | 7.72 | 7.91 | 8.56 | 7.94 | 7.79 | 7.85 |
| (SD) | (1.06) | (0.927) | (0.993) | (1.22) | (0.964) | (0.795) | (0.841) | (1.09) | (0.911) | (0.815) | (0.886) | (1.15) | (0.826) | (0.897) | (1.01) | (1.15) |
| | 218 | 252 | 240 | 34 | 3127 | 8532 | 13974 | 1476 | 1454 | 5171 | 16072 | 2343 | 337 | 1708 | 7520 | 1062 |
| Missing | (99.1%) | (50.7%) | (53.8%) | (59.6%) | (99.3%) | (43.7%) | (42.1%) | (54.0%) | (99.5%) | (41.8%) | (43.1%) | (42.7%) | (98.8%) | (38.6%) | (42.4%) | (50.3%) |
| **Sleep Efficiency, %** | | | | | | | | | | | | | | | | |
| Mean | 0.817 | 0.885 | 0.871 | 0.918 | 0.897 | 0.894 | 0.905 | 0.876 | 0.859 | 0.897 | 0.904 | 0.879 | 0.876 | 0.889 | 0.892 | 0.875 |
| (SD) | (0.0561) | (0.0942) | (0.114) | (0.0911) | (0.0800) | (0.0915) | (0.0929) | (0.128) | (0.185) | (0.0917) | (0.0975) | (0.127) | (0.0950) | (0.0971) | (0.109) | (0.128) |
| | 218 | 252 | 254 | 35 | 3127 | 8567 | 14557 | 1671 | 1454 | 5208 | 16719 | 2617 | 337 | 1722 | 7843 | 1150 |
| Missing | (99.1%) | (50.7%) | (57.0%) | (61.4%) | (99.3%) | (43.8%) | (43.8%) | (61.1%) | (99.5%) | (42.1%) | (44.8%) | (47.7%) | (98.8%) | (38.9%) | (44.2%) | (54.5%) |
| **Difficulty Initiating Sleep** | | | | | | | | | | | | | | | | |
| | | 31 | 38 | 3 | 11 | 814 | 1836 | 315 | | 433 | 1993 | 665 | 2 | 228 | 1257 | 289 |
| Yes | 0 (0%) | (6.2%) | (8.5%) | (5.3%) | (0.3%) | (4.2%) | (5.5%) | (11.5%) | 9 (0.6%) | (3.5%) | (5.3%) | (12.1%) | (0.6%) | (5.2%) | (7.1%) | (13.7%) |
| | 211 | 229 | 202 | 17 | 2929 | 7643 | 10626 | 596 | 1394 | 4672 | 12593 | 874 | 320 | 1583 | 6144 | 387 |
| Missing | (95.9%) | (46.1%) | (45.3%) | (29.8%) | (93.0%) | (39.1%) | (32.0%) | (21.8%) | (95.4%) | (37.7%) | (33.7%) | (15.9%) | (93.8%) | (35.8%) | (34.6%) | (18.3%) |
| **Difficulty Maintaining Sleep** | | | | | | | | | | | | | | | | |
| | | 4 | 9 | 3 | | | 396 | 182 | | | 356 | 265 | | | 153 | 152 |
| Yes | 0 (0%) | (0.8%) | (2.0%) | (5.3%) | 5 (0.2%) | 43 (0.2%) | (1.2%) | (6.7%) | 1 (0.1%) | 28 (0.2%) | (1.0%) | (4.8%) | 0 (0%) | 7 (0.2%) | (0.9%) | (7.2%) |
| | 215 | 483 | 405 | 44 | 3085 | 18990 | 30497 | 1851 | 1452 | 12098 | 34726 | 4037 | 338 | 4349 | 16714 | 1457 |
| Missing | (97.7%) | (97.2%) | (90.8%) | (77.2%) | (98.0%) | (97.2%) | (91.8%) | (67.7%) | (99.4%) | (97.7%) | (93.1%) | (73.5%) | (99.1%) | (98.3%) | (94.2%) | (69.0%) |
| **Early Morning Awakenings** | | | | | | | | | | | | | | | | |
| | 1 | 6 | 13 | 6 | 17 | 116 | 697 | 261 | | | 685 | 337 | 1 | 14 | 290 | 177 |
| Yes | (0.5%) | (1.2%) | (2.9%) | (10.5%) | (0.5%) | (0.6%) | (2.1%) | (9.5%) | 7 (0.5%) | 67 (0.5%) | (1.8%) | (6.1%) | (0.3%) | (0.3%) | (1.6%) | (8.4%) |
| | 211 | 480 | 393 | 37 | 3038 | 18808 | 29908 | 1708 | 1428 | 12014 | 34150 | 3929 | 333 | 4326 | 16555 | 1426 |
| Missing | (95.9%) | (96.6%) | (88.1%) | (64.9%) | (96.5%) | (96.2%) | (90.0%) | (62.5%) | (97.7%) | (97.0%) | (91.5%) | (71.6%) | (97.7%) | (97.8%) | (93.3%) | (67.5%) |

**Supplementary Table 10b. Descriptive statistics of Time in bed, total sleep Time Sleep efficiency, Difficulty Initiating Sleep, Difficulty Maintaining Sleep, Early Morning Awakenings, stratified by age and BMI and smoking status**

| | Nonsmokers | | | | Former Smokers | | | | Smokers | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (n=3205) | (n=18273) | (n=37828) | (n=3927) | (n=465) | (n=7890) | (n=28331) | (n=2952) | (n=1593) | (n=9857) | (n=20545) | (n=3462) |
| **Total Sleep Time, hours** | | | | | | | | | | | | |
| Mean | 7.56 | 7.21 | 7.03 | 6.92 | 7.43 | 7.17 | 7.03 | 7.22 | 7.49 | 7.12 | 7.00 | 6.90 |
| (SD) | (1.04) | (0.926) | (1.04) | (1.36) | (1.07) | (0.924) | (1.02) | (1.27) | (1.12) | (0.986) | (1.09) | (1.30) |
| | 181 | 395 | 2541 | 896 | 57 | 270 | 3255 | 1152 | 140 | 433 | 1718 | 343 |
| Missing | (5.6%) | (2.2%) | (6.7%) | (22.8%) | (12.3%) | (3.4%) | (11.5%) | (39.0%) | (8.8%) | (4.4%) | (8.4%) | (9.9%) |
| **Time in Bed, Hours** | | | | | | | | | | | | |
| Mean | 8.40 | 8.01 | 7.79 | 7.95 | 9.00 | 8.00 | 7.80 | 8.03 | 8.75 | 7.89 | 7.71 | 7.80 |
| (SD) | (1.03) | (0.784) | (0.853) | (1.12) | (1.41) | (0.802) | (0.911) | (1.18) | (0.698) | (0.910) | (0.971) | (1.12) |
| | 3192 | 7477 | 16073 | 2098 | 463 | 3223 | 11892 | 2032 | 1582 | 5221 | 10055 | 740 |
| Missing | (99.6%) | (40.9%) | (42.5%) | (53.4%) | (99.6%) | (40.8%) | (42.0%) | (68.8%) | (99.3%) | (53.0%) | (48.9%) | (21.4%) |
| **Sleep Efficiency, %** | | | | | | | | | | | | |
| Mean | 0.901 | 0.896 | 0.904 | 0.861 | 0.800 | 0.890 | 0.897 | 0.893 | 0.877 | 0.893 | 0.903 | 0.883 |
| (SD) | (0.0847) | (0.0904) | (0.0953) | (0.135) | (0.283) | (0.0953) | (0.102) | (0.120) | (0.120) | (0.0940) | (0.0994) | (0.124) |
| | 3192 | 7515 | 16696 | 2347 | 463 | 3236 | 12560 | 2269 | 1582 | 5251 | 10299 | 809 |
| Missing | (99.6%) | (41.1%) | (44.1%) | (59.8%) | (99.6%) | (41.0%) | (44.3%) | (76.9%) | (99.3%) | (53.3%) | (50.1%) | (23.4%) |
| **Difficulty Initiating Sleep** | | | | | | | | | | | | |
| | 10 | 659 | 1979 | 585 | 3 | 342 | 1700 | 307 | 16 | 483 | 1339 | 380 |
| Yes | (0.3%) | (3.6%) | (5.2%) | (14.9%) | (0.6%) | (4.3%) | (6.0%) | (10.4%) | (1.0%) | (4.9%) | (6.5%) | (11.0%) |
| | 2988 | 6489 | 11925 | 760 | 400 | 2774 | 9161 | 736 | 1473 | 4862 | 8353 | 315 |
| Missing | (93.2%) | (35.5%) | (31.5%) | (19.4%) | (86.0%) | (35.2%) | (32.3%) | (24.9%) | (92.5%) | (49.3%) | (40.7%) | (9.1%) |
| **Difficulty Maintaining Sleep** | | | | | | | | | | | | |
| | 11 | | 547 | 290 | 1 | 27 | 359 | 272 | | 23 | 112 | 53 |
| Yes | (0.3%) | 84 (0.5%) | (1.4%) | (7.4%) | (0.2%) | (0.3%) | (1.3%) | (9.2%) | 7 (0.4%) | (0.2%) | (0.5%) | (1.5%) |
| | 3099 | 17484 | 34132 | 2541 | 438 | 7602 | 26114 | 1592 | 1551 | 9735 | 19732 | 3200 |
| Missing | (96.7%) | (95.7%) | (90.2%) | (64.7%) | (94.2%) | (96.3%) | (92.2%) | (53.9%) | (97.4%) | (98.8%) | (96.0%) | (92.4%) |
| **Early Morning Awakenings** | | | | | | | | | | | | |
| | 17 | 127 | 843 | 332 | 3 | 61 | 633 | 359 | | 26 | 222 | 83 |
| Yes | (0.5%) | (0.7%) | (2.2%) | (8.5%) | (0.6%) | (0.8%) | (2.2%) | (12.2%) | 7 (0.4%) | (0.3%) | (1.1%) | (2.4%) |
| | 3063 | 17389 | 33802 | 2457 | 423 | 7512 | 25475 | 1451 | 1521 | 9627 | 19354 | 3134 |
| Missing | (95.6%) | (95.2%) | (89.4%) | (62.6%) | (91.0%) | (95.2%) | (89.9%) | (49.2%) | (95.5%) | (97.7%) | (94.2%) | (90.5%) |

**Supplementary Table 11. Objective and subjective time in bed, total sleep time and sleep efficiency, stratified by age and sex**

| | Time in bed, hours | | | Total sleep time, hours | | | Sleep efficiency, % | | |
|---|---|---|---|---|---|---|---|---|---|
| Strata by age and sex | N | Actigraphy Mean ± SD | Diary Mean ± SD | N | Actigraphy Mean ± SD | Diary Mean ± SD | N | Actigraphy Mean ± SD | Diary Mean ± SD |
| 6 to 13 years | | | | | | | | | |
| Total | 900 | 9.2±0.7 | 10.2±0.6 | 900 | 7.7±0.7 | 9.6±0.7 | 900 | 83.8±4 | 93.5±5 |
| Male | 427 | 9.2±0.7 | 10.2±0.6 | 427 | 7.6±0.7 | 9.6±0.7 | 427 | 82.7±5 | 93.6±5 |
| Female | 473 | 9.2±0.7 | 10.2±0.6 | 473 | 7.8±0.7 | 9.6±0.8 | 473 | 84.7±4 | 93.5±5 |
| 14 to 17 years | | | | | | | | | |
| Total | 486 | 8.4±0.8 | 8.9±0.8 | 486 | 7.2±0.9 | 8.5±0.8 | 486 | 85.9±7 | 95.6±4 |
| Male | 221 | 8.3±0.8 | 8.8±0.8 | 221 | 7.0±0.8 | 8.5±0.7 | 221 | 84.6±6 | 95.9±4 |
| Female | 265 | 8.4±0.8 | 8.9±0.8 | 265 | 7.3±0.9 | 8.4±0.8 | 265 | 87.1±8 | 95.2±4 |
| 41 to 64 years | | | | | | | | | |
| Total | 1,270 | - | 8.1±0.9 | 1,270 | 6.0±0.9 | 6.8±0.9 | 1,270 | 74.4±9 | 84.6±10 |
| Male | 557 | - | 7.8±0.8 | 557 | 5.7±0.9 | 6.8±0.9 | 557 | 73.5±9 | 86.9±9 |
| Female | 713 | - | 8.3±0.8 | 713 | 6.2±0.8 | 6.8±0.9 | 713 | 75.1±8 | 82.8±10 |
| ≥65 years | | | | | | | | | |
| Total | 668 | - | 8.4±0.8 | 668 | 6.2±0.9 | 6.9±1.0 | 668 | 73.9±8 | 82.3±11 |
| Male | 319 | - | 8.3±0.8 | 319 | 6.1±0.9 | 7.0±1.0 | 319 | 73.3±9 | 84.4±11 |
| Female | 349 | - | 8.4±0.8 | 349 | 6.3±0.9 | 6.7±1.0 | 349 | 74.4±8 | 80.3±10 |

Note: Prevalence was not calculated if <200 participants in a cell. Abbreviations: N=sample size; SD=standard deviation.

**Supplementary table 12. Sleep diary reported and actigraphically estimated sleep duration contrasted to recommendations**

| Age group | N | Recommended | Actigraphy | | Diary | | Acceptable | Actigraphy | | Diary | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sleeping less, % | Sleeping more, % | Sleeping less, % | Sleeping more, % | | Sleeping less, % | Sleeping more, % | Sleeping less, % | Sleeping more, % |
| 6-13 yrs | 900 | 9-11 hrs | 98.1 | 0 | 18.1 | 1.6 | 7-12 hrs | 16.3 | 0 | 0.4 | 0.2 |
| 14-17 yrs | 486 | 8-10 hrs | 87.7 | 0.6 | 24.2 | 2.8 | 7-11 hrs | 38.7 | 0.6 | 3.7 | 0.2 |
| 41-64 yrs | 93,837 | 7-9 hrs | 89.2 | 0.1 | 54.7 | 1.2 | 6-10 hrs | 47.3 | 0 | 14.7 | 0.2 |
| >65 yrs | 8,195 | 7-8 hrs | 81.7 | 2.1 | 51.1 | 9.5 | 5-9 hrs | 9.4 | 0.1 | 2.6 | 96.5 |

**Supplementary Table 13. Actigraphically estimated time in bed, total sleep time and sleep efficiency in the Netherlands and the UK, stratified by age and sex**

| | Time in bed, hours | | | | Total sleep time, hours | | | | Sleep efficiency, % | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Strata by age and sex | Rott Study N | Rott Study Mean ± SD | UKBB N | UKBB Mean ± SD | Rott Study N | Rott Study Mean ± SD | UKBB N | UKBB Mean ± SD | Rott Study N | Rott Study Mean ± SD | UKBB N | UKBB Mean ± SD |
| **41 to 64 years** | | | | | | | | | | | | |
| Total | 1,270 | 8.1±0.9 | 47,726 | 9.6±1.0 | 1,270 | 6.0±0.9 | 47,726 | 7.2±0.9 | 1,270 | 74.4±9 | 47,726 | 76 ±7 |
| Male | 557 | 7.8±0.8 | 19,244 | 9.7±1.0 | 557 | 5.7±0.9 | 19,244 | 7.1±0.10 | 557 | 73.5±9 | 19,244 | 74 ±7 |
| Female | 713 | 8.3±0.8 | 28,482 | 9.6±0.9 | 713 | 6.2±0.8 | 28,482 | 7.4±0.9 | 713 | 75.1±8 | 28,482 | 78 ±7 |
| **≥65 years** | | | | | | | | | | | | |
| Total | 668 | 8.4±0.8 | 37,773 | 9.8±0.9 | 1,270 | 6.2±0.9 | 37,773 | 7.4±0.9 | 668 | 73.9±8 | 37,773 | 76 ±7 |
| Male | 319 | 8.3±0.8 | 18,167 | 9.9±0.9 | 319 | 6.1±0.9 | 18,167 | 7.3±0.9 | 319 | 73.3±9 | 18,167 | 75 ±7 |
| Female | 349 | 8.4±0.8 | 19,606 | 9.7±0.9 | 349 | 6.3±0.9 | 19,606 | 7.4±0.8 | 349 | 74.4±8 | 19,606 | 78 ±7 |

Note: Prevalence was not calculated if <200 participants in a cell. Abbreviations: N=sample size; SD=standard deviation. Rott=Rotterdam Study, UKBB=UK Biobank

**Supplementary Table 14. International comparisons of total sleep time, stratified by age and sex**

| Strata by age and sex | Total sleep time, hours 15 Studies Netherlands 1993 to 2015 | | Total sleep time, hours UK Biobank* 2006-2010 | | Total sleep time, hours USA NHIS 2004-2017 | |
|---|---|---|---|---|---|---|
| | N | Mean ± SD | N | Mean ± SD | N | Mean ± SD |
| 18 to 25 years | | | | | | |
| Total | 5,192 | 7.5 ± 1.1 | - | - | 47,123 | 7.3 ± 1.4 |
| Male | 2,049 | 7.4 ± 1.1 | - | - | 22,034 | 7.3 ± 1.3 |
| Female | 3,143 | 7.6 ± 1.0 | - | - | 25,089 | 7.3 ± 1.4 |
| 26 to 40 years | | | | | | |
| Total | 38,635 | 7.2 ± 0.9 | - | - | 108,332 | 7.0 ± 1.3 |
| Male | 16,182 | 7.1 ± 0.9 | - | - | 48,561 | 6.9 ± 1.2 |
| Female | 22,453 | 7.3 ± 1.0 | - | - | 59,771 | 7.1 ± 1.3 |
| 41 to 64 years | | | | | | |
| Total | 93,837 | 7.0 ± 1.1 | 405,331 | 7.1 ± 1.1 | 164,834 | 6.9 ± 1.4 |
| Male | 40,603 | 6.9 ± 1.0 | 178,456 | 7.0 ± 1.0 | 75,666 | 6.9 ± 1.3 |
| Female | 53,234 | 7.1 ± 1.1 | 226,875 | 7.1 ± 1.1 | 89,168 | 7.0 ± 1.4 |
| ≥65 years | | | | | | |
| Total | 8,195 | 7.0 ± 1.3 | 66,428 | 7.3 ± 1.1 | 89,328 | 7.5 ± 1.6 |
| Male | 3,504 | 7.2 ± 1.2 | 31,593 | 7.4 ± 1.1 | 36,109 | 7.6 ± 1.6 |
| Female | 4,691 | 6.8 ± 1.4 | 34,835 | 7.2 ± 1.2 | 53,219 | 7.4 ± 1.6 |

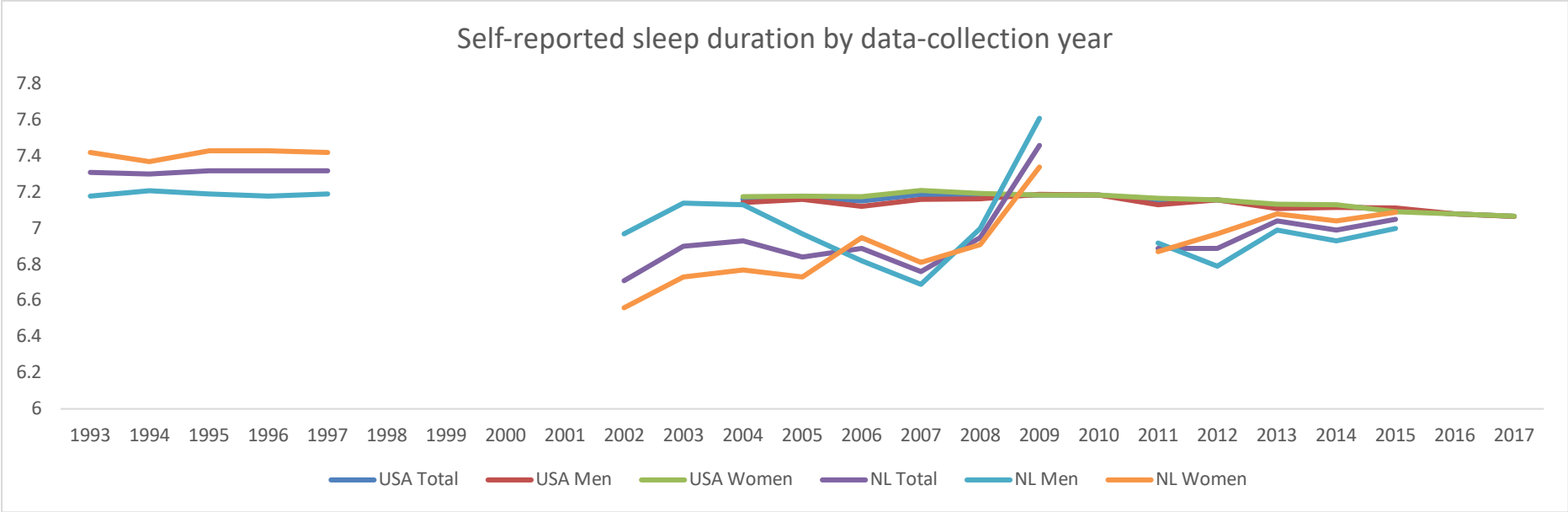
Note: Prevalence was not calculated if <200 participants in a cell. Abbreviations: N=sample size; SD=standard deviation, NHIS=National Health Interview Survey
*only persons that did not report to take naps 'usually' were selected

**Supplementary Table 15. International comparisons of the prevalence of insomnia symptoms, stratified by age and sex**

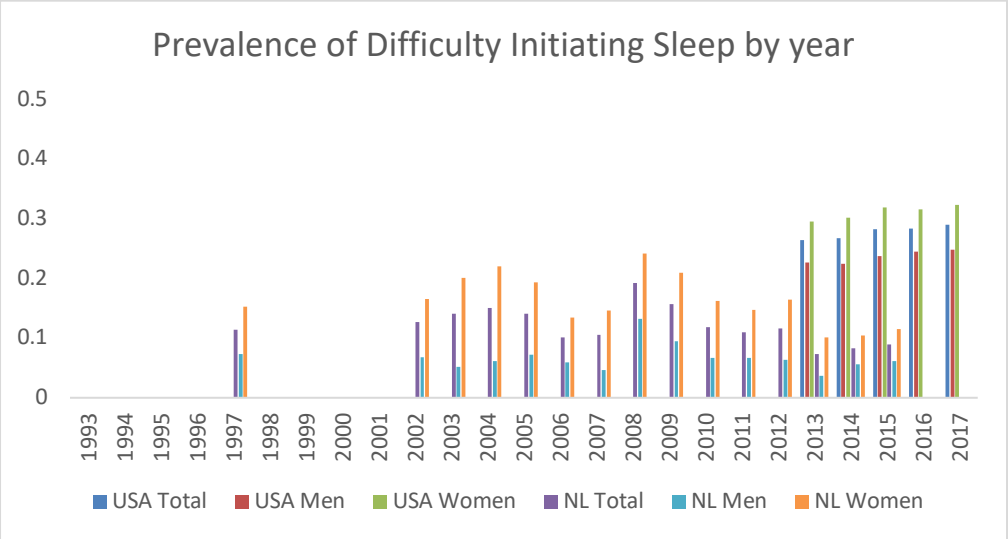
| Strata by age and sex | Insomnia symptoms | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Difficulty initiating sleep | | | | Difficulty maintaining sleep | | | |
| | Netherlands 22 Studies 1997 to 2015 | | USA NHIS 2013-2017 | | Netherlands 15 Studies 1998 to 2015 | | USA NHIS 2013-2017 | |
| | N | % | N | % | N | % | N | % |
| 18 to 25 years | | | | | | | | |
| Total | 2,227 | 22.6 | 17,107 | 20.6 | 1,961 | 9.4 | 17,100 | 16.3 |
| Male | 969 | 19.4 | 8,238 | 16.6 | 856 | 8.6 | 8,235 | 11.4 |
| Female | 1,252 | 25.1 | 8,869 | 24.2 | 1,105 | 10.0 | 8,865 | 20.9 |
| 26 to 40 years | | | | | | | | |
| Total | 26,264 | 7.2 | 39,605 | 21.1 | 3,795 | 11.3 | 39,595 | 22.9 |
| Male | 10,850 | 5.5 | 17,811 | 17.3 | 1,550 | 7.4 | 17,801 | 17.9 |
| Female | 15,413 | 8.3 | 21,794 | 24.2 | 2,244 | 13.9 | 21,794 | 27.1 |
| 41 to 64 years | | | | | | | | |
| Total | 73,648 | 9.3 | 63,299 | 23.1 | 19,056 | 15.7 | 63,265 | 32.3 |
| Male | 31,637 | 5.4 | 29,368 | 18.4 | 8,640 | 10.5 | 29,353 | 27.8 |
| Female | 41,975 | 12.3 | 33,931 | 27.2 | 10,416 | 20.1 | 33,912 | 36.3 |
| ≥65 years | | | | | | | | |
| Total | 8,869 | 14.9 | 39,679 | 18.1 | 3,255 | 20.2 | 39,640 | 29.9 |
| Male | 3,841 | 8.0 | 16,392 | 14.1 | 1,527 | 14.5 | 16,380 | 28.3 |
| Female | 5,028 | 20.2 | 23,287 | 21.0 | 1,728 | 25.3 | 23,260 | 31.1 |

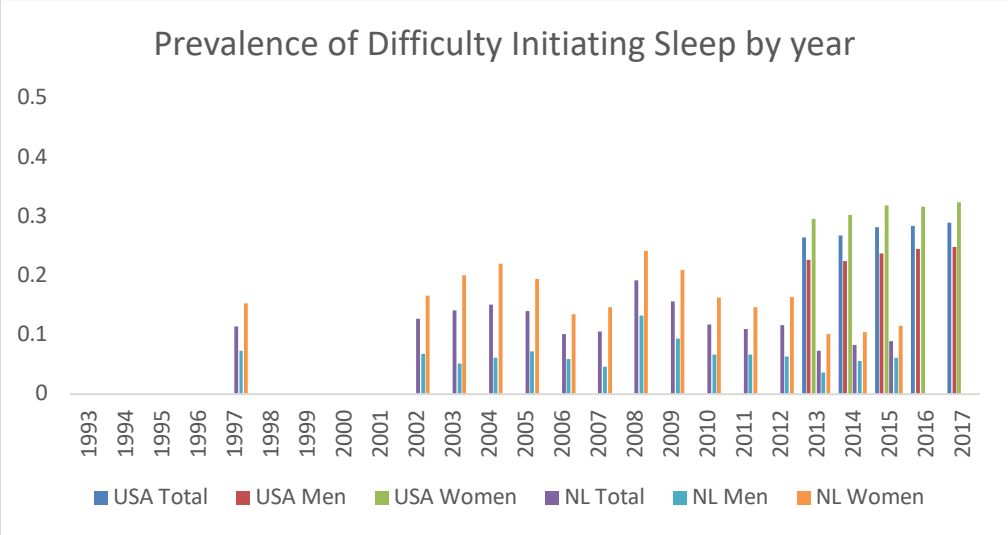
Note: Prevalence rates were not calculated if <200 participants in a cell. Abbreviations: ND=not defined if inapplicable for the age group. NHIS=National Health Interview Survey

**Supplementary Figure 6. Average self-reported sleep duration by data-collection year in the Netherlands and USA**



**Supplementary Figure7. Prevalence of insomnia symptoms by data-collection year in the Netherlands and USA**



**Supplementary Table 16. Desriptive statistics and distribution of missing data of main sleep characteristics, stratified by age and sex.**

| | 1-3 yrs | | 3-5 yrs | | | 6-13 yrs | | | 14-17 yrs | | | 18-25 yrs | | 26-40 yrs | | | 41-65 yrs | | 65 yrs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | Male | Female | miss | Male | Female | miss | Male | Female | miss | Male | Female | Male | Female | miss | Male | Female | Male | Female |
| | 1620 | 1674 | n=3354 | n=3261 | n=1 | n=11135 | n=11117 | n=10 | n=2487 | n=2686 | n=3 | n=3597 | n=4909 | n=17947 | n=24403 | n=1 | n=44122 | n=57367 | n=4705 | n=5959 |
| **Time in Bed, hrs** | | | | | | | | | | | | | | | | | | | | |
| Mean (SD) | 11.6 (0.732) | 11.7 (0.705) | 11.4 (0.644) | 11.5 (0.633) | NA (NA) | 10.7 (0.833) | 10.8 (0.878) | 9.72 (0.995) | 8.72 (0.844) | 8.78 (0.849) | 9.38 (0.177) | 7.97 (1.20) | 8.52 (1.05) | 7.73 (0.865) | 8.13 (0.809) | NA (NA) | 7.53 (0.877) | 7.95 (0.870) | 7.92 (1.09) | 7.87 (1.16) |
| Median [Min, Max] | 11.5 [8.00, 15.0] | 11.8 [9.00, 15.0] | 11.5 [8.00, 15.0] | 11.5 [8.00, 17.0] | NA [NA, NA] | 11.0 [4.25, 13.5] | 11.0 [5.50, 13.3] | 10.3 [8.00, 10.5] | 8.75 [3.50, 12.0] | 9.00 [4.50, 13.0] | 9.38 [9.25, 9.50] | 8.00 [3.50, 13.0] | 8.50 [3.57, 13.3] | 7.75 [3.00, 18.0] | 8.00 [3.00, 15.5] | NA [NA, NA] | 7.50 [3.50, 17.5] | 8.00 [3.00, 16.0] | 8.00 [2.33, 13.5] | 8.00 [2.28, 13.0] |
| Missing | 26 (1.6%) | 28 (1.7%) | 113 (3.4%) | 81 (2.5%) | 1 (100%) | 1658 (14.9%) | 1697 (15.3%) | 2 (20.0%) | 742 (29.8%) | 686 (25.5%) | 1 (33.3%) | 3029 (84.2%) | 4303 (87.7%) | 8009 (44.6%) | 10472 (42.9%) | 1 (100%) | 22887 (51.9%) | 27516 (48.0%) | 2417 (51.4%) | 2767 (46.4%) |
| **Total Sleep Time, hrs** | | | | | | | | | | | | | | | | | | | | |
| Mean (SD) | 11.9 (1.93) | 12.7 (1.04) | 11.5 (0.567) | 11.6 (0.564) | NA (NA) | 10.5 (0.965) | 10.6 (1.01) | 10.5 (1.32) | 7.92 (0.974) | 7.59 (1.12) | NA (NA) | 7.43 (1.11) | 7.60 (1.05) | 7.05 (0.895) | 7.26 (0.966) | NA (NA) | 6.93 (0.988) | 7.08 (1.07) | 7.20 (1.22) | 6.84 (1.36) |
| Median [Min, Max] | 11.5 [10.0, 14.5] | 13.0 [11.0, 13.5] | 11.5 [8.80, 13.3] | 11.8 [8.00, 13.0] | NA [NA, NA] | 10.8 [3.25, 13.0] | 11.0 [3.50, 13.3] | 10.0 [9.50, 12.0] | 8.00 [3.75, 10.0] | 7.75 [3.00, 10.8] | NA [NA, NA] | 7.00 [3.00, 13.0] | 8.00 [3.00, 13.0] | 7.00 [3.00, 16.0] | 7.00 [3.00, 14.0] | NA [NA, NA] | 7.00 [2.50, 18.0] | 7.00 [2.50, 18.0] | 7.00 [2.50, 12.0] | 7.00 [2.30, 12.0] |
| Missing | 1616 (99.8%) | 1669 (99.7%) | 2701 (80.5%) | 2648 (81.2%) | 1 (100%) | 6950 (62.4%) | 6928 (62.3%) | 7 (70.0%) | 2298 (92.4%) | 2362 (87.9%) | 3 (100%) | 1548 (43.0%) | 1766 (36.0%) | 1765 (9.8%) | 1950 (8.0%) | 1 (100%) | 3519 (8.0%) | 4133 (7.2%) | 1201 (25.5%) | 1268 (21.3%) |
| **Sleep Efficiency, %** | | | | | | | | | | | | | | | | | | | | |
| Mean (SD) | 0.936 (NA) | 0.940 (0.0849) | 0.995 (0.0176) | 0.995 (0.0262) | NA (NA) | 0.970 (0.0527) | 0.970 (0.0516) | 0.952 (0.0673) | 0.923 (0.0683) | 0.908 (0.0824) | NA (NA) | 0.890 (0.0892) | 0.902 (0.0970) | 0.904 (0.0840) | 0.887 (0.0972) | NA (NA) | 0.916 (0.0876) | 0.891 (0.104) | 0.904 (0.108) | 0.859 (0.137) |
| Median [Min, Max] | 0.936 [0.936, 0.936] | 0.940 [0.880, 1.00] | 1.00 [0.826, 1.00] | 1.00 [0.660, 1.00] | NA [NA, NA] | 1.00 [0.484, 1.00] | 1.00 [0.515, 1.00] | 0.952 [0.905, 1.00] | 0.946 [0.590, 1.00] | 0.938 [0.510, 1.00] | NA [NA, NA] | 0.889 [0.625, 1.00] | 0.938 [0.600, 1.00] | 0.923 [0.316, 1.00] | 0.903 [0.300, 1.00] | NA [NA, NA] | 0.933 [0.286, 1.00] | 0.914 [0.214, 1.00] | 0.938 [0.238, 1.00] | 0.889 [0.278, 1.00] |
| Missing | 1619 (99.9%) | 1672 (99.9%) | 2750 (82.0%) | 2682 (82.2%) | 1 (100%) | 7674 (68.9%) | 7649 (68.8%) | 8 (80.0%) | 2301 (92.5%) | 2363 (88.0%) | 3 (100%) | 3565 (99.1%) | 4828 (98.3%) | 9269 (51.6%) | 11877 (48.7%) | 1 (100%) | 23552 (53.4%) | 28424 (49.5%) | 2684 (57.0%) | 3058 (51.3%) |
| **Difficulty Initiating Sleep** | | | | | | | | | | | | | | | | | | | | |
| No, % | 623 (38.5%) | 653 (39.0%) | 2658 (79.2%) | 2599 (79.7%) | 1 (100%) | 5867 (52.7%) | 5640 (50.7%) | 8 (80.0%) | 626 (25.2%) | 734 (27.3%) | 2 (66.7%) | 778 (21.6%) | 938 (19.1%) | 9982 (55.6%) | 13768 (56.4%) | 1 (100%) | 29117 (66.0%) | 35956 (62.7%) | 3498 (74.3%) | 3974 (66.7%) |
| Yes, % | 32 (2.0%) | 28 (1.7%) | 117 (3.5%) | 103 (3.2%) | 0 (0%) | 825 (7.4%) | 923 (8.3%) | 2 (20.0%) | 93 (3.7%) | 176 (6.6%) | 0 (0%) | 188 (5.2%) | 316 (6.4%) | 586 (3.3%) | 1252 (5.1%) | 0 (0%) | 1677 (3.8%) | 5103 (8.9%) | 302 (6.4%) | 1011 (17.0%) |
| Missing, % | 965 (59.6%) | 993 (59.3%) | 579 (17.3%) | 559 (17.1%) | 0 (0%) | 4443 (39.9%) | 4554 (41.0%) | 0 (0%) | 1768 (71.1%) | 1776 (66.1%) | 1 (33.3%) | 2631 (73.1%) | 3655 (74.5%) | 7379 (41.1%) | 9383 (38.5%) | 0 (0%) | 13328 (30.2%) | 16308 (28.4%) | 905 (19.2%) | 974 (16.3%) |
| **Difficulty Maintaining Sleep** | | | | | | | | | | | | | | | | | | | | |
| No, % | 0 (0%) | 0 (0%) | 779 (23.2%) | 796 (24.4%) | 0 (0%) | 3316 (29.8%) | 3236 (29.1%) | 5 (50.0%) | 417 (16.8%) | 483 (18.0%) | 2 (66.7%) | 781 (21.7%) | 990 (20.2%) | 1435 (8.0%) | 1929 (7.9%) | 1 (100%) | 7732 (17.5%) | 8321 (14.5%) | 1305 (27.7%) | 1290 (21.6%) |
| Yes, % | 0 (0%) | 0 (0%) | 55 (1.6%) | 48 (1.5%) | 0 (0%) | 285 (2.6%) | 366 (3.3%) | 2 (20.0%) | 84 (3.4%) | 189 (7.0%) | 0 (0%) | 74 (2.1%) | 111 (2.3%) | 114 (0.6%) | 313 (1.3%) | 0 (0%) | 905 (2.1%) | 2091 (3.6%) | 222 (4.7%) | 437 (7.3%) |
| Missing, % | 1620 (100%) | 1674 (100%) | 2520 (75.1%) | 2417 (74.1%) | 1 (100%) | 7534 (67.7%) | 7515 (67.6%) | 3 (30.0%) | 1986 (79.9%) | 2014 (75.0%) | 1 (33.3%) | 2742 (76.2%) | 3808 (77.6%) | 16398 (91.4%) | 22161 (90.8%) | 0 (0%) | 35485 (80.4%) | 46955 (81.9%) | 3178 (67.5%) | 4232 (71.0%) |
| **Early Morning Awakenings** | | | | | | | | | | | | | | | | | | | | |
| No, % | 0 (0%) | 0 (0%) | 479 (14.3%) | 569 (17.4%) | 0 (0%) | 1561 (14.0%) | 1809 (16.3%) | 0 (0%) | 19 (0.8%) | 15 (0.6%) | 0 (0%) | 809 (22.5%) | 1000 (20.4%) | 634 (3.5%) | 768 (3.1%) | 1 (100%) | 3216 (7.3%) | 3427 (6.0%) | 1290 (27.4%) | 1293 (21.7%) |
| Yes, % | 0 (0%) | 0 (0%) | 356 (10.6%) | 271 (8.3%) | 0 (0%) | 763 (6.9%) | 442 (4.0%) | 0 (0%) | 1 (0.0%) | 1 (0.0%) | 0 (0%) | 82 (2.3%) | 127 (2.6%) | 87 (0.5%) | 143 (0.6%) | 0 (0%) | 685 (1.6%) | 1082 (1.9%) | 289 (6.1%) | 503 (8.4%) |
| Missing, % | 1620 (100%) | 1674 (100%) | 2519 (75.1%) | 2421 (74.2%) | 1 (100%) | 8811 (79.1%) | 8866 (79.8%) | 10 (100%) | 2467 (99.2%) | 2670 (99.4%) | 3 (100%) | 2706 (75.2%) | 3782 (77.0%) | 17226 (96.0%) | 23492 (96.3%) | 0 (0%) | 40221 (91.2%) | 52858 (92.1%) | 3126 (66.4%) | 4163 (69.9%) |