

## Annex B — Effects on Sleep by Device Type

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### TV Set:

Association between television watching and various types of sleep indices was demonstrated, including late bedtime, reduced sleep duration, difficulty falling asleep and waking up, difficulty maintaining continuous sleep, decreased sleep efficiency, and daytime sleepiness in adolescents.

Examples of research in the field (most of the reported studies are cross-sectional studies, along with a few cohort or interventional studies):

- In a review of 42 articles on this topic published in 1999-2014, a negative effect of TV viewing was found in 32 of them. The studies demonstrated a dose-response relationship: higher TV viewing duration was associated with a greater effect on sleep deprivation (the association between TV viewing hours and sleep duration was found to be more common in older adolescents versus younger and in boys versus girls).
- A cohort study among 759 adolescents (aged 14 to 22) examined the association between TV viewing duration at the age of 14 and sleep problems in adulthood. 14-year-olds who watched TV for at least 3 hours a day were at increased risk of sleep problems after the age of 16-22. Adolescents who reduced screen time from >1 hour a day at 14 to <1 hours at 16 were significantly less sleep-deprived than those who did not reduce screen time.
- In an interventional trial that included tests in a sleep lab and self-report questionnaire, 11 boys aged 12-14 were exposed to exciting movies for one hour within 2-3 hours before bedtime. Compared to children who did not watch such movies, decreased sleep quality was found.
- Studies examining the extent of sleep loss following watching TV during a typical day have found a 20-minute delay in falling asleep among TV viewers. Sleep delay within the range of 5 to 10 minutes per hour of television watching was found.

### Computer:

The findings demonstrate that using a computer primarily before turning off lights can affect the sleep of children and adolescents. Teenagers using a computer reported fatigue or sleepiness during the day and other sleep problems. Prolonged use of **digital games** on a computer was associated with late sleep, increased sleep latency, daytime sleepiness, decreased sleep duration, and decreased overall quality of sleep. It should be noted that the effect of computer use on sleep has been primarily associated with the use during lights-out time; however, some studies did not show an association with sleep disorders.

**Using the Internet** has been associated with sleep delay and total sleep time shortening as well as undue fatigue and an increase in the reporting of insomnia. This association was also observed for total use, bedtime use, daytime use, and heavy use. Examples of research in the field:

- An interventional study showed the effect of computer gaming before sleep on prolonging sleep latency, with no effect on overall sleep quality or other sleep indices.
- In a clinical trial conducted in 22 boys (aged 12 to 15), computer games (of any kind) were found to be associated with postponement of turning off lights.
- A study focusing on the impact of computer use on sleep demonstrated a 51-minute decrease in sleep time among adolescents who reported regular or frequent Internet use for social purposes compared to those who did not report such use.

### **Cell Phone:**

Studies have shown that using a mobile phone is associated with sleep deprivation, awakening difficulties, insufficient sleep, daytime sleepiness, and other sleep disorders. It is estimated that using cell phones during the night can shorten sleep by 21-45 minutes.

Examples of research in the field:

- A 1999-2014 literature review revealed that out of 18 studies that examined the effect of cell phone use on sleep, 15 were found to be associated with at least one sleep problem (mainly a decrease in sleep or sleep delay).
- Phone use for incoming or outgoing calls and messages after turning off lights (a phenomenon that characterizes many teens and which incidence increases with age) has been associated with fatigue at the time and even upon a year's follow-up. Adolescents who used the phone between midnight and 3am were almost 4 times more likely to be tired than those who did not use it after turning off lights.
- Cross-sectional studies in adolescents in Japan found that using a phone for calls or messages after turning off lights is associated with sleep disorders, and even with suicidal thoughts, self-harm, and mental disorders.
- A survey of Belgian adolescents in 2007 found that 62% used a cell phone after turning off lights, and using a cell phone at that time was associated with an increase in sleepiness the following day.
- American college students filled out sleep diaries over two weeks. The findings revealed that 47% of students woke up during the night to reply to text messages and 40% woke up to answer phone calls. As the level of technology use increased after bedtime, sleep quality decreased, and poor sleep quality was found associated with depression/anxiety.

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