DEVELOPMENT OF SLEEP ARCHITECTURE & SLEEP ACROSS THE LIFESPAN

l. **Premature Neonates**

Two sleep stages:

"**Quiet" sleep** and "**Active" sleep**

Active sleep develops first, may be up to 75% of TST

2. **Neonates (full term)**

TST = 16-17 hours/24

Quiet sleep – 50% & gradually increases in amount as *S* matures

Seen at SO if 3 months or older

Immature version of NREM/SWS

Active sleep – 50% & gradually decreases in amount as *S* matures

See at SO from birth to 3 months of age

Presumed activation of "**central motor programs**"

3. **Six months of Life**

70% Quiet sleep + 30% Active sleep

4. **Sleep during First Year of Life**

At birth, infant sleeps a lot, mostly in active sleep, with brief bursts of quiet sleep

Sleep is interspersed with brief bouts of wake

Gradual consolidation of wake into one period of time

Gradual consolidation of sleep into several periods of time, nocturnal plus long naps

"polycyclic" sleep

4. **Sleep during First Year of Life** (cont.)
   Gradual maturation of sleep EEG patterns
      Delta waves and sleep spindles emerge
   Gradual decrease in active/REM sleep
   Gradual decrease in TST

5. Sleep during **Early Childhood** (1-5 years of life)
   TST = 10-12 hours/24, consolidated into nocturnal sleep plus
      one afternoon nap by 2 years of age
   Full EEG sleep staging by 5 years of age
   Boys sleep mean average of 611 minutes, girls 576 minutes
   Sleep "architecture":
      Stage l = 2%, Stage 2 = 46%, Stage ¾ = 20%, Stage REM = 31%

   Lots of Stages 3&4 sleep, difficult to arouse *S*, more **parasomnias**

6. Sleep in **Middle Childhood** (5-12 years of life)
   By 6 years, TST = 9-12 hours, consolidated, no afternoon naps
   Boys sleep mean average of 573 minutes, girls 589 minutes
   Sleep architecture:
      Stage 1 = 2%, Stage 2 = 48%, Stage ¾ = 20%, Stage REM = 28%

   Importance of growth hormone, parasomnias still frequent

7. Sleep in **Adolescence** (12-18 years of life)
   decreasing TST, mean average 8.5 hours (may need more)
   decreasing number of REM periods
   growth hormone and sexual hormones
   orgasm and ejaculation seen in REM sleep
   generally poor sleep hygiene, likely to develop delayed sleep phase
   increase in EDS…sleep deprived or a normal adolescent trait?…

8. Sleep in **Early Adulthood** (18-30 years)
TST = 7.5 to 8 hours (range 4.5 to 10.5)
Sleep efficiency: 91-99% males, 94-98% females
Awakenings: 0-6 males, 0-2 females (> 2 minutes duration)
Sleep architecture:
Stage 1 = 2-6%, Stage 2 = 41-51% males, 46-58% females,
Stage ¾ = 6-26% males, 11-25% females
Stage REM = 22-34% males, 21-29% females
Again, may be shorting sleep…

9. Sleep in **Early Middle Age** (30-45 years)
TST = 399-436 minutes in males, 394-448 minutes in females
SE: 85-99% males, 90-99% females
Awakenings: 1-7 males, 0-5 females
Sleep architecture:
Stage 1 = 3-11% males, 2-8% females
Stage 2 = 45-66% 45-63%
Stage ¾ = 2-18% 4-21%
Stage REM = 19-27% 21-31%
Parasomnias are very rare
Increasing frequency of **sleep disorders** (OSA, PLMD, snoring,
Insomnia, etc)

10. Sleep in **Later Middle Age** (45-60 years)
TST = 340-440 minutes in males, 396-466 minutes in females
SE = 88-96% males, 86-100% females
Awakenings: 4-7 males, 3-7 females
Sleep architecture:
Stage 1 = 4-12% males, 3-7% females Stage REM = 17-25% m
Stage 2 = 52-72% 51-65% 19-25% f
Stage ¾ = 0-12% 5-17%

11. Sleep in **Old Age** (60 years +)

TST = 5-6 hours/24 + afternoon nap (1 hour usually)

Cannot keep sleep consolidated at night

286-460 minutes in males, 349-461 minutes in females

SE: 57-97% males, 73-96% females

Sleep architecture:

Stage 1 – 6-14% males, 4-12% females

Stage 2 – 38-72% 44-64%

Stage ¾ - 0-3% 0-18%

Stage REM – 11-27% 15-25%

Increased numbers of awakenings: medical problems + sleep changes?

Ages 60-69: 4-11 in males, 2-7 in females

Ages 70-79: 1-10 3-14

Greater tendency to phase advance

Greater amounts of daily exercise & greater durations of daylight exposure --- better sleep