The adolescent asynchronization

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The rate of children who answered as always or sometimes to the following question; Are you getting sleepy during 3rd and 4th lessons?

2005 by health care teachers in Tokyo
The rate of children who answered as always or sometimes to the following question; Are you getting sleepy during 3rd and 4th lessons?

More than 70% of junior high school students complained of daytime sleepiness.

9-10y 10-11y 11-12y 12-13y 13-14y 14-15y
4th grade 5th grade 6th grade JH 1st JH 2nd JH 3rd

2005 by health care teachers in Tokyo
Background 2/3

Insomnia Among Japanese Adolescents: A Nationwide Representative Survey

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Study Objectives: Although a number of previous studies have examined the prevalence of insomnia among adolescents, there have been very few nationwide studies. The objectives of this nationwide study were to clarify the prevalence of insomnia, its symptoms, and associated factors among Japanese adolescents.

Design and Setting: This study was designed as a cross-sectional sampling survey. The targets were junior and senior high schools throughout Japan. Sample schools were selected by cluster sampling. Self-reported anonymous questionnaires were sent to schools for all students to fill out.

Participants: A total of 103,650 adolescents responded, and 102,451 questionnaires were subjected to analysis.

Intervention: N/A

Measurements and Results: The prevalence of difficulty initiating sleep, difficulty maintaining sleep, and early morning awakening was 14.8%, 11.3%, and 5.5%, respectively. Insomnia was defined as the presence of one or more of these three symptoms. The prevalence of insomnia was 23.5%. Multivariate analyses revealed that, among junior high school students, male sex, poor mental health, skipping breakfast, drinking alcohol, smoking, not participating in extracurricular activities, and late bedtime had significantly higher odds ratios for insomnia. Among senior high school students, the same characteristics were associated with a significantly higher odds ratio for insomnia, as was the additional factor of having no intent to study at university.

Conclusion: Insomnia in Japanese adolescents is common and associated with multiple factors. The results of this study suggest the need for comprehensive program to prevent insomnia in Japanese adolescents.

Keywords: Insomnia; adolescents; Japan

Citation: Kaneita Y, Ohida T, Osaki Y et al. Insomnia among Japanese adolescents: a nationwide representative survey. SLEEP 2006:29(12);1543-1550.
The prevalence of insomnia in a total of 102451 adolescents in Japan was 23.5% (difficulty in initiating sleep; 14.8%, difficulty in maintaining sleep; 11.3%, early morning awakening; 5.5%).

About one quarter of junior high and high school students suffer from insomnia.

Study Objectives: Although a number of previous studies have examined one or more of these three symptoms. The prevalence of insomnia significantly higher odds ratio for insomnia, as was the additional factor of having no intent to study at university.

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Citation: Kaneita Y, Ohida T, Osada Y et al. Insomnia among Japanese adolescents: a nationwide representative survey. SLEEP 2006:29(12);1543-1550.
More than half of students in Japan complained of daytime sleepiness, while about one quarter of junior high and high school students in Japan suffer from insomnia.
According to the conventional diagnostic criteria, most of these youngsters might be diagnosed as having behavioral-induced insufficient sleep syndrome due to inadequate sleep hygiene. If this diagnosis is correct, they must be cured easily by following adequate sleep hygiene (=sleep health).
Sleep health; basic four principles

• 1. Increase exposure to morning light.
• 2. Engage in physical activity during daytime.
• 3. Sleep in the dark during the night (i.e., turn off all artificial lighting).
• 4. Eat regular meals.

In addition; Avoid substances that disturb sleep (e.g., caffeine, alcohol, nicotine), and avoid excessive media exposure (e.g., video games, computers, television).
According to the conventional diagnostic criteria, most of these youngsters might be diagnosed as having behavioral-induced insufficient sleep syndrome due to inadequate sleep hygiene. If this diagnosis is correct, they must be cured easily by following sleep health.

However, this therapeutic approaches often fail. No one knows the reason for this failure.
Introduction 3/3

• To explain the reason for the failure to help youngsters in Japan by providing adequate sleep health, a new clinical entity - *asynchronization* - was proposed (Kohyama J (2009). Brain Dev 31, 255-273).

• This term has been designated with special reference to the concept of *singularity*. 
Syngularity

• Circadian singularity behavior (also called suppression of circadian rhythms) was discovered in 1970, according to observation that specific, dim, blue-light, pulse stimulus, with a unique stimulus time and duration, resulted in disturbed circadian rhythm in Drosophila

Examples of syngularity


Circadian rhythm of the transcription levels of *tim* gene in Dorsophilia assessed by the TIM protein level was both suppressed and restored by a single pulse. Leloup J-C, Goldbeter A: A molecular explanation for the long-term suppression of circadian rhythms by a single light pulse. Am J Physiol 280: R1206-12, 2001.
Asynchronization 1/6

• Essence:
Disturbance of various aspects (e.g., cycle, amplitude, phase, and interrelationship) of biological rhythms that indicate circadian oscillation.

• Presumable causes:
Light exposure during the night.
Lack of light exposure in the morning.
Decreased physical activities.
Asynchronization 1/7

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  Disturbance of various aspects (e.g., cycle, amplitude, phase, and interrelationship) of biological rhythms that indicate circadian oscillation.

• Presumable causes:
  Light exposure during the night.
  Lack of light exposure in the morning.
  Decreased physical activities.
  → Presumable disturbance of the biological clock in addition to that of serotonergic, melatonergic, and wake-and sleep-promoting systems.
Asynchronization 2/7

• Symptoms 1/2:
  Disturbances related to the autonomic nervous system
  sleepiness, insomnia, gastrointestinal problems,
  disturbance of hormonal excretion,
  sympathetic nervous system predominance
  Somatic disturbances
  tiredness, fatigue, neck and/or back stiffness, headache,
  persistent yawn, desire for sleep, wish to lie down,
  inactivity, slow movements (meal), lumbago
Asynchronization 3/7

• Symptoms 2/2:

Disturbances related to higher brain function.

disorientation, loss of sociality, loss of will or motivation, impaired alertness and performance, difficulties to remember, difficulties to concentrate

Neurological disturbances

attention deficit, aggression, impulsiveness, hyperactivity, irritated, hypersensitive

Psychiatric disturbances

Symptoms observed in depressive disorders, personality disorders and anxiety disorders.

Patients are inactive and are hard to hasten even the time to do something is approaching.
Sleep duration ranged 3.75(#) - 11.00(##)hr (mean; 8.19)
Asynchronization 4/7

Differential diagnosis; Asynchronization and Circadian rhythm sleep disorders, delayed sleep phase types

• Circadian rhythm sleep disorders,
  delayed and advanced sleep phase types
  sleep quality and duration are normal for age
irregular sleep—wake type
total sleep time per 24-hour period is essentially normal for age.

• Asynchronization
  sleep duration varies markedly day by day.
  (e.g.; 0-15 hours a day )

ICSD-2, 2005
Normal

Delayed

Advanced

Free-running

Irregular

Asynchronization

Schematic drawings of sleep pattern in circadian rhythm sleep disorders including asynchronization.
Asynchronization 5/7
Schematic drawing of the development of asynchronization

Late bedtime
(Light exposure at night)

Inadequate sleep health
(caffeine, extreme media exposure, etc)

Insomnia

Sleep deficiency

Daytime sleepiness

Unfavorable physical & mental conditions
(fatigue, pain, depressive mood, etc)

Waking late in the morning
(Lack of morning light exposure)

Early phase of asynchronization
(Symptoms due to inadequate sleep health)

Unknown factors?
e.g. Wake-/Sleep-promoting/inhibiting systems?

an enhancement of vicious cycles?

Chronic phase of asynchronization

Melatonin reduction

Low serotonin activity

Low physical activity
Presumable prognosis:

Early phase:
Disturbances are functional and can be relatively easily resolved, eg., through establishment of a regular sleep-wake cycle.

Chronic phase:
Without adequate intervention, disturbances can gradually worsen, involving loss of serotonergic activity, which is difficult to resolve.
Asynchronization 7/7

• Potential therapeutic approaches:
  Morning light exposure, an avoidance of nocturnal light exposure, conventional approaches
  light therapy, medications (hypnotics, antidepressants, melatonin, vitamin B12),
  physical activation, chronotherapy
  and alternative ones.
  Kampo, respiration (qigong, tandem breathing),
  control of the autonomic nervous system, etc
A proposed diagnostic criteria of asynchronization.

Patients are suffering from both insomnia and hypersomnia.

Patients also showed disturbances related to the autonomic nervous system including sympathetic nervous system predominance, somatic disturbances, disturbances related to higher brain function, neurological disturbances, and also psychiatric disturbances.

Most patients are inactive and are hard to hasten. Sleep duration varies markedly day by day.
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Take home message

To prevent adolescents from falling into asynchronization, tell them sleep health.
Sleep health; basic four principles

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In addition; Avoid substances that disturb sleep (e.g., caffeine, alcohol, nicotine), and avoid excessive media exposure (e.g., video games, computers, television).