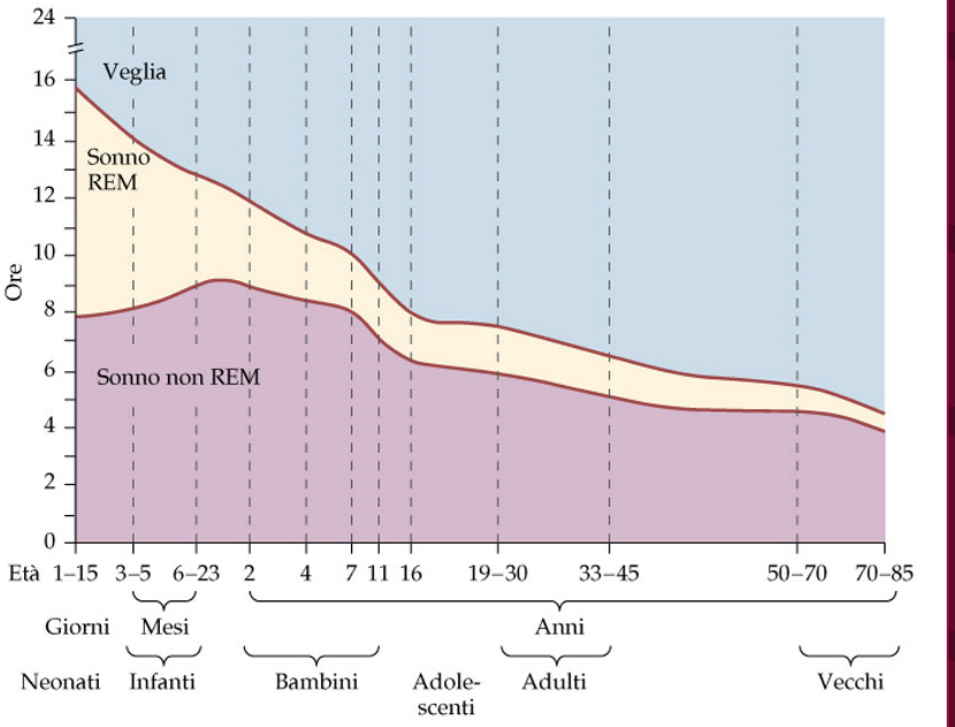
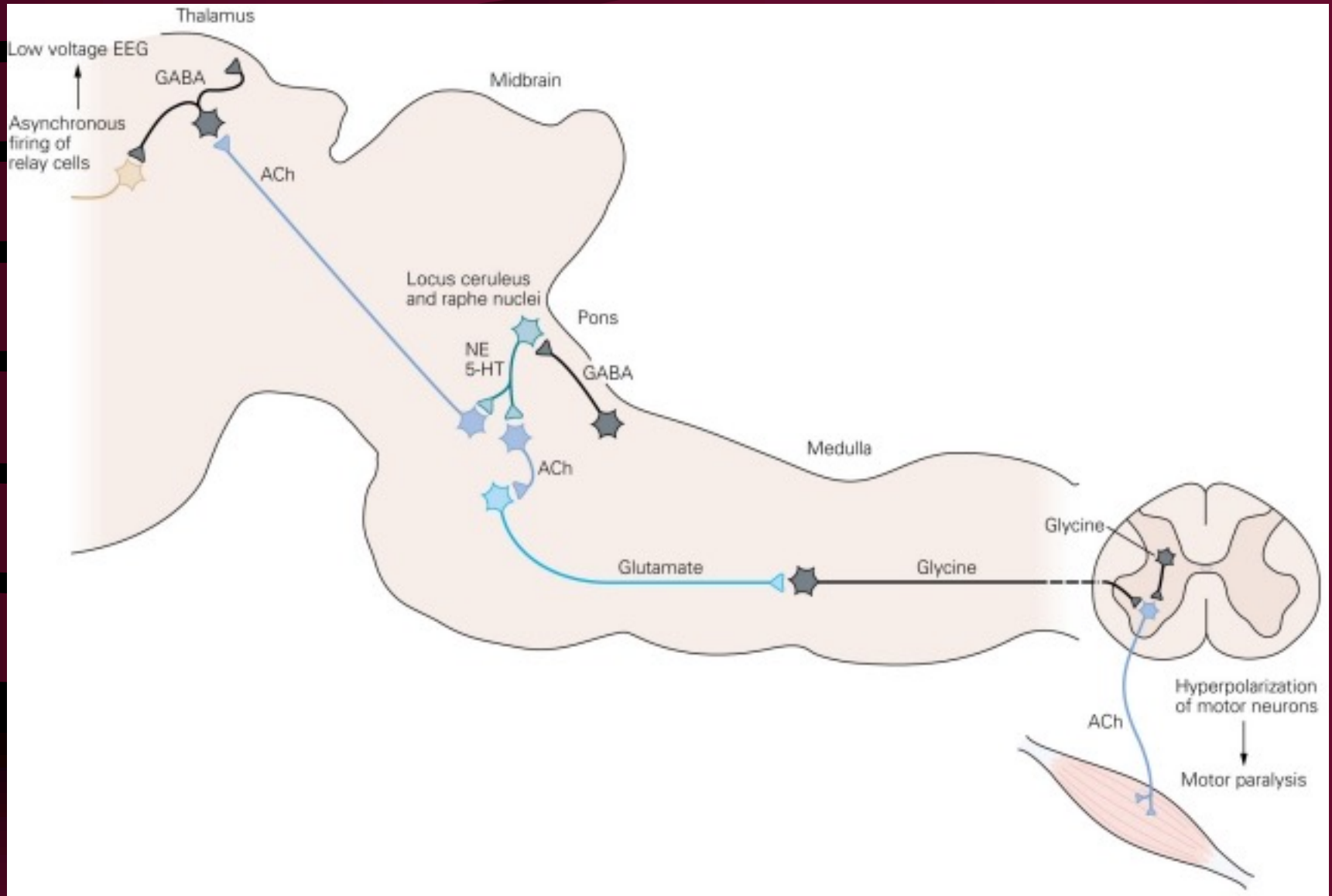

24
16
14
12
10
8
6
4
2
0
Ore
Veglia
Sonno REM
Sonno non REM
Età 1–15 3–5 6–23 2 4 7 11 16 19–30 33–45 50–70 70–85
Giorni
Mesi
Anni
Neonati
Infanti
Bambini
Adole-scenti
Adulti
Vecchi

Ontogenesi del sonno umano

- L'età è uno dei più importanti determinanti del sonno.
- Due variabili:
  - Andamento evolutivo del ciclo veglia/sonno
  - Andamento evolutivo del ciclo NREM/REM
- Quasi tutto il sonno *in utero* potrebbe essere REM

Ontogenesi del sonno umano

- I neonati hanno una media di 16 ore di sonno al giorno (*range*=11-21 h)
- Anche i neonati suddividono il loro sonno in qualcosa di analogo al REM e NREM (sonno ATTIVO e QUIETO)
- Il sonno REM è prevalentemente caratterizzato da attività muscolari (REMs, *twitches*, espressioni facciali)



Appleton & Lange
Kandel/Schwartz/Jessell
Principles of Neural Science
Fig. 47.05

Ontogenesi del sonno umano

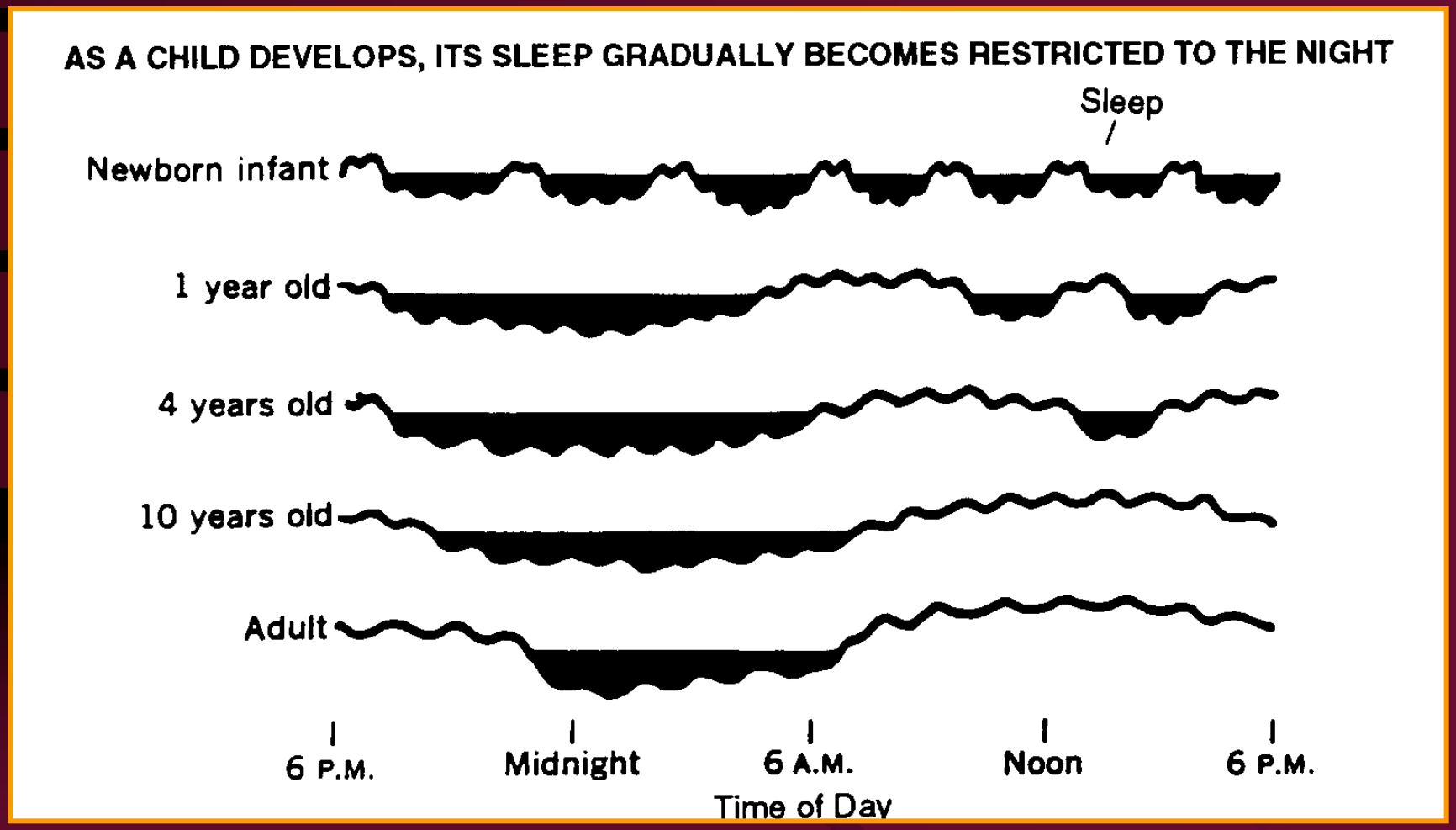
- Il sonno NREM è più quieto, la respirazione è più lenta e regolare, e la muscolatura più rilassata
- Anche i bambini presentano cicli REM e NREM
- Ogni ciclo di sonno dura, in media, circa 1 ora e, a differenza dell'adulto, inizia con il sonno REM

Ontogenesi del sonno umano

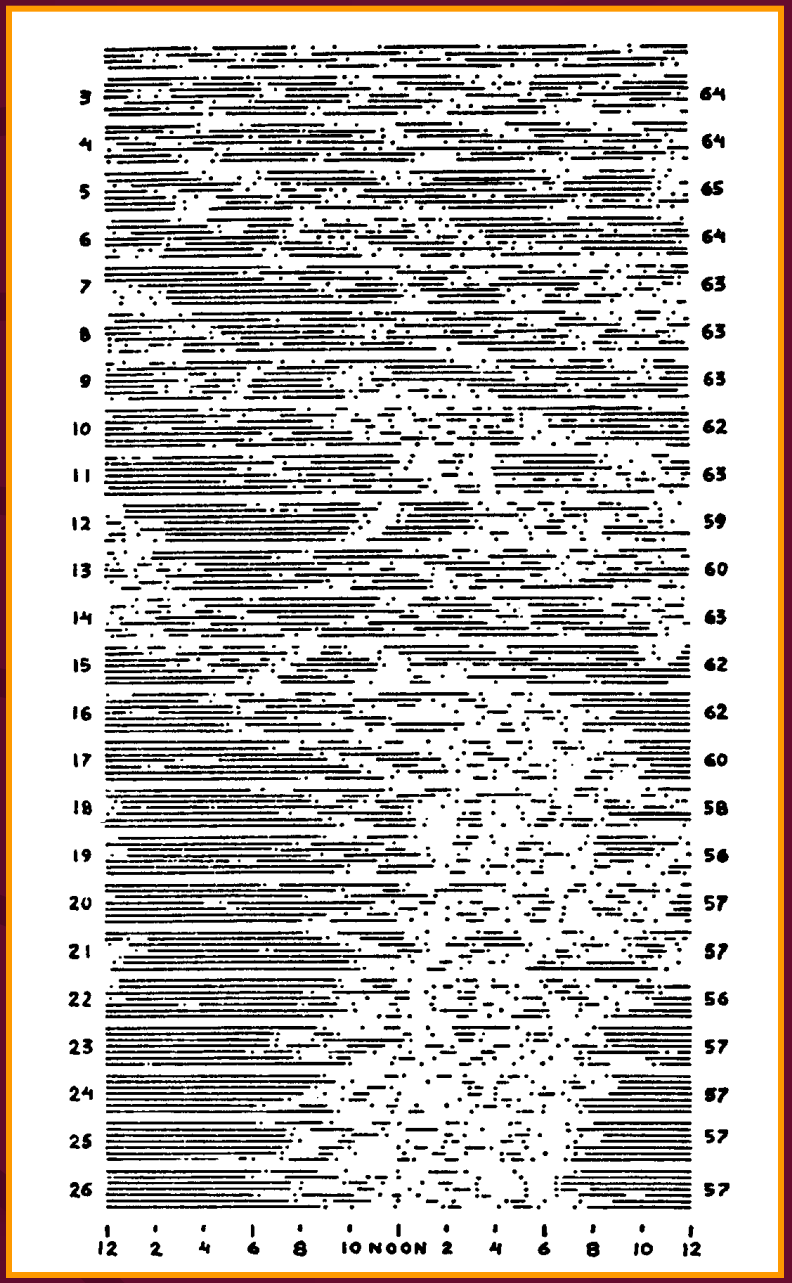
- I genitori influenzano fortemente le caratteristiche del sonno del bambino sviluppando metodi e periodicità per la veglia, l'alimentazione e il sonno.

Ma è anche vero che i bambini influenzano fortemente le caratteristiche del sonno dei genitori…

Wake / Sleep Pattern Development



Development of the wake / sleep pattern in a human infant



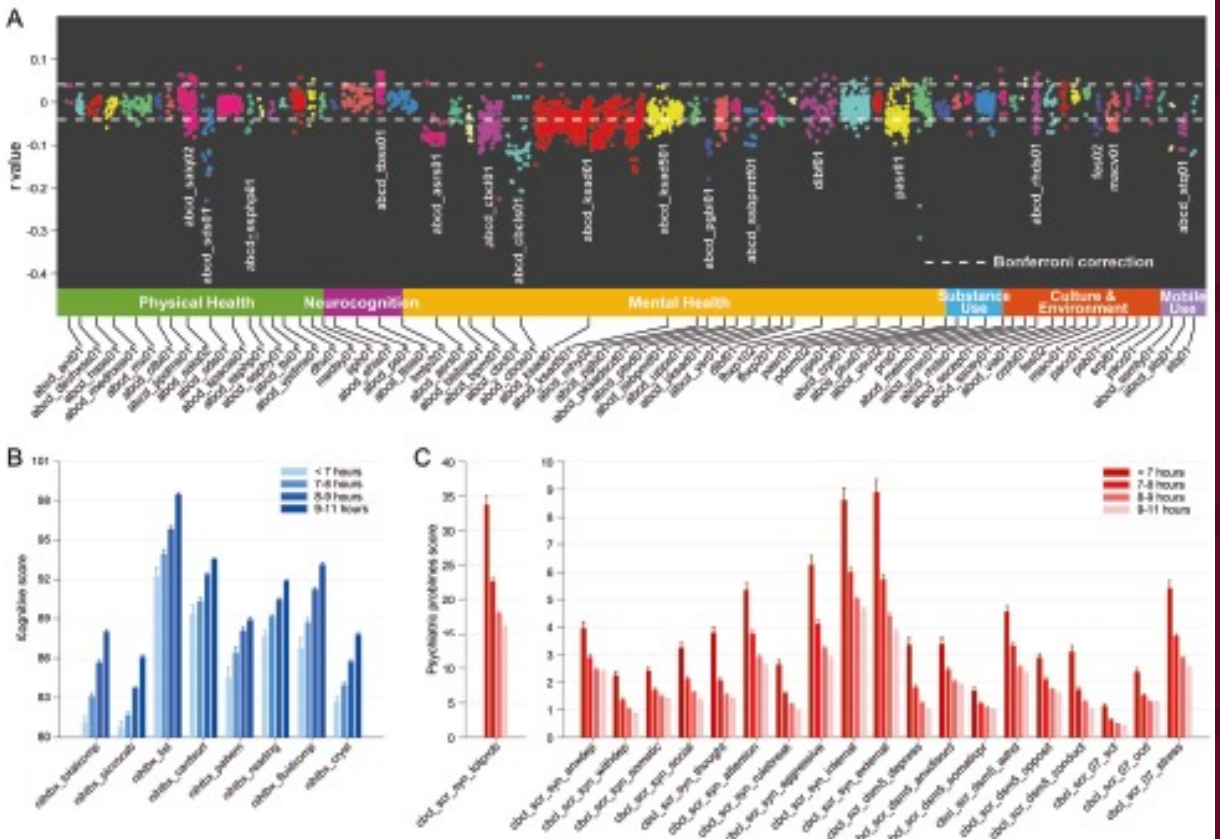


Fig. 1 Sleep duration, and cognitive and psychiatric problems scores. a The correlation between sleep duration and a wide variety of measurements including physical and mental health, neurocognition, substance use, culture, environment and mobile technology, etc. Here we highlight the 17 measurements that are significantly correlated with sleep duration. For example, the positive r value for the cognition scores indicates that long sleep duration is positively correlated with good cognition. The full names for these measurements are shown below and the details for each item are provided in Table S1. b A histogram showing the relation between the number of hours of sleep and cognitive measures. The Y axis is the cognitive score and the error bar is the standard error of the mean (SEM). There was a significant correlation between the cognitive score and the number of hours of sleep (Bonferroni corrected, $p < 0.05$). The children with long sleep duration tended to have good cognitive performance. c A histogram showing the relation between the number of hours of sleep and the psychiatric problems scores. The Y axis is the psychiatric problems score and the error bar is the SEM. There was a significant negative correlation between the psychiatric problems scores and the number of hours of sleep (Bonferroni corrected, $p < 0.05$). The children with short sleep duration tended to have high psychiatric problems score*abcd_saiq02* ABCD Parent Sports and Activities Involvement Questionnaire (SAIQ), *abcd_sds01* ABCD Parent Sleep Disturbance Scale for Children, *abcd_ssphp01* ABCD Sum Scores Physical Health Parent, *abcd_tbss01* ABCD Youth NIH TB Summary Scores, *abcd_asrs01* Adult Self Report summary scores, *abcd_cbcl01* ABCD Parent Child Behavior Checklist Raw Scores Aseba (CBCL), *abcd_cbcls01* Child Behavior Check List summary scores, *abcd_ksad01* ABCD Parent Diagnostic Interview for DSM−5 Full, *abcd_ksad01* ABCD Parent Diagnostic Interview for DSM−5 Full (KSADS-5), *abcd_ksad501* ABCD Youth Diagnostic Interview for DSM-5 (KSADS-5), *abcd_pgbi01* ABCD Parent Parent General Behavior Inventory-Mania, *abcd_sshpmtf01* ABCD Summary Scores Brief Problem Monitor-Teacher Form for Ages 6–18, dibf01 ABCD Parent Diagnostic Interview for DSM-5 Background Items Full, *pasr01* ABCD Parent Adult Self Report Raw Scores Aseba, *abcd_rhds01* Residential History Derived Scores, *fes02* ABCD Parent Family Environment Scale-Family Conflict Subscale Modified from PhenX, *macv01* ABCD Parent Mexican American Cultural Values Scale Modified, *abcd_stq01* ABCD Youth Screen Time Survey.

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ARTICLE

Sleep duration, brain structure, and psychiatric and cognitive problems in children

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The sample included 11,067 subjects (ages 9–11 years, 5301 females)

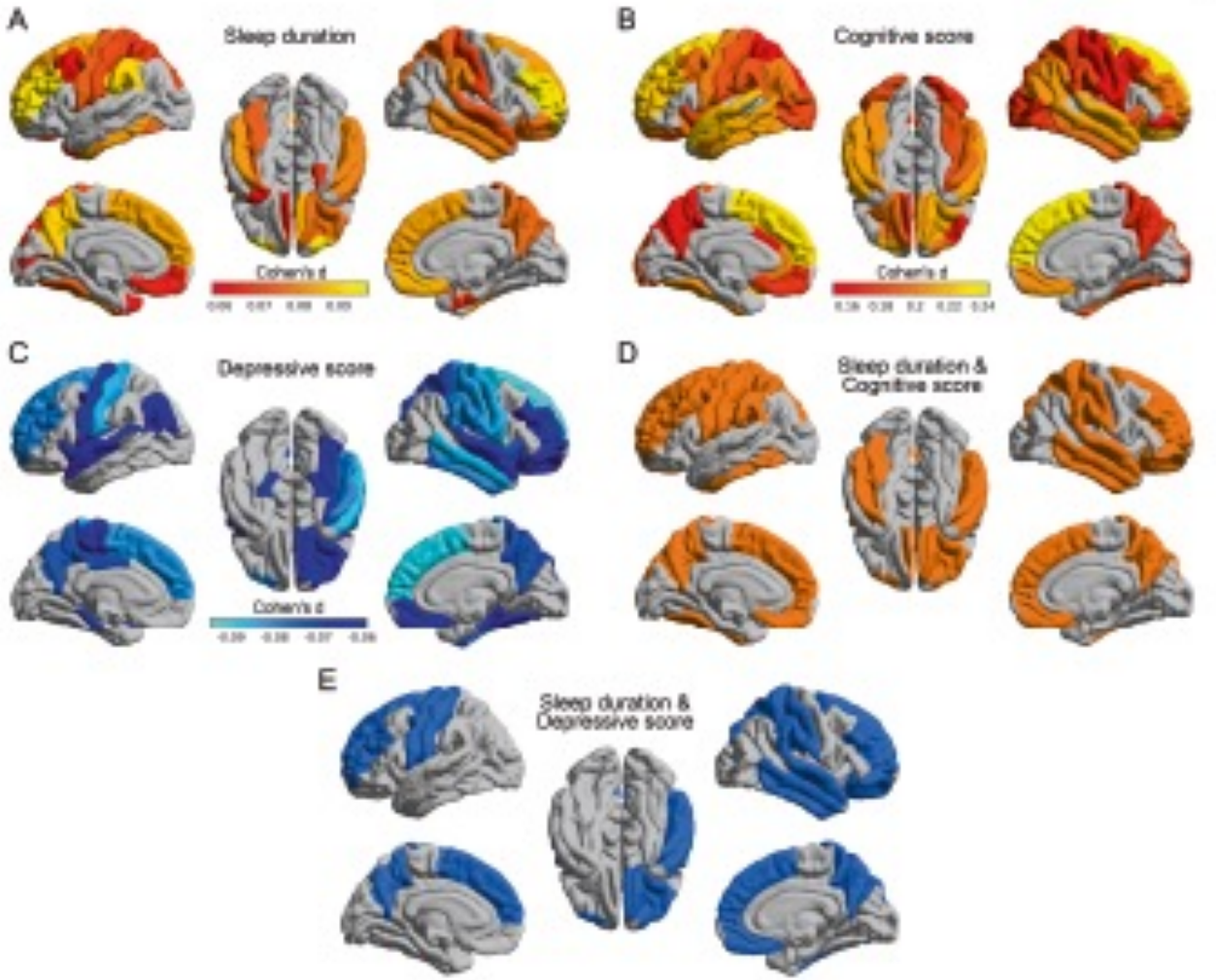


Fig. 2 Brain regions with their area significantly related to sleep duration, cognitive scores, and depressive scores. **a** Brain regions with their cortical area significantly associated with sleep duration (FDR corrected, $p < 0.005$). The red color indicates brain regions with high area positively associated with longer sleep duration. **b** Brain regions with their area significantly associated with the cognitive total score (FDR corrected, $p < 0.005$). The red color indicates brain regions where high area is positively correlated with a higher cognitive score. Here, we only show the regions with Cohen's *d* larger than 0.15. **c** Brain regions with their area significantly associated with the depressive problems' score (FDR corrected, $p < 0.005$). Blue indicates brain regions with a negative correlation between area and the depressive problems score (i.e., a low cortical area is associated with depressive problems). The brain regions shown here were confirmed using a nonparametric approach that utilized a permutation test (with 5000 random samplings). **d** Brain regions with their area associated with both sleep duration and the cognitive total score. The regions shown are the overlap of what is shown in a and b. **e** Brain regions with their area associated with both sleep duration and the depressive problems score. The regions shown are the overlap of what is shown in a and c.

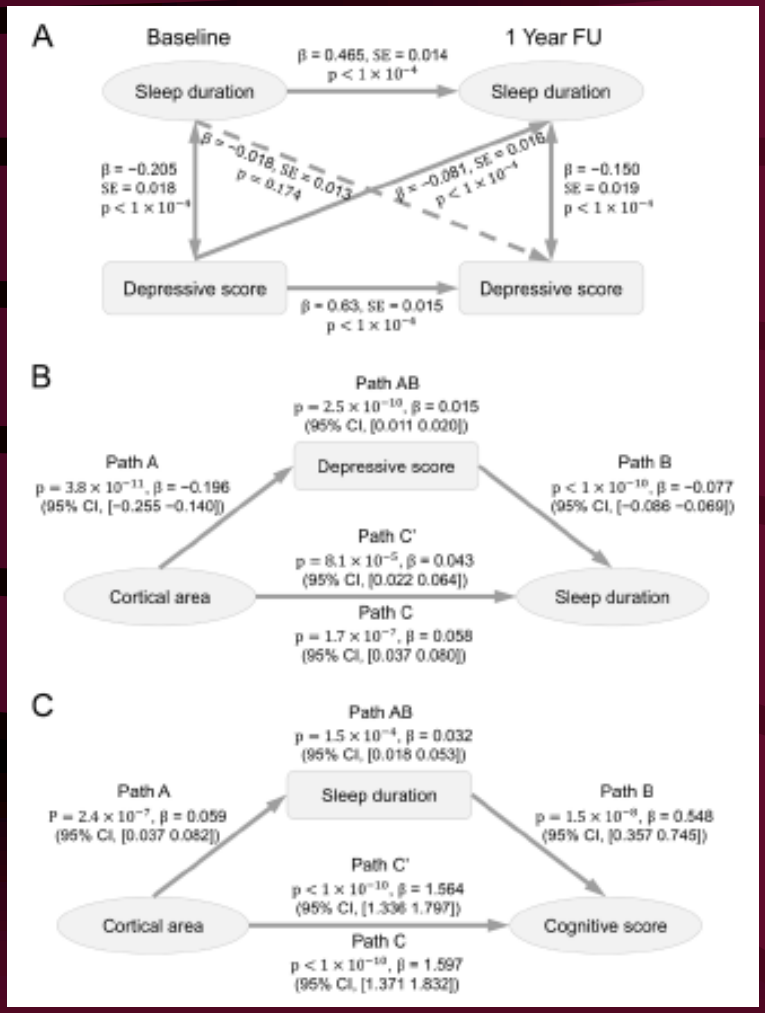
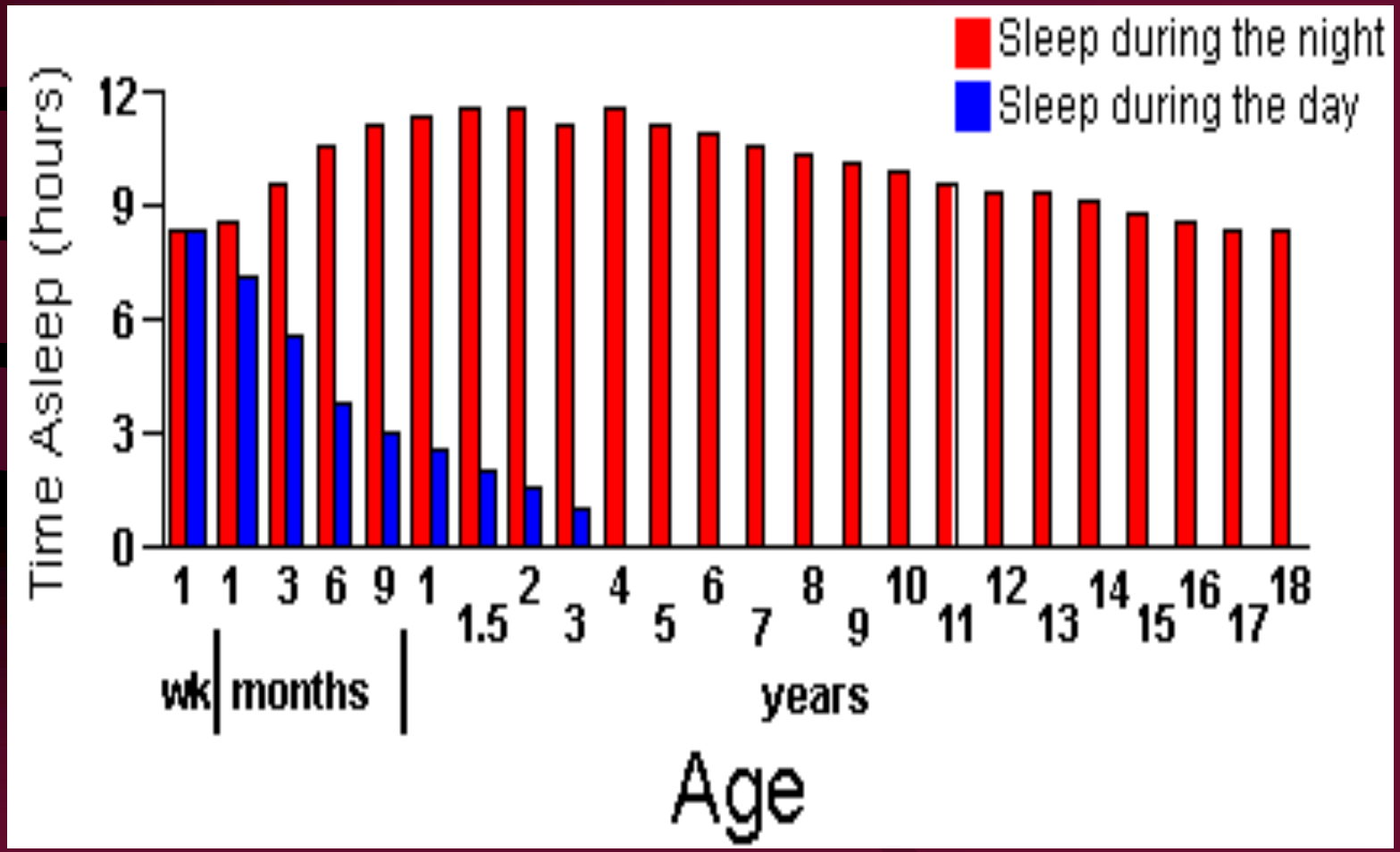
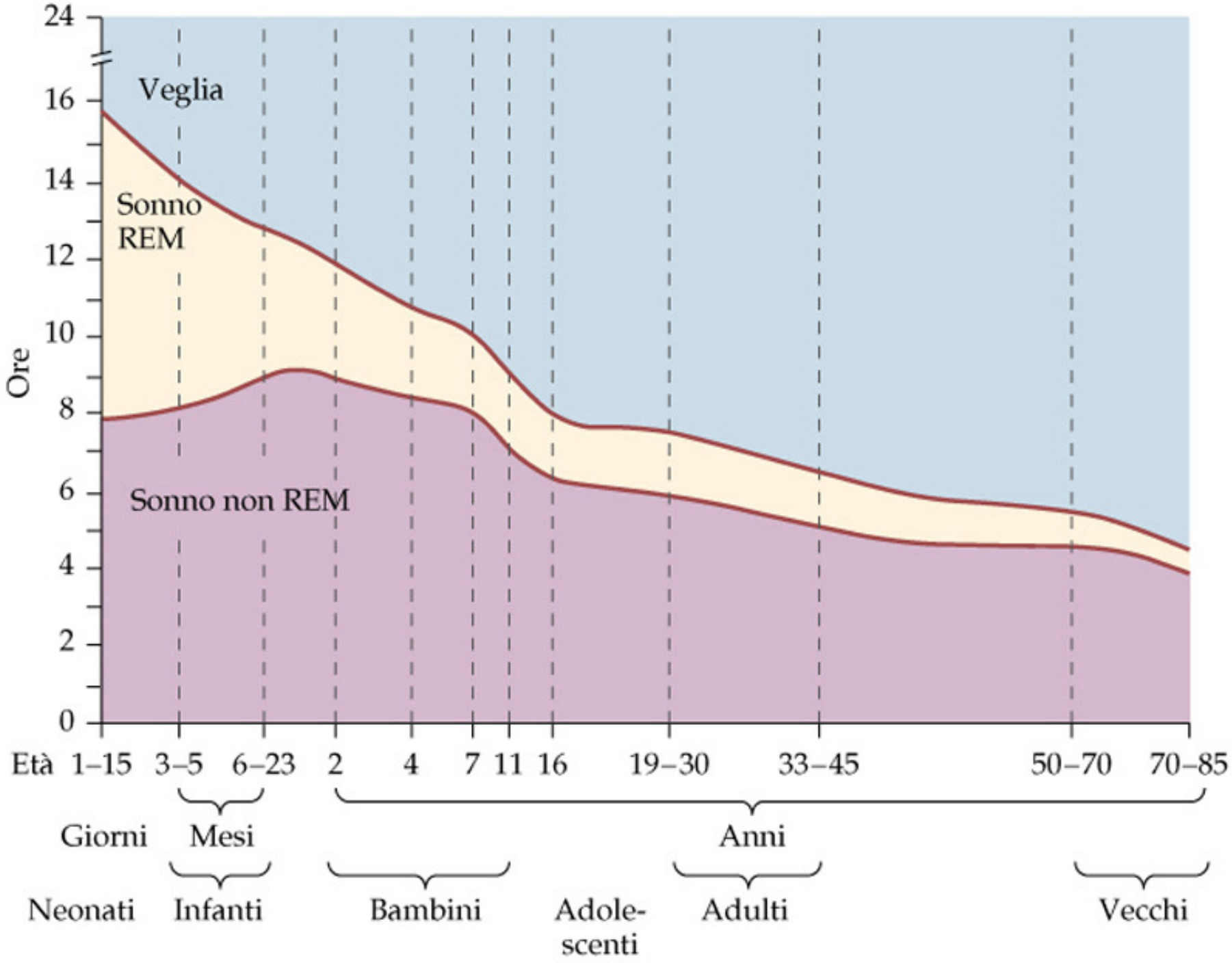


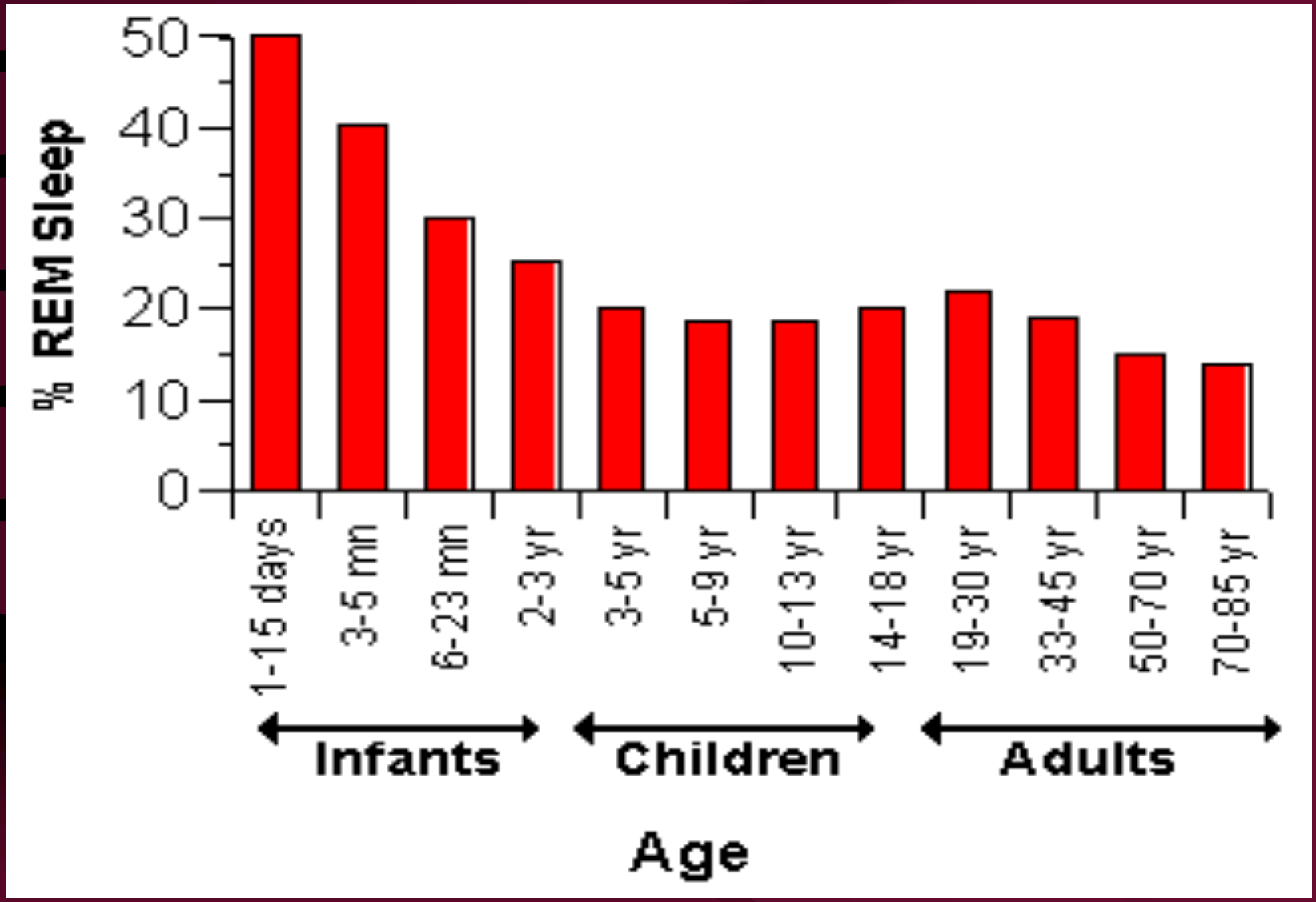
Fig. 3 The relation between depressive problems scores and sleep duration. a The longitudinal association between the depressive problems score and the sleep duration revealed by structural equation modeling (using a two-wave cross-lagged panel model). The depressive problems score was significantly associated with lower sleep duration measured 1 year later ($\beta = -0.081$, SE = 0.016, $p < 1 \times 10^{-4}$); and the reverse (dashed line) was not true ($\beta = -0.018$, SE = 0.013, $p = 0.174$). **b** Mediation analysis: the mediation implemented by depressive problems from the cortical area on sleep duration was significant ($\beta = 0.015$, $p = 2.5 \times 10^{-10}$). The indirect path (A, AB, and B) shows that the depressive problems' score mediates part of the effect of cortical area on sleep duration. Path A: effect of the independent variable, the mean cortical area of the brain regions shown in Fig. 2e which are associated with both sleep duration and the depressive score, on the mediator, the depressive problems' score; Path B: the effect of the mediator (depressive problems score) on the outcome (sleep duration); Path C shows that the regression coefficient (beta value) of the cortical area on the sleep duration was high when the sleep duration was not taken into account. The beta values show the regression coefficient of the effect of the independent variable (cortical area) on the dependent variable (sleep duration). Path C′ indicates the direct effect of the cortical area on the outcome (sleep duration) controlling for the mediator (the depressive problems score). Path C′ shows some reduction in the regression coefficient when the effect of the depressive problems score was taken into account. Path AB indicates the extent to which taking the depressive problems score into account can explain the 25.9% effect of the cortical area on sleep duration, which is significant as noted above at $p = 2.5 \times 10^{-10}$. **c** Mediation analysis: the mediation implemented by sleep duration from the cortical area on cognition was significant ($\beta = 0.032$, $p = 1.5 \times 10^{-4}$). SE standard error.

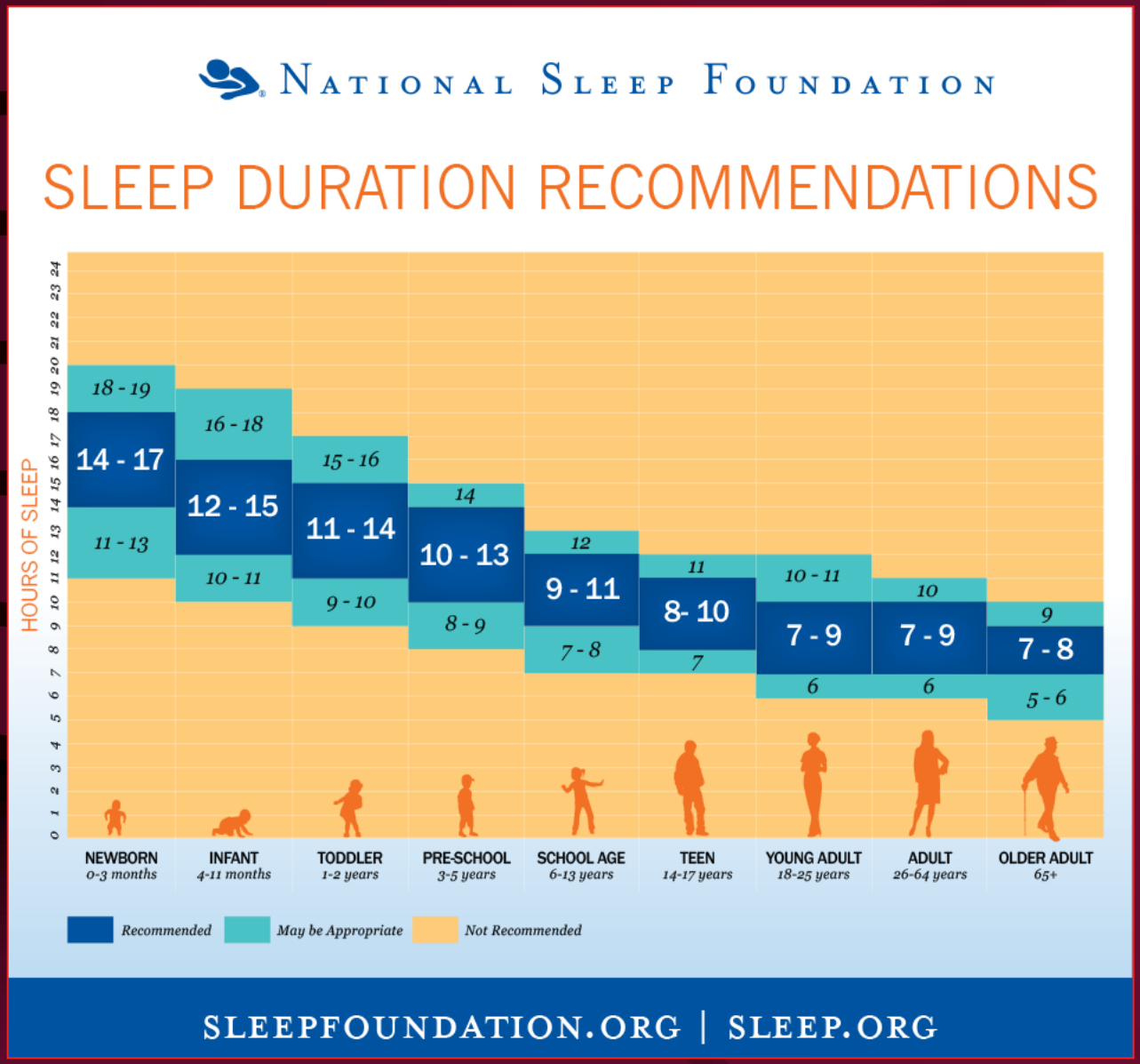
The brain areas in which higher volume was correlated with longer sleep duration included the orbitofrontal cortex, prefrontal and temporal cortex, precuneus, and supramarginal gyrus. Longitudinal data analysis showed that the psychiatric problems, especially the depressive problems, were significantly associated with short sleep duration 1 year later. Further, mediation analysis showed that depressive problems significantly mediate the effect of these brain regions on sleep. Higher cognitive scores were associated with higher volume of the prefrontal cortex, temporal cortex, and medial orbitofrontal cortex.

Age Related Changes in Day-Sleep and Night-Sleep



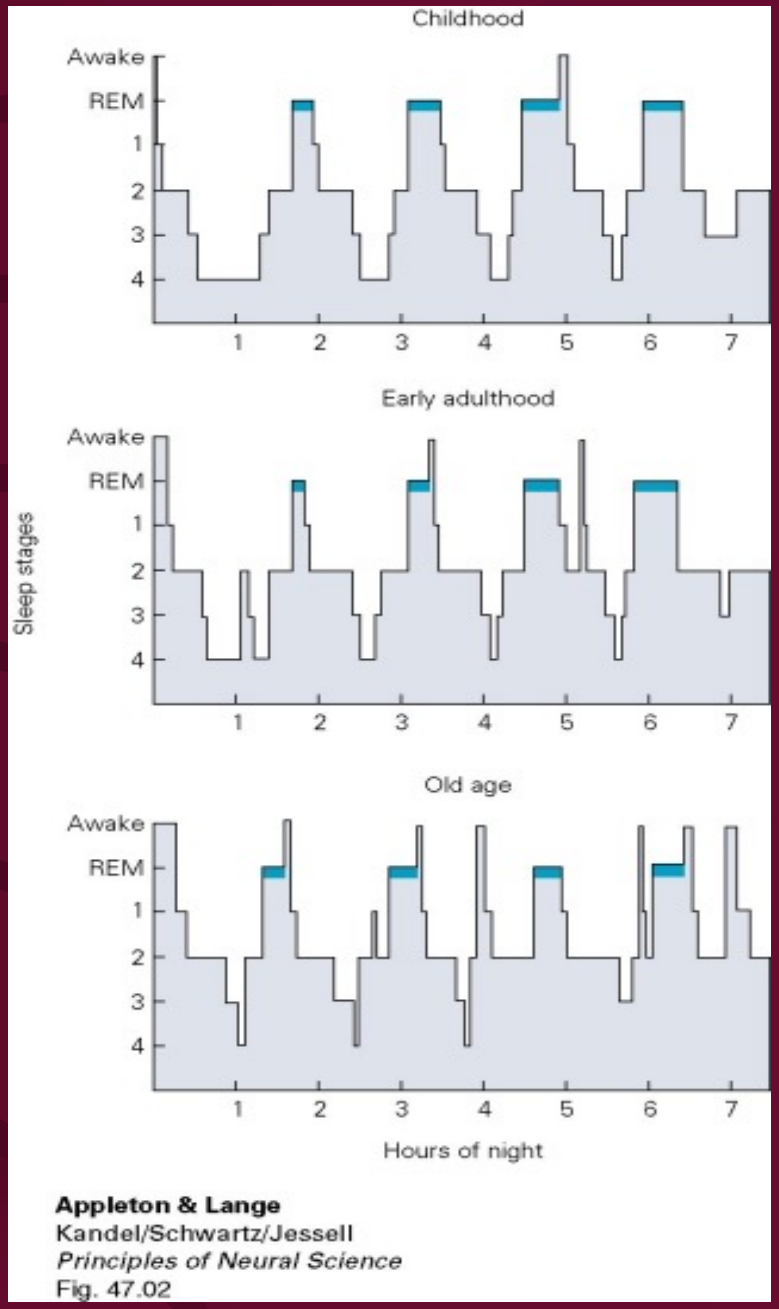

24
16
14
12
10
8
6
4
2
0
Ore
Veglia
Sonno REM
Sonno non REM
Età 1–15 3–5 6–23 2 4 7 11 16 19–30 33–45 50–70 70–85
Giorni
Mesi
Anni
Neonati
Infanti
Bambini
Adole-scenti
Adulti
Vecchi

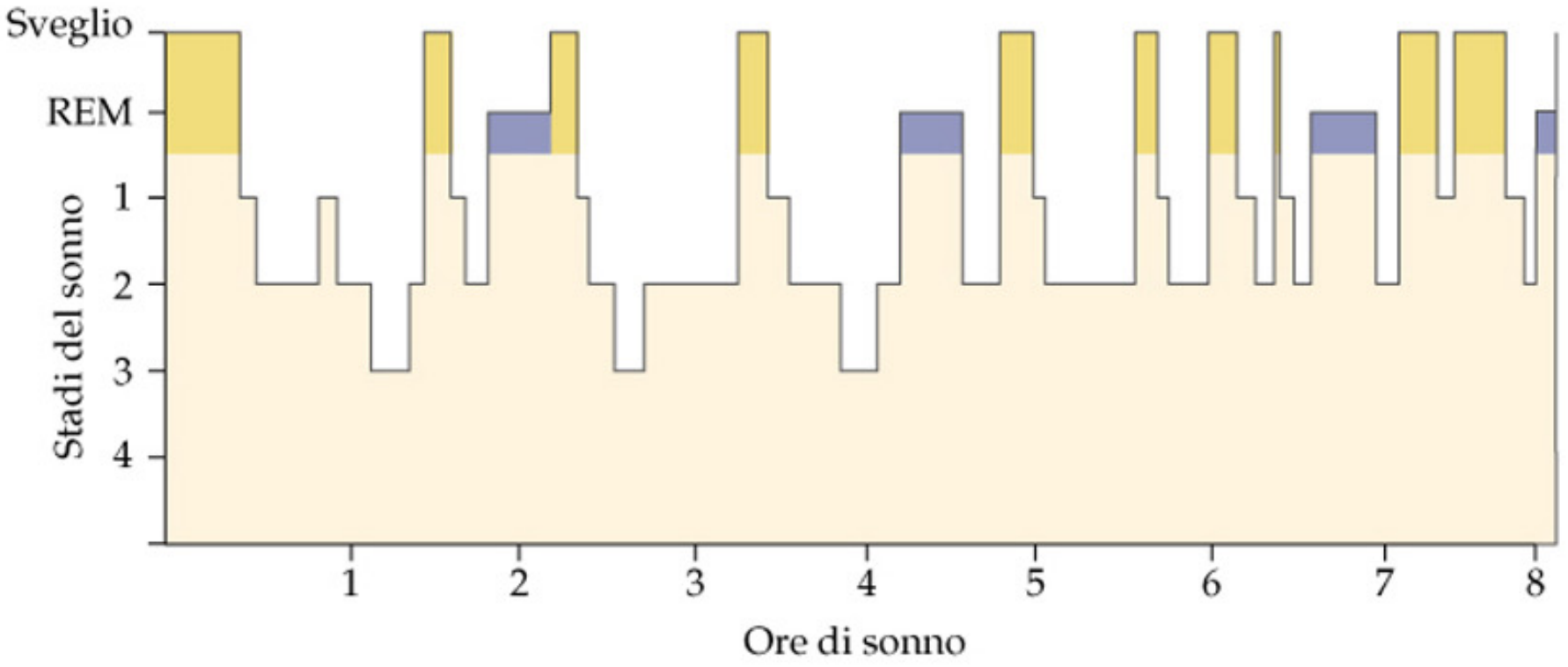

% REM Sleep
50
40
30
20
10
0
1-15 days
3-5 mn
6-23 mn
2-3 yr
3-5 yr
5-9 yr
10-13 yr
14-18 yr
19-30 yr
33-45 yr
50-70 yr
70-85 yr
Infants
Children
Adults
Age



Il fabbisogno di sonno raccomandato

Sleep architecture over the lifespan

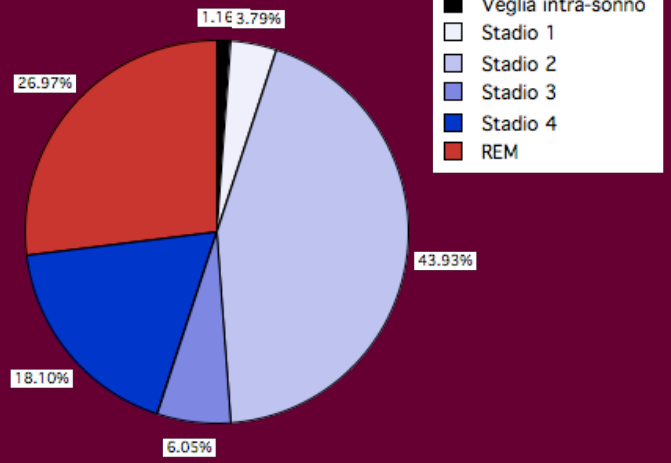



Sveglio
REM
1
2
3
4
Stadi del sonno
1
2
3
4
5
6
7
8
Ore di sonno

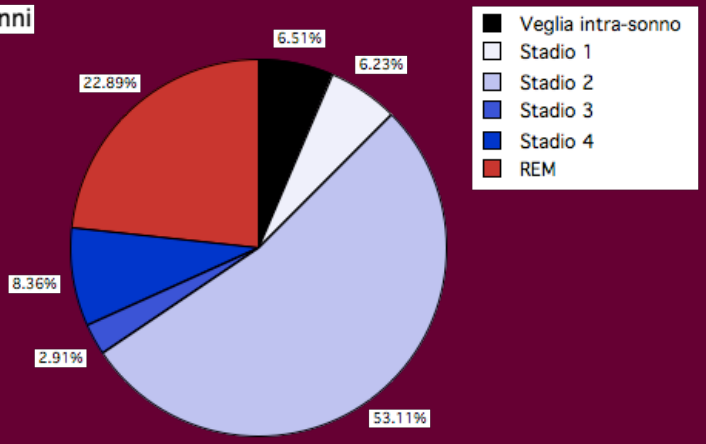
In the elderly...

- Sleep and alertness complaints are more frequent
- Waketimes and bedtimes are earlier
- Nighttime sleep episodes are shorter
- Daytime sleep episodes are more frequent
- Sleep is shallower (less slow-wave sleep, more stage 1 sleep)
- Sleep is more fragmented (more wakefulness during the sleep episode)

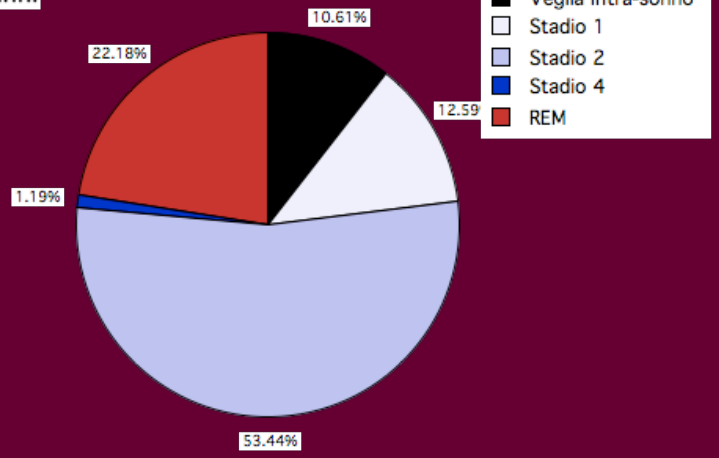
13-15 anni

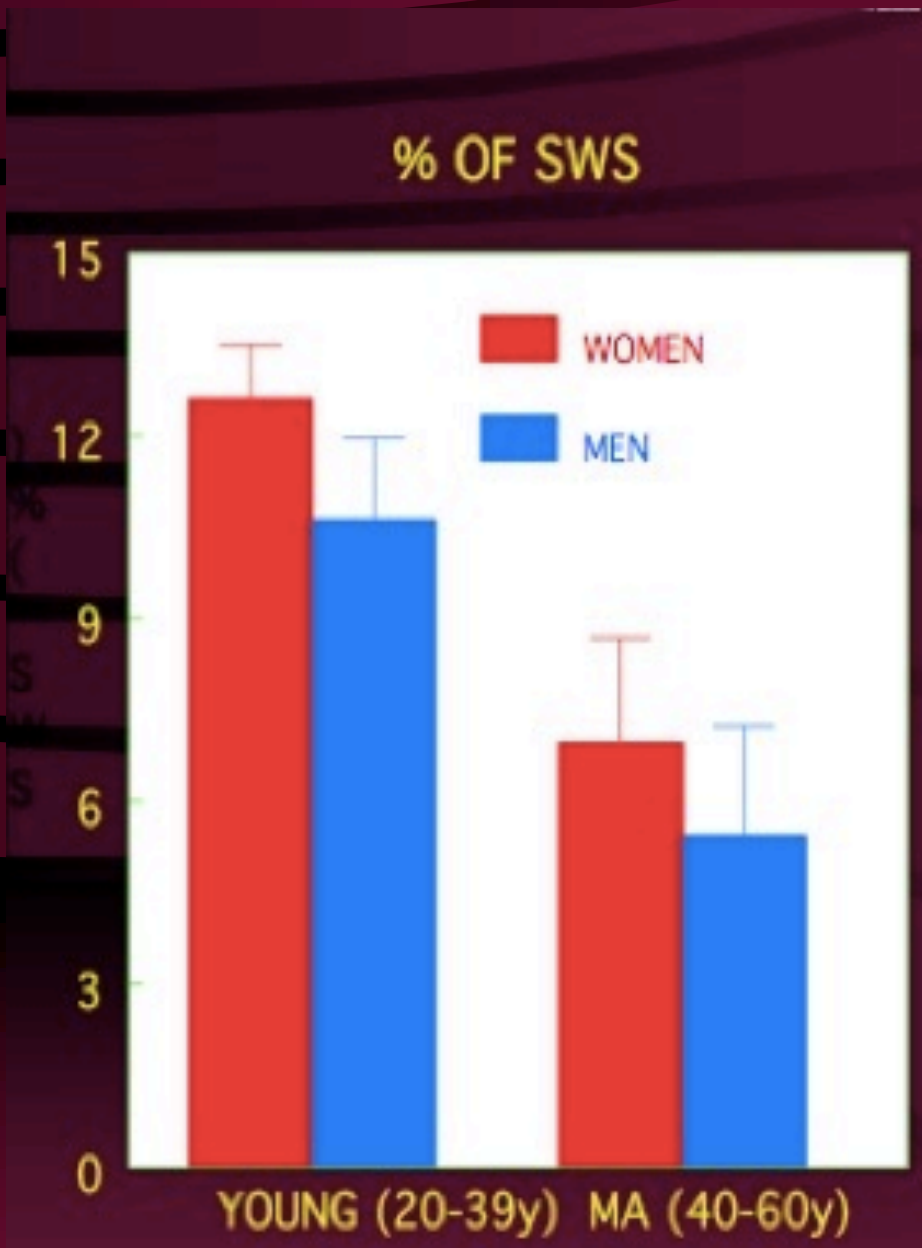


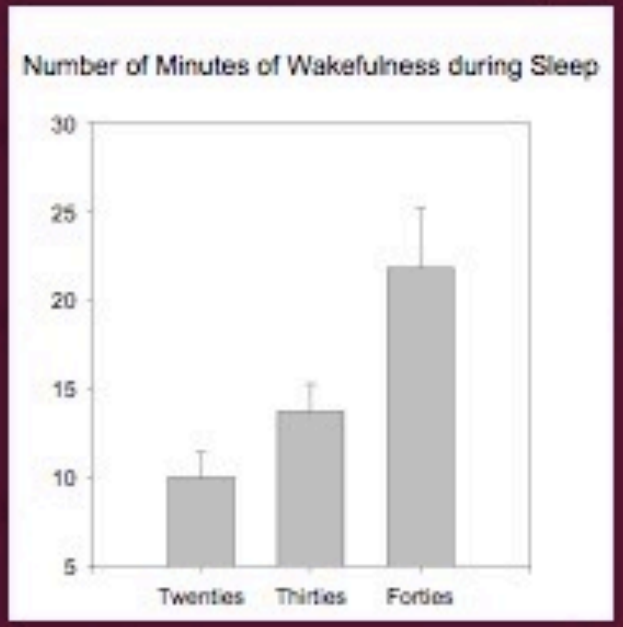
41-46 anni

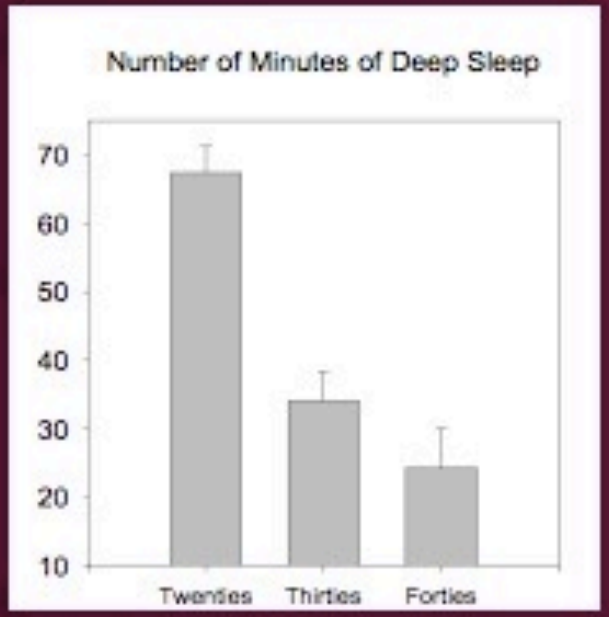


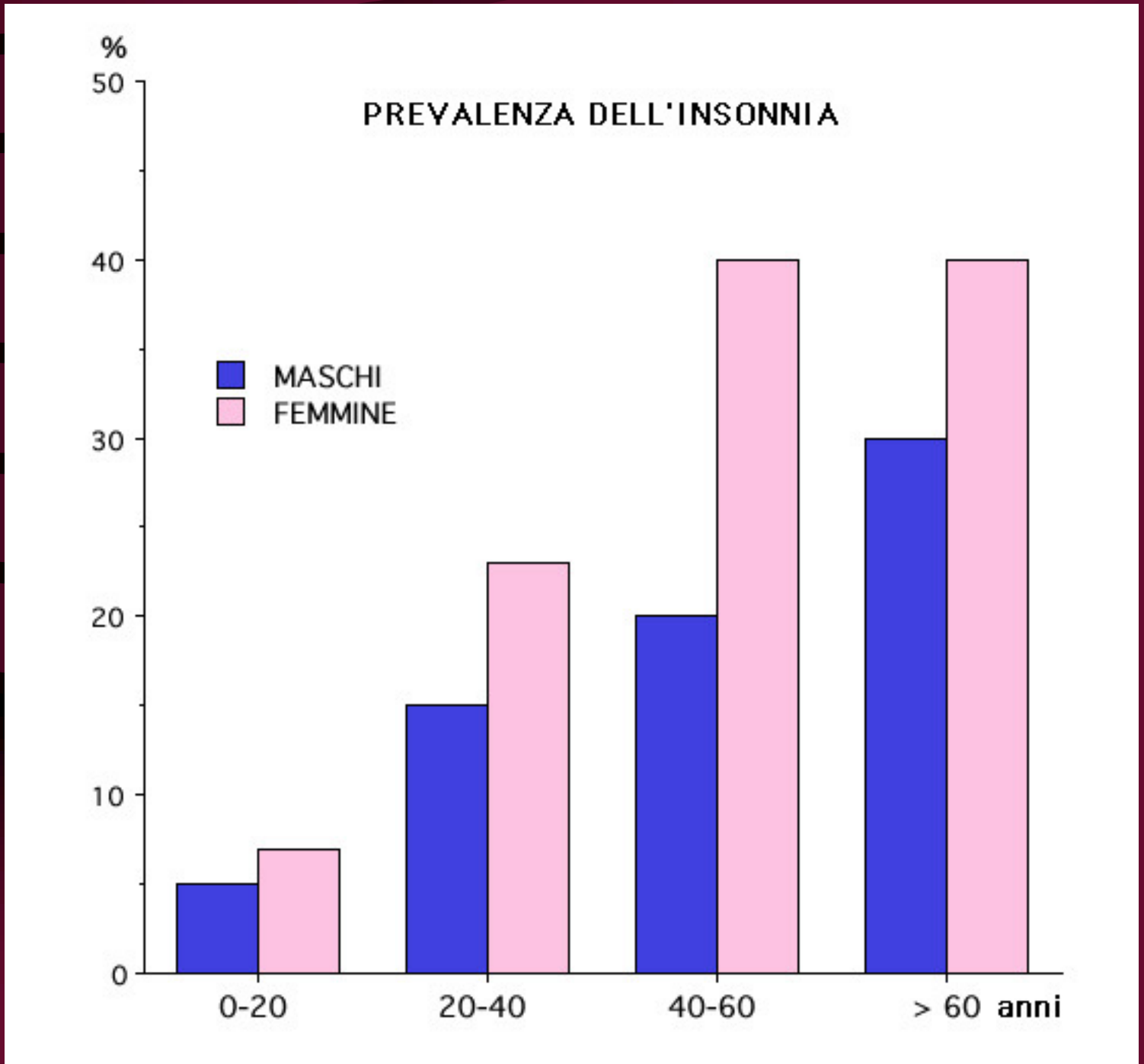
60-69 anni




% OF SWS
15
12
9
6
3
0
WOMEN
MEN
YOUNG (20-39y)
MA (40-60y)


Number of Minutes of Wakefulness during Sleep
30
25
20
15
10
5
Twenties
Thirties
Forties


Number of Minutes of Deep Sleep
70
60
50
40
30
20
10
Twenties
Thirties
Forties


%
50
40
30
20
10
0
PREVALENZA DELL'INSONNIA
MASCHI
FEMMINE
0-20
20-40
40-60
> 60 anni

Alcuni disturbi del sonno infantile.

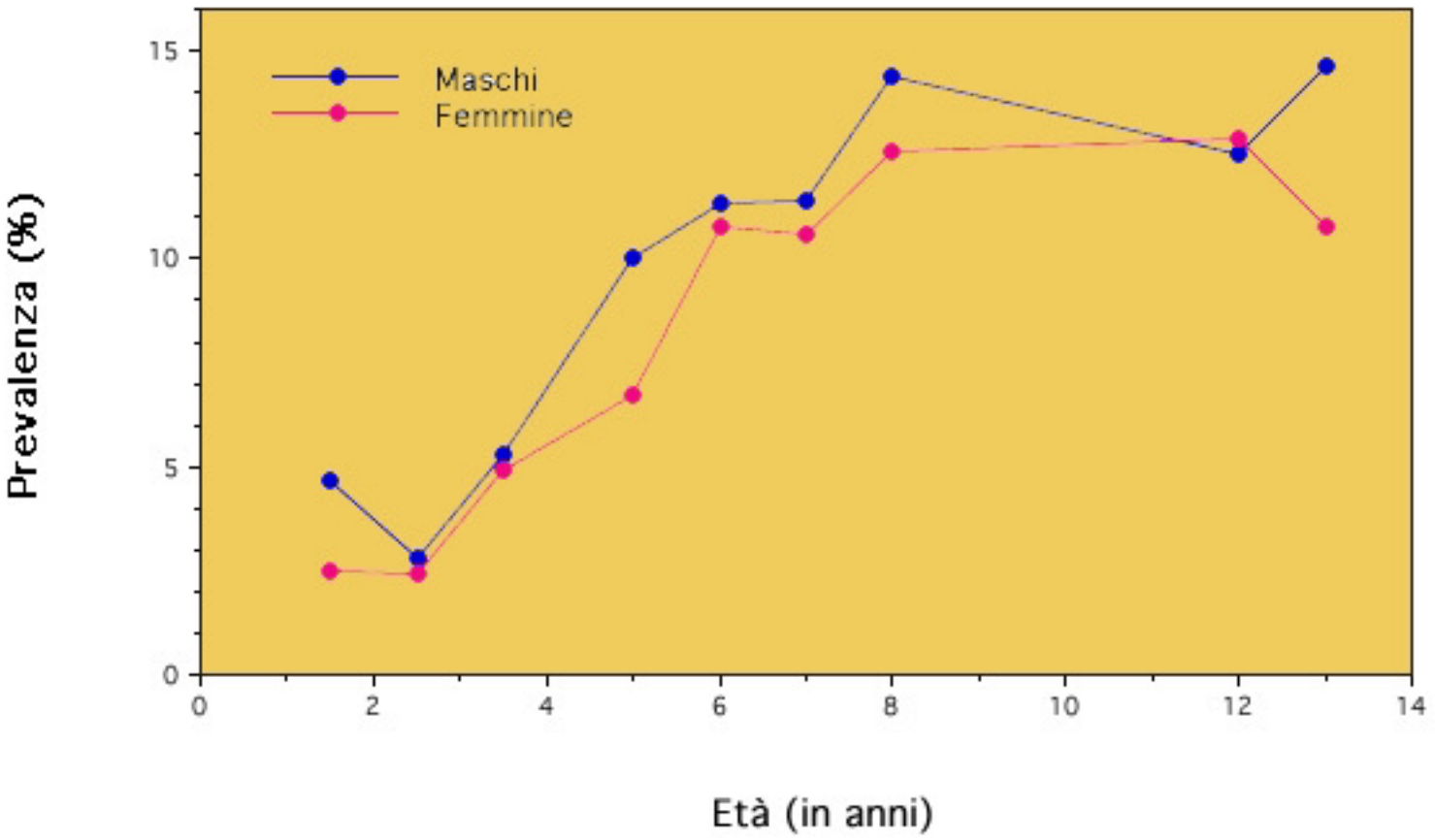
Parasonnie, il cui andamento evolutivo è in massima parte benigno, scomparendo dopo la pubertà

Disturbi dell'Arousal

Parasonnie associate al sonno REM

Altre parasonnie

Sonnambulismo


Maschi
Femmine
Prevalenza (%)
0
5
10
15
0
2
4
6
8
10
12
14
Età (in anni)


4:39
24. 4.1991
CMSDR

Sonnambulismo agitato

Disturbo della gamba senza riposo

Movimenti periodici degli arti

Mioclono benigno di addormentamento

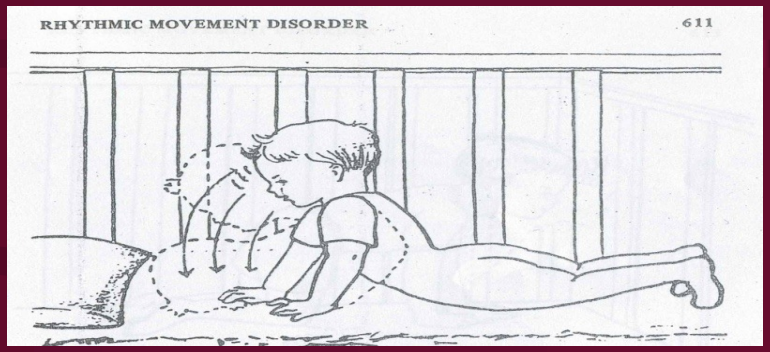
Pavor nocturnus

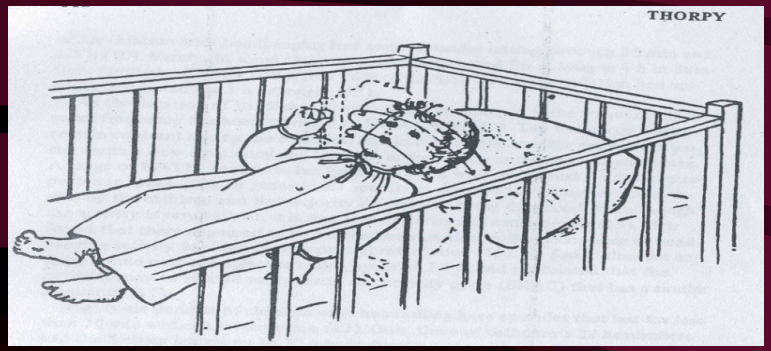
Nightmare


HOW TO DEAL WITH NIGHT TERRORS

Antero-posterior head movements

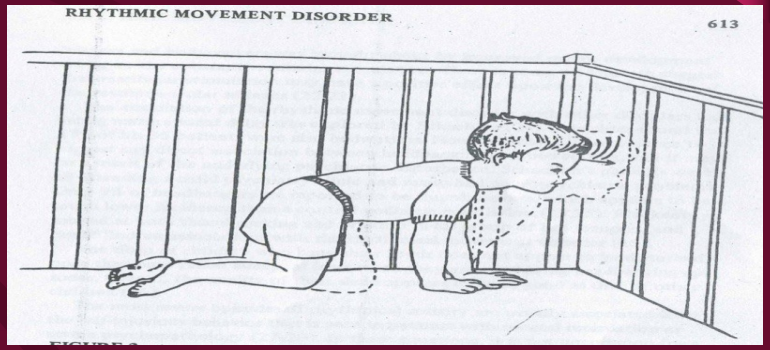
(headbanging)





Lateral head movements with supine body position **(headrolling)**

Shaking and rocking rhytmic head and body movements usually on all four positions **(bodyrocking)**



Bodyrocking


Created with Flip4Mac WMV Demo
www.Flip4Mac.com

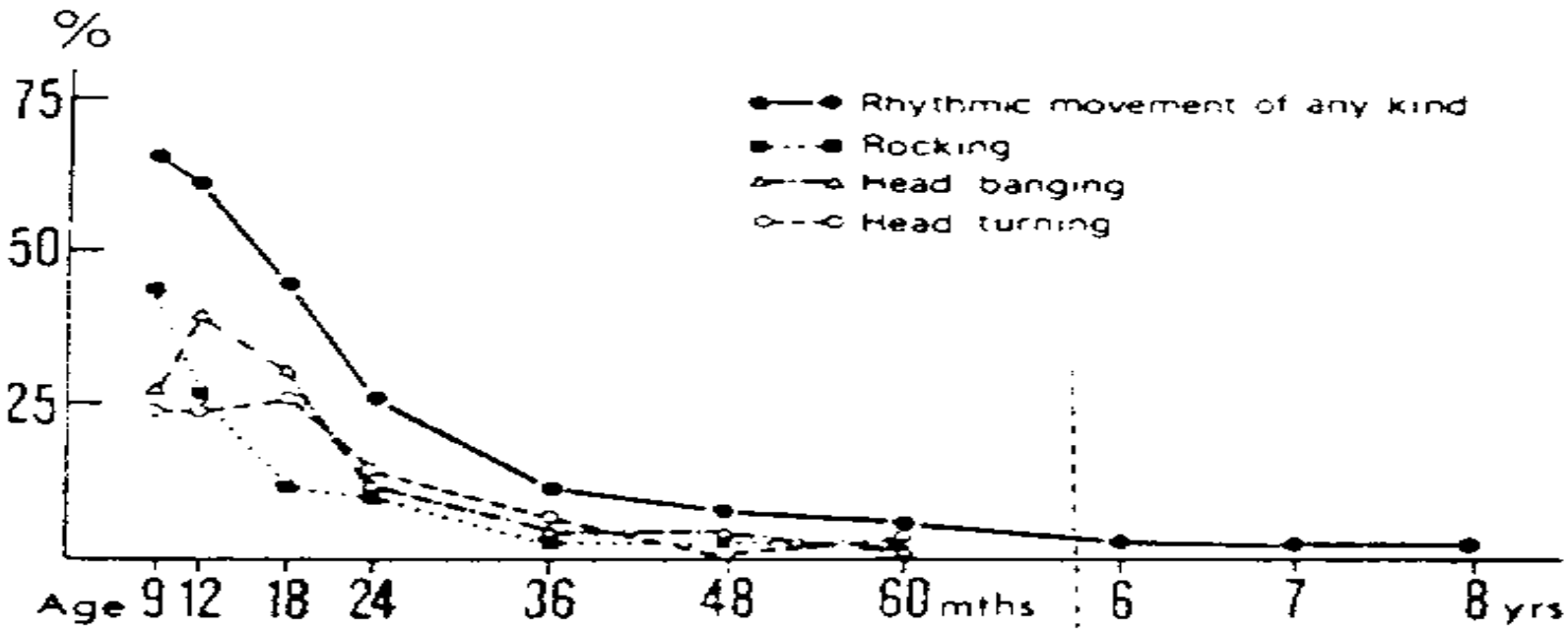
Sleep rocking e head banging

Bodyrolling

Klackenberg G, Acta Ped Scand 1971

Incidenza nei bambini sani

- 66% dei bambini sani presenta a 9 mesi qualche forma di attività ritmica
- La qualità del loro sonno è sovrapponibile a quella dei bambini senza questa attività



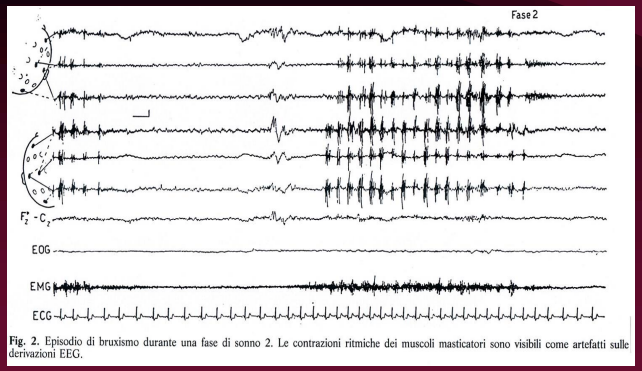


Fig. 2. Episodio di bruxismo durante una fase di sonno 2. Le contrazioni ritmiche dei muscoli masticatori sono visibili come artefatti sulle derivazioni EEG.

Bruxismo