SCIENTIFIC RESEARCH REPORT

The use of mobile phones does not influence sleep patterns in teenagers

ABSTRACT

This project investigates the relationship between phone usage and sleep in teenagers from 13-18 years old. Statistical analysis of sleep pattern and mobile phone use was undertaken. Using data that was randomised, and having a high level of independence, the results indicate that there is a clear statistical relationship observed.

LITERATURE REVIEW

Sleep patterns

It is found that teenagers have inadequate sleep and daytime exhaustion or sleepiness. It is estimated that 85% at the most and 45% at the least of twelve to eighteen year olds are not getting the suitable amount of sleep recommended for them on school nights (Carskadon M, 2006) [8], (Calamaro CJ et al., 2009) [6], and 44% have difficultly staying awake and focused at school [3]. A large survey discovered that 45% of fourteen to eighteen year olds sleep after midnight on school nights (Carskadon M & Mancuso, 1988) [7]. Journal article by Wolfson A & Carskdon M, (1998) talks about sleep schedules in teens however, it includes outdated data as old as 1974, therefore is not as relevant to this day and may provide readers with wrong information. Wolfson A and Carskdon M have many years of experience with writing journals. Both have PhD's in psychology and specialise in researching teens sleep as they have co-authored over seven journals based on this topic.

Mobile phones

A survey from 2004 shows that approximately 45% of teenagers owned a mobile phone and ever since, the use of mobile phones have increased every year especially for the teens at the age of twelve to seventeen. In 2006 63% owned a phone, and 2 years later the percentage has climbed up to 71% (Lenhart A, 2009). This journal was produced by a senior research specialist associated with the Pew Internet and American Life Project.

Relationship between phone use and sleep

The typical teenager requires between 9-9.5 hours of sleep. However, the average amount of sleep that teenagers currently get is between 7-7.5 hours every night and sometimes even less because of phone usage late in the night [4]. Sleep and Circadian Research Group, Woolcock Institute of Medical Research reports that it affects roughly 25-40% of adolescents at some stage in their development.

Gamble A.L et al (2014), wrote a journal article about the adolescent sleep patterns and night time technology use, mainly based around mobile phones. They have different sources and are each apart of a research group in Sydney University, NHMRC Centre, Woolcock Institute of Medical Research,

Sydney Nursing School and the Royal Prince Alfred Hospital. Interestingly, Gamble A.L et al has referenced Carskadon M and Wolfson A, whose journal was used and mentioned in the first theme meaning his information must be reliable and himself as an author must be popular amongst other authors.

Similar to the journal by A.L Gamble, the journal by Adams et al also mentions the trends and relations between screens and sleep patterns without mentioning the reasons to why they are connected. Van den Bulck (2007) [9] found that mobile phone usage after lights out contributes to the increase in tiredness, and an obvious association between phone use after lights out (Munezawa et al., 2011) [8]. Students who use mobile phones after sleep onset are awake an extra 46 minutes per week (Adams & Kisler) [1].

According to the journal article by Akçay D, (2018), students who slept next to their mobile phones and has a poor sleep routine has an increased mobile phone usage time, and, 65.5% of participants of the investigation had poor quality sleep. This journal accurately analyses the results of surveys and investigations, however the results require updates. It was found that 20.1% to 43.3% reported mobile phone-related awakenings at least once per month, which was associated with sleep deprivation which causes exhaustibility and daytime tiredness (Fobian A.D et al., 2016) [21], (Van den Bulck J et al., 2007) [24]. Personally stimulating social media use before bedtime was associated with worse sleep quality and impaired health (Johnson J.G et al., 2004) [13], nevertheless, the relationship between media use and health might be partly, but not entirely mediated by sleeping problems (Cain N & Gradisar M, 2010) [2]. “Although the associations between electronic media use and sleeping problems seem quite consistent, bias cannot be ruled out.” It is pointed out that these studies are longitudinal and cross-sectional studies that were conducted ages ago before the mobile phone age (Van den Bulck J et al., 2007) [26].

The journal articles by Gamble A.L et al and Akçay D have good currency as they were published recently therefore also provide very accurate and reliable data and material however, they may require a few updates as these authors referenced information from over a decade ago. The journal articles include studies and survey results, and there are many references to all the articles with contributors who are scholars and researchers from hospitals and universities. All journals are copyrighted and peer-reviewed. Hence, these journals are highly reliable sources.

Blue light

The journal article by Zhao et al (2018) tells readers what the blue light emitting from phone screens does to teens circadian rhythm. According to Zhao et al., a number of studies have shown that blue light can regulate the body clock and promote alertness, memory and cognition. The blue light from screens stimulates the secretion of melatonin in the pineal gland, which consequently keeps teens from falling and staying asleep (Minch M'etal., 2016) (191, (GabelV et al., 2017) [6], (Scheuermaier K et al., 2018) [5]. It states that the high energy blue light emitting through screens are exposed to the eye; it passes through the cornea and lens to the retina causing inhibition of melatonin secretion, which will destroy the hormonal balance and directly affect sleep quality.

This journal by Zhao et al was published in 2018, therefore is accurate and would still provide identical information if published this year. Zhao Z.C has contributed to many academic journals and specialises in Science, therefore is a highly reliable author. He referenced and used other researchers information and data to add to his work and the contributors are mostly scholars, hence, a reliable journal has been produced by him and his co-authors.

SCIENTIFIC RESEARCH QUESTION

Does the use of mobile phones impact sleep patterns in teenagers?

NULL HYPOTHESIS

The use of mobile phones does not influence sleep patterns in teenagers.

METHOD

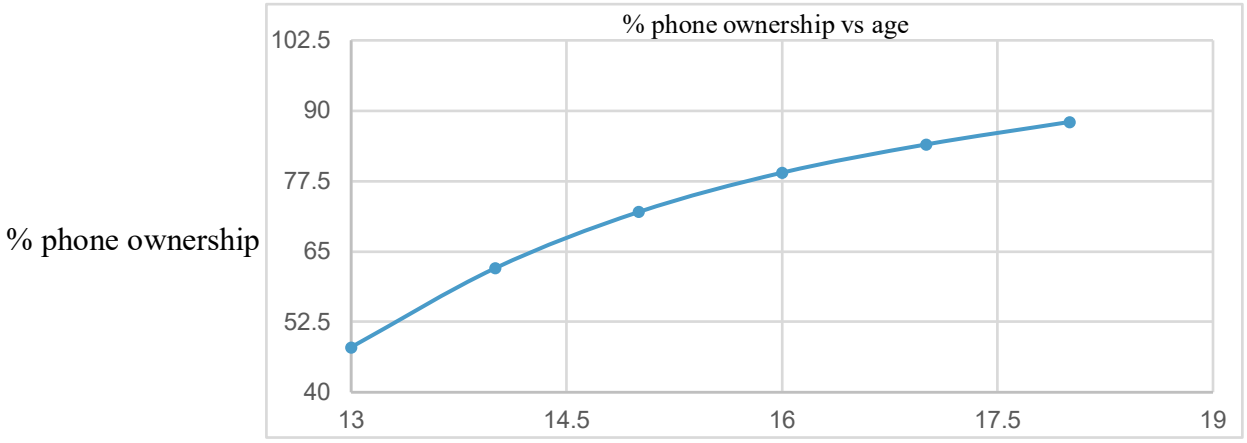
From the various sources used, a content analysis was performed. Keywords were extracted and explored with ideas in details. The datasets relating to the aim of the investigation were sourced and their relevance and currency were assessed. Statistical tests were undertaken, such as hypothesis testing, comparing the categories. The statistical tests conducted were a cross tab chi-squared test for nominal variables. Chi-squared (χ^2) Contingency tests test for a statistically significant gap between the predicted frequencies and the observed frequencies in one or more categories of a contingency table. The p-value is calculated using the statistical sampling distribution of the test statistic acknowledging the null hypothesis, the sample data, and the type of test being conducted. The assumptions of a chi-squared test is that the study groups must be independent, there are two variables in which both measured as categories and there should some level of correlation between the actual and expected relationship. The association was observed by constructing a graph and detecting the relationship between the two categories; phone usage and teen sleep patterns.

The t-test was conducted to compare the means between female and male phone usage. By performing a survey, primary data was collected and the table formed. It determined which subject spends more time on their phone, which then can be compared with secondary sources data about female sleep hours compared to male sleep hours.

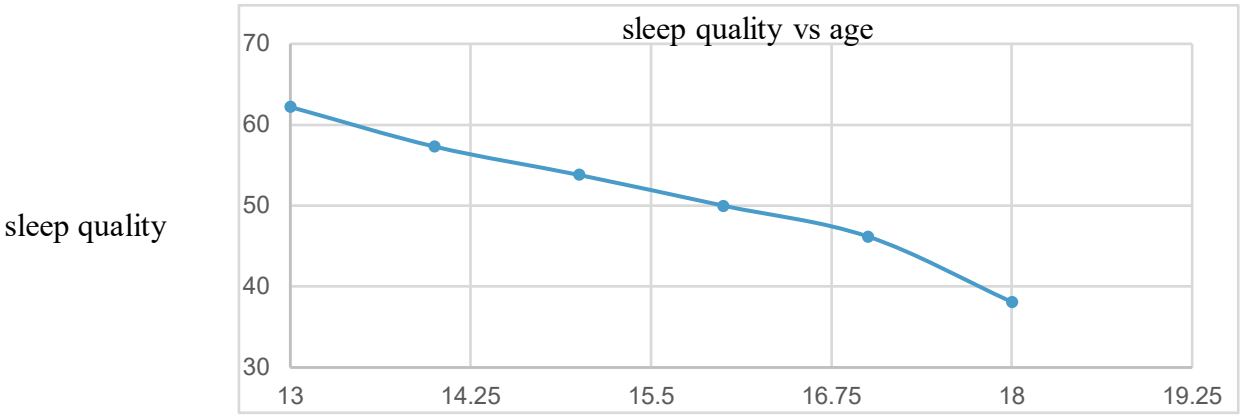
RESULTS

Using the source data, two graphs were constructed which show that the quality of sleep decreases (graph 1), and the increase of phone use (graph 2) as teens get older.

Graph 1

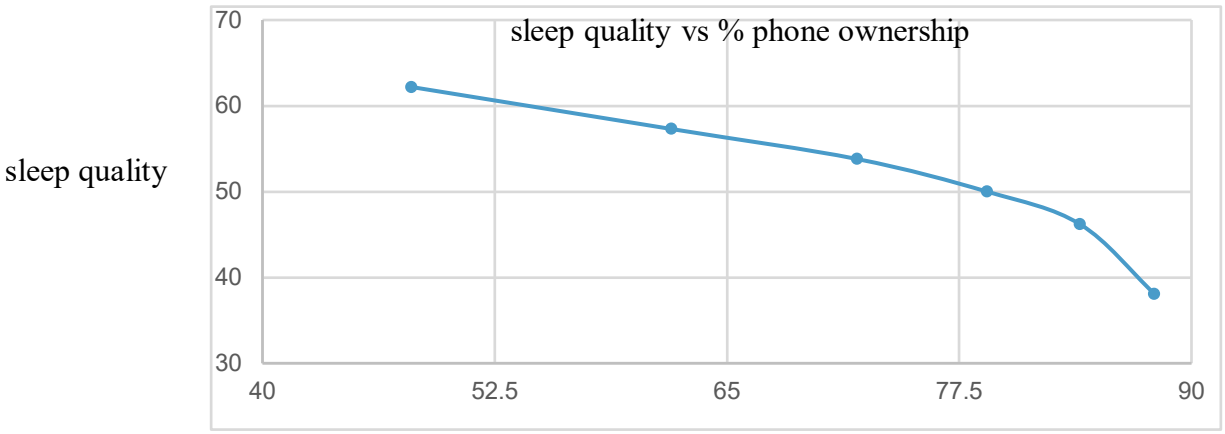


Graph 2:



Below, the Graph 1 and 2 have been combined together to compare it in a clearer visual representation. Graph 3 is the combination of Graph 1 and 2, and it shows the association of the categories, the percentage of phone ownership by age, and teenager sleep quality by age.

Graph 3:



By conducting a survey, the difference of the number of hours of phone use was able to be compared between two subjects, male and female. Table 1 shows the difference in means of the two subjects using 20 people's weekly screen time average on their iPhone. This t-test reveals that females spend time on their phones roughly over 50 minutes than men.

Table 1:

	male	female
1	293	250
2	343	427
3	176	452
4	398	198
5	254	362
6	196	172
7	405	381
8	246	256
9	272	401
10	168	378
average	275.1	327.7

By using secondary data from the journal article "Effects of Mobile Use on Subjective Sleep Quality", Table 2 is the comparison of screen time and sleep quality between female and male subjects.

Table 2:

	Male	Female	P-Value
Mobile screen usage time (hours)	8.07±3.90	8.71±4.77	0.005
Time spent on watching videos (hours) on mobile	2.06±1.79	1.73±1.73	0.01
Mobile screen usage time in the bed after the lights are turned off (minutes)	42.43±53.02	36.97±48.62	0.046
Poor sleep quality	33%	53.7%	0.026

P value < 0.05 is considered statistically significant.

< *Effects of Mobile Use on Subjective Sleep Quality* >

In Table 2, it is shown that females spend less time watching videos and less time using mobile phones in bed after lights are out, but in total, the mobile screen usage time for female are longer than men. This table also reveals that females have higher mobile screen usage time, resulting in poorer sleep quality than men by 20.7%.

DISCUSSION

The relationship between phone usage and teenager sleep patterns was verified statistically using hypothesis testing such as the chi-squared test, t-test and by constructing graphs which visually represented the trend between the two categories analysed.

Firstly, three graphs were constructed. Graph 1 and 2 showed the categories against age, and Graph 3 combined both results. This assists the determination of whether the null hypothesis is correct or incorrect by forming a clearer representation of the relationship of the two categories. A limitation to this method is that line graphs provide a very simple result which can identify a relationship just through observation. So, more tests have been conducted in a more complex way using hypothesis tests with accurate statistical results.

To support the evidence from the three graphs, a t-test was conducted between male and female. The t-test allowed the means to be compared thus allowing a comparison of this data against sleep times. A source states that men sleep more than women by 12%. As women and men have different internal clocks and require different amount of sleep, women require about 20 more minutes of sleep than men, however by looking at the results provided statistically, it is evident that women are actually getting less sleep than men due to the many hours they spend on their mobile phones. By comparing both results, it can be assumed that since females use their mobile phones just above fifty minutes than a male, they are getting less sleep. Not only by associating the phone ownership by age with sleep quality, but also by hours of phone sleep gender, there is more evidence and reasoning to reject the null hypothesis and say that it is clear that phones do impact sleep quality. The t-test has many assumptions, for example, it is assumed that the data is randomised, the variance is approximately equal, the population is normally distributed and that the sample is representative of the population. It is difficult to confidently agree that this data represent the population, and when data violates the assumptions, t-test might not have reliability.

The null hypothesis once again has been proven wrong with the use of the statistical testing, the Chi-squared test. The Chi-squared test determines whether there is an association between the two categorical variables accurately. Limitations of the Chi-squared test include its sample size requirements as it requires a sufficient sample size in order for the chi-square approximation to be valid, and difficulty of interpretation when there are large numbers of categories (20 or more) in the independent or dependent variables. However as only two variables were analysed, the results are accurate to a great extent. The alpha value is the significance level which is the probability of making an incorrect conclusion, in this case, the null hypothesis. The P-value is the probability of extracting results as accurate with a high confidence, and is measured assuming the null hypothesis is correct, and is calculated using the statistical sampling distribution of the test statistic acknowledging the null hypothesis, the sample data, and the type of test being conducted. If the P-value is less than 0.05, which is the alpha value, then the null hypothesis must be rejected. As each P-value given in Table 2 was less than 0.05, the null hypothesis that ‘the use of mobile phones does not influence sleep patterns in teenagers’ is incorrect, therefore revealing that there is a relationship between phone use and sleep quality.

The literature review was written about the relationship between phone use and sleep, and the inquiry question is that the use of mobile phones does not influence sleep patterns in teenagers. Twelve articles were divided and put into subtopics that relate to the topic. Reliability of the journal articles

used and accuracy of the information included will also be discussed and compared. All the journal articles referenced were very reliable, hence providing reliable information, supporting the investigation to determine whether the null hypothesis was true or false without any bias involved.

CONCLUSION

The literature review compared the journals used at the end of each theme to put their reliability and accuracy to the test. The null hypothesis was weakened and proved incorrect as the journals mentioned about the connection between phone usage and poor sleep, and then factors to poor sleep patterns. To add onto this evidence of the impact of mobile phone usage and teenagers sleep quality and patterns, two statistical hypothesis tests were conducted, and three line graphs were constructed. The various methods support each result and weakens the null hypothesis.

The research of this scientific research question, ‘Does the use of mobile phones impact sleep patterns in teenagers?’ and null hypothesis ‘The use of mobile phones does not influence sleep patterns in teenagers.’ found that the use of mobile phones influences sleep patterns in teenagers through both primary and secondary data collection and statistical hypothesis testing.