DEVELOPMENT OF SLEEP ARCHITECTURE & SLEEP ACROSS THE LIFESPAN

1. **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 1 = 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