KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

THE IMPACT OF THE USE OF SMART MOBILE DEVICES ON SLEEP QUALITY AMONG HEALTH TRAINEES AT COLLEGE OF HEALTH AND WELL-BEING, KINTAMPO - GHANA

By

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THE IMPACT OF THE USE OF SMART MOBILE DEVICES ON SLEEP QUALITY AMONG HEALTH TRAINEES (A CASE STUDY AT COLLEGE OF HEALTH AND WELL-BEING, KINTAMPO - GHANA)

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DECLARATION

I hereby declare that the submission of this compilation is the true findings of my own researched work presented towards an award of a second degree in the Health Informatics and that, to the best of my knowledge, it contains no material previously published by another person nor submitted to any other University or institution for the award of degree except where due acknowledgement has been made in text. However, references from the work of others have been clearly stated.

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ABSTRACT

Sleep quality is an essential need of humans especially the young and the old. A good night or good sleep is a great determinant of one‘s ability to function effectively and efficiently

during the daytime activities. The main objective of this study was to ascertain the impact of the use of smart mobile devices on sleep quality among health trainees at the College of Health and Well-being, Kintampo. Significantly, it verifies whether the frequent use of smart mobile devices have any impact on sleeping habits that lead to any sleeping disorders. A cross-sectional study design was used to assess the evidence of relationship between smart device usage and sleep duration, subjective sleep quality, daytime sleepiness, and sleep quality index, of respondents as well as their demographic characteristics. The internationally accepted tool for assessing sleep quality index from the Pittsburgh University was used to determine the score of respondents‘ sleep quality index. The research was conducted at the College of Health and Well-being, Kintampo among the trainees from different programmes of study comprising a sample of 500 students. Pilot study survey was conducted with 200 trainees from the Techiman Nurses‘ Training College Techiman Ghana. Primary insomnia was the most prevalent sleep disorder among the respondents (52.24%) and this formed the majority of the respondents. There was evidence of a linear by linear relationship between the frequency of the number of smart mobile devices usage and respondents with insomnia. The sleep quality worsens with increasing addiction of smart mobile devices usage.

LIST OF ABBREVIATIONS

EEG	Electroencephalogram
GSM	Global System for Mobile Communication
IT	Information Technology
MP3	Moving Picture Experts Layer 3

OS	Operating System
Non-REM	Non Rapid Eye Movement
PSQI	Pittsburgh Sleep Quality Index
REM	Rapid Eye Movement
SPSS	Statistical Package of the Social Sciences
P-Value alone.	is the probability that the results of a study are caused by chance

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Sleep quality is an essential need of humans especially the young and the old. Good night or good sleep is a great determinant of one‘s ability to function effectively and efficiently during the daytime activities. Prolonged nap loss and related drowsiness and daytime deficiencies in the teenage years are a serious menace to the educational accomplishment, wellbeing, and welfare of our country‘s youth and an imperative public wellbeing concern (Owens, 2015).

Lack of nap quality is a common problematic issue and contributes to a wide variety of sleep disorders in the society and the world as a whole. The public and monetary costs of sleep illnesses are massive (Behar et al., 2013).

Nap/Sleep is an important genetic development for every human being. It is a normal and episodic state of repose during which consciousness of the world is adjourned (Han et al., 2012). Majority of people might have poor knowledge of nap and the variations that transpire as they mature. Nap is not a single step but rather splits into non-rapid eye motion (Non-REM) sleep and rapid eye movement (REM) or dreaming whiles asleep. Non-rapid eye movement sleep is further subdivided into three stages of sleep. An individual enters into nap through the gateway of light step one nap, which usually lasts only up to five percent of the night. The subsequent stage of light nap is step two nap, which usually incorporates approximately fifty percent of the night. Sleep spindles and K developments

on the electroencephalogram (EEG) mark Stage two sleep. People tend to have about twenty to twenty-five percent of the night when young which consists of level three or intensive nap. Level three nap which is the last part of non-rapid eye movement sleep is explained as the presence of minimal occurrence and maximum voltage electroencephalogram waves which is termed as channel or slow waves. People tend to reduce this intensive nap and this attenuation in intensive nap as they grow old is often more noticeable in males than females. People tend to be least easily awakened from Stage three sleep (Vorona, 2009).

Rapid eye movement nap is greatly different from non-rapid eye movement nap and is explained as quick eye motions, loss of chin muscle elasticity, and a low voltage and mixed occurrence electroencephalogram. Unlike intensive nap, the proportion of quick eye movement nap does not change much over time and normally includes twenty to twenty-five of the night. surprisingly, with the exclusion of our eye muscles and our diaphragm, which is the main muscle of respiration, people are paralyzed during rapid eye movement sleep. Generally, it lasts about fifteen minutes to enter step two nap. This time from staying to step two nap which is known as the nap latency to step two. This then takes about ninety to one hundred and ten (90-110) minutes from the beginning of nap until people enter the beginning of rapid eye movement nap. Subsequently, people go through cycle of non-rapid eye movement and rapid eye movement nap through the night, usually about three to five rapid eye movement time a night for grownups. Most of our intensive nap is focused to the first half of the night and most of our quick eye movement nap occurs during the second half of the nighttime. Rapid eye movement times commonly become prolonged during the

night. A prolonged first quick eye movement time can trace a sleep specialist to the likelihood of a depression (Vorona, 2009).

The question of how many hours should people go to sleep? This query prompts some arguments and rely importantly on the age of a person. For instance, senior high school students appear to require about 9.25 hours of nap a nighttime (Vorona, 2009). Grownups comprising of the old tend to need minimal nap than teenagers, with most professionals commending about seven to eight hours of nap a night (Vorona, 2009). Research findings from different studies suggest that the lowest death in grownups is linked with people who have nearly seven hours of sleep a night. Both significantly less sleep and greater sleep amounts are connected with reports of numerous death, for reasons that remain unclear (Vorona, 2009).

Virtually fifty percent of grownups complain of struggle while trying to fall asleep. Poor nap results in high threat of substantial indisposition and death. The reduction seen in the nap of the grownup is mostly as a result of a decline in the aptitude to get desirable sleepiness. Nevertheless, the diminished aptitude is less a factor of aging but more of a cause of other attributes that go with getting old, for instance, therapeutic and mental sickness, rise in the use of curative drugs, developments in the endogenic diurnal clock and an increase in the occurrence of definite nap conditions (Ancoli-israel, 2010).

Insomnia is a serious health problem that affects millions of people. Insomnia is defined as a complaint of difficulty in initiating sleep, difficulty in maintaining sleep, waking up too early, or sleep that is chronically non-restorative or poor in quality (Bidaki et al., 2012).

Smartphone is a term for distinguishing mobile phones with advanced features from basic feature phones. The term ―Smartphone‖ first appeared in 1997, when Ericsson described its GS 88 ―Penelope‖ concepts as a smartphone. This term was basically introduced in the market for an innovative range of portable movable handsets that provided unified services from information service, processing and mobile network sectors such as voice communication, messaging, personal information management applications and wireless communication capability. Modern Smartphone's currently include all the features of a laptop, including web browsing, Wi-Fi, and 3-party apps etc.

1.2 Problem Statement

A number of research studies have reported that a large fraction of road traffic accidents around the world are related to insufficient or disordered nap (Mello et al., 2013). Recent studies have linked driver fatigue to between sixteen to twenty percent of fatal highway misfortunes in the United Kingdom, Australia, and Brazil (Mello et al., 2013). Tiredness as a result of insufficient nap illnesses have been revealed to be a main contributing factor in motor vehicle accidents (Mello et al., 2013). A growing body of research indicates that sleep disturbances are associated with hopeless ideation and conducts (Joiner, 2007).

Mobile smartphone obsession excessive use in India ranges from thirty-nine percent to forty-four percent as per fixed effects calculated which revealed a strong evidence of association. Portable smartphone addiction, abuse or misuse is one of the forms of obsessive use of ―a mobile phone‖ by young people across the globe. A new kind of health disorder in this category among adolescents, ―Portable smartphone addiction, abuse or misuse‖ is now challenging healthiness policy makers internationally to think on this

rapidly developing concern. Portable smartphone obsession among Indian and other teens can damage interpersonal skills, and may also lead to significant negative health risks and harmful psychological effects on Indian adolescents (Davey & Davey, 2014a). Adolescents in Korea who abnormally use smartphones had significantly more problematic behaviours, somatic symptoms, attention deficits, and aggression. The youth were also found to be more addicted to portable smartphone as well as exhibiting more severe psychopathologies. Nine of ten Americans reported using a technological device in the hour before bed. However, those under thirty years of age were more likely to use portable smartphone. Most adolescents and majority of young adults use portable smart devices than individuals who are over thirty years (Gradisar et al., 2013). Technology use near bedtime is extremely prevalent in the United States. Among a range of technologies, interactive technological devices are most strongly associated with sleep complaints (Gradisar et al., 2013).

The use of smart electronic gadgets is common among youth during the day as well as at nighttime (Hysing, et al., 2015). Smartphone usage has a considerable impact on society and other aspects of life. The key impact of smartphones on society are both positive and negative and includes; addiction to phones, disrespectful behaviour, privacy issues, impact on culture, distraction at work and at educational institutions and many more (Sarwar & Soomro, 2013).

Boys play digital games and use Internet more often than girls whose mobile phone usage was more intensive. Information communication technology usage is associated with poor perceived health particularly only when it negatively affects sleeping habits, which in turn

is associated with increasing waking-time tiredness. The associations are genderspecific especially among young grownups (Raija-Leena, 2006).

The most common activities that some selected African countries use their mobile phones to do is shown below in Table 1.1. Nigerians (58%) use their mobile phones more to access facebook followed by Ghanaians (54%).

Table 1.1: Most common use of Mobile phones activity by selected African countries

Activity	South Africa	Nigeria	Ghana	Kenya	Uganda
Facebook	41%	58%	54%	44%	44%
Send SMS	52%	39%	40%	55%	43%
FM Radio	40%	36%	40%	46%	46%
Browse Internet	40%	47%	51%	34%	29%
Take Photos	45%	38%	37%	34%	31%
Instant Messaging	41%	34%	34%	40%	34%
Play Games	34%	34%	33%	30%	27%
Download Apps	34%	28%	31%	19%	18%
Twitter	14%	14%	13%	14%	11%

Source: (IT News Africa, 2015)

Mobile data user subscription is rapidly increasing in Ghana. Based on the information from the National Communications Authority of Ghana, the number of mobile data user subscribers in Ghana increased from fifteen million eight hundred and four thousand six hundred and eight (15,804,608) subscribers at the end of February, 2015 to sixteen million one hundred and six thousand two hundred and eighteen (16,106,218) at the end of March 2015, representing a penetration rate of 59.78 percent (IT News Africa, 2015).

1.3 Objectives of the study

The main objective of this study is to ascertain the impact of the use of smart mobile devices on sleep quality among health trainees at the College of Health and Well-being, Kintampo.

Significantly, it verifies whether the frequent use of smart mobile devices have any impact on sleeping habits that lead to any sleeping disorders.

The following specific objectives would help to answer the above main objective;

- To ascertain the types and usage of smart mobile devices among the health trainees.
- To determine the prevalence of primary insomnia among the health trainees.
- To examine the association between smart devices and: (i) sleep duration, (ii) subjective sleep quality; and (iii) excessive daytime sleepiness among the Health Trainees at College of Health and Well-being.
- To assess the relationship between the level of usage of smart mobile devices and primary insomnia among the health trainees.

1.4 Research Questions

This study will attempt to answer the following questions;

1. What is the prevalence of primary insomnia among the health trainees?
2. What is the association between smart devices and;

   i. sleep duration ii. subjective sleep quality; and iii. excessive daytime sleepiness (daytime dysfunction) among the Health Trainees.

4. What is the relationship between the usage of smart mobile devices and primary insomnia among the health trainees.

1.5 Significance of the study

The significance of this study is that it is a preliminary study that provides information to understand the prevalence and duration of usage of smart mobile devices and its impact on sleep duration, sleep quality and excessive daytime sleepiness that may lead to a

sleeping disorder among the Health Trainees at College of Health and Well-being, Kintampo and the youth of Ghana as a whole. It also offers a current picture of the sleep quality of healthy young adults of Ghana. Its relatively simple design makes it possible to recruit a large number of participants at the College of Health and Wellbeing Training School.

1.6 Scope of the study

The study would focus on only the health trainees from five different programmes of study at the College of Health and Well-being. Five hundred health trainees at the College of Health and Well-being from five different programmes of study comprising of one hundred trainees from each programme of study were used. Only the programmes of study with the required number of health trainees were selected to take part of this research.

1.7 Overview of research methodology

A Cross-Sectional study design was used to assess the evidence of relationship between smart device usage and sleep duration, subjective sleep quality, daytime sleepiness, and sleep quality index, of respondents as well as their demographic characteristics.

Numerical responses on surveys using questionnaire was used to gather data from respondents for assessment.

The research was conducted at the College of Health and Well-being among the trainees from different programmes of study comprising a sample population of five hundred students. The inclusion criteria were; any student regardless of age in the second or thirdyear student at the College of Health and Well-being and who was willing to answer the Pittsburgh Sleep Quality Index (PSQI). The standardized PSQI questionnaire, which

includes 19 closed-ended questions, was used to measure and provide information about habits and sleep quality of the participants on sleeping and waking time during the last month.

The internationally accepted tool for assessing sleep quality index from the Pittsburgh University was used to determine the score of respondents‘ sleep quality index. The Pearson correlation was also used to assess the evidence of any relationship between using smart devices and sleep quality index of the respondents.

1.8 Limitations of the study

Limitations include the cross-sectional study design, which could not determine the relationship of cause-and-effect between smart mobile devices usage duration and sleep duration, sleep quality, and daytime sleepiness. It only measures the relationship between the variables.

1.9 Organisation of the study

The research is organized as follows:
Chapter one gives a brief insight into the paper. It deals with the background to the study, the statement of the problem, the significance of the study and the limitations of the study. Chapter two focuses on the review of existing literature on the prevalence of sleeping disorders among young adults. It goes further to ascertain the level of usage of smart devices and the findings of various researches with respect to the correlation between smart devices and sleeping disorders or disturbances. Chapter three looks at the methodology adopted for the research. It presents the research design, the population size, sampling techniques and the sources of data. Chapter four offers quantitative research results and

findings related to the use and impact of smart devices on sleep quality. It looks at the issue by focusing on the correlation between the usage of smart devices and its impact on sleep, which leads to disorder. Finally, chapter five looks at the summary, conclusion and policy recommendations.

1.10 Study area

The Kintampo North Municipal, one of the twenty seven (27) locale in the Brong Ahafo Region, was made in 1988 by Legislative Instrument 1480 spin-off of the Government's decentralization program with Kintampo as its capital.

It is situated between scopes 8º45'N and 7º45'N and Longitudes 1º20'W and 2°1'E and shares limits with five areas in the Country:, in particular; Central Gonja District toward the North; Bole District toward the West; East Gonja District toward the North-East (all in the Northern Region); Kintampo South District toward the South; and Pru District toward the South-East (all in the Brong Ahafo Region). The Municipal Capital,

Kintampo, is around 130KM away by street from the local capital and lies east of the BAR Capital, Sunyani. The Municipal has a surface range of around 5,108km², accordingly possessing an area zone of around 12.9% of the aggregate area zone of BAR (39,557km²). As far as area and size, the Municipal is deliberately situated at the focal point of Ghana and serves as a travel point between the northern and southern parts of the nation. It is trusted that the development of the Kunsu-Ntankro-Prang-Kintampo-Wa streets will promote open and improve vehicular movement on these streets and additionally collaboration between the southern and northern parts of Ghana. The then Kintampo District was built up in 1988 under LI 1480. In any case, in 2004 the Kintampo

South District was cut out from it, and it was renamed the Kintampo Municipal by the Local government Act, Act 462, LI 1762. The Kintampo Municipal is one of the Seven (7) Municipals and among the Twenty-two (22) Municipal in the Brong Ahafo Region of Ghana.

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Ntankro-Prang-Kintampo-Wa streets will assist open and upgrade vehicular activity on these streets and also association between the southern and northern parts of

Ghana. The Kintampo North Municipal which falls inside of the Voltain Basin and the Southern Plateau physiographic locales is a plain with rolling and undulating land surface with a general height between 60-150m above ocean level. The southern Voltain level involving the southern part of the region is described by arrangement of slopes. The civil which falls inside of the Voltain bowl is enriched with a great deal of water assets. The real water bodies incorporate the Fra, Urukwain, and the Nyamba waterways. Others are waterways Oyoko, Nante, Pumpum and Tanfi. These water bodies course through the west of the area and join the Black Volta at Buipe. The slants through which the streams stream have offered ascend to water falls. The significant ones incorporate the Fular Falls on the Oyoko River and the Kintampo water falls on the Pumpum River. The greater part of these streams are discontinuous and the expansive ones like Urukwain and Pumpum vary in volume. This makes them temperamental for watering system reason. As far as alleviation and seepage, the limitless span of level land particularly the northern part makes it suitable for vast scale automated cultivating. Street development and different exercises are additionally moderately shoddy. The immeasurable water assets in the western part of the area could be outfit for watering system purposes particularly rice development and dry season cultivating and also local supply of consumable water.

1.11 Study Site

Kintampo Rural Health Training School regularly alluded to as Rural Health began from an unassuming starting as a Ministry of Health preparing foundation. It was completely settled in 1969 with a command to prepare center level wellbeing experts to give quality

and extensive human services to the masses particularly those living in the rustic and underserved ranges. The foundation of the school originated from the felt requirement for bleeding edge wellbeing staff to expand the doctor workforce that was horribly lacking and which was likewise influenced by misdistribution in the nation. In light of those needs, the cluster of sixteen (16) understudies selected into the school in 1969 to be prepared as wellbeing focus administrators. The School now known as 'The College of Health and Well-Being' has as of late enhanced and extended in system substance, degree and understudy numbers. It has formed into an advanced school situated in a quiet domain favorable for preparing and sustaining wellbeing experts. The wellbeing school being the main establishment of its kind in the nation and sub-area, keep on drawing in profoundly qualified candidates into different projects of concentrate every year. These projects/courses of learn at the school reflect ebb and flow practices and arrangements in the wellbeing segment and are composed and created in view of sickness weight and the wellbeing needs of the populace. Right now, the establishment runs twenty (20) fundamental, post-essential projects of study in the ranges of Community Medicine, Dentistry and Health, Medical Laboratory Science, Health Information Management, Health Promotion, Community Nutrition, Applied Epidemiology, Community Mental Health and Clinical Psychiatry among others. The projects some of which are at recognition and degree levels give scholarly vocation movement pathways to center level wellbeing experts in clinical and preventive wellbeing. The establishment has prepared a few many different classes of center level wellbeing experts who are giving wellbeing administrations over the length and expansiveness of Ghana in accordance with its main goal. The school staff has additionally extended quickly and the enrollment keeps on developing. A few

wellbeing professionals including clinicians and educators, biomedical researchers, academicians both inside of Ghana and abroad are connected with drilling and instructing on the courses. With a present understudy populace of around 2000 and 150 scholarly and clinical staff (both full and low maintenance) the school is ready to turning into a University College in connection with the Kwame Nkrumah University of Science and Technology and to be guided and supported into a world class University of Health. The College of Health and Well-Being in the previous decade has cultivated associations with organizations both home and abroad.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Sleeping disturbances leading to sleep disorders are widespread in the general population and can significantly affect physical and psychological health and emotional well-being (Panossian & Avidan, 2009). There is a broad range of sleep disorders with different medical presentations.

This review focuses on the literature on smart mobile devices usage impact on sleep quality or disturbances in research and publication in academia. The literature is grouped under the following sub topics that explain the focal aim of this research study.

i. The types and usage of smart mobile devices ii. The prevalence of primary insomnia iii. The association between smart mobile device usage level and sleep duration, sleep

quality, and preventable daytime sleepiness iv. The relationship between the usage of smart mobile devices and primary insomnia.

2.1 Overview of Mobile Computers

Mobile computer is a personal computer, which is handy to be carried around. In the same way, a smart portable device is a processing device handy enough to hold in the hand. The most common type of mobile computer is the notebook/laptop computer

(Shelly et al., 2011) (Shelly et al., 2012).

2.1.1 Notebook/Laptop Computer

A notebook computer also known as a laptop computer is a transportable personal computer, which is frequently designed to fit on the lap. Laptop computers are thin and not heavy; however, they may be as powerful as the average Microsoft desktop personal computers. A personal netbook computer is a type of notebook computer, which is smaller, lighter than and mostly not as powerful as a laptop computer. Most netbook computers cost less than personal laptop computers regularly only a few amounts of dollars. An ultra-thin personal computer is another type of notebook or laptop computer that is not heavy and characteristically less than one inch thick. Some laptops have touch screens, allowing one to interact with the device by using the visual display usually with the tip of a finger. One unique characteristic of a notebook computer is the keyboard on top of the case, and the screen which attaches to the case with joints. Laptop computers weigh on the average from 2.5 to a little more than 10 pounds depending on the configuration, which allows users to transport the laptops everywhere with ease. Most laptop computers can operate on both direct current and on batteries or both (Shelly et al., 2012), (Shelly et al., 2011).

2.1.2 Tablet Computers

Tablet Computer is a separate kind of notebook computer that allows you to displace or make drawings on the covering by using a digital pen. Users correspond or make drawings by pressing the electronic pen on the visible presentation unit and issues commands to the Tablet Computer by tapping on the protected display unit. For users who prefer typing instead of handwriting, some Tablet Computers have unique designs that make it possible to attach keyboard and others permit you to connect a segregated keyboard to the device. Most Tablet Computers have touch screens. Tablet Computers can also support speech input so that users can enter text and issue commands by speaking into the Tablet computer. Tablet Computers are beneficial especially for taking notes at lectures, in gatherings, symposiums, and other settings where the typical notebook computer is not practical (Shelly et al., 2011;Shelly et al., 2012).

2.2 Overview of Smart Mobile Devices

Smart portable devices are movable enough to convey in a pocket and generally do not have platter drives. These devices accumulation programs and data permanently instead on definite main memory found under the case or on tiny storing medium such as flash memory chips. Smart Mobile device can often be connected to a personal computer for exchange of information between the computer and the smart mobile device. Most of the smart portable devices are Net enabled which declares that they can be connecting to the Cyberspace wirelessly. Users could send e-mail, chat and also send instant messages by getting access to the World Wide Web. The screens on smart mobile devices are small because of their reduced size. Most of the favourite types of portable movable devices are

smart movable phones, handheld computers, movable media players, Individualised Digital Assistants, and digital cameras (Shelly et al., 2011;Shelly et al., 2012).

2.2.1 Smart Mobile Phones

Smart movable phone is a Cyberspace enabled device, which generally grants private data organisation functions such as an address book, a calendar, planning book, a calculator, and a wordpad. Smart movable phone gadget allows users to channelise and obtain electronic mail messages and access the World Wide Web and most often for an added fees. Some smart mobile phones interconnect with other devices or computers wirelessly. Various clever phones serve as a movable media player and commonly include built-in digital cameras for sharing of photos or videos with others as soon images are captured. Most smart mobile phones bring out a diversity of software program applications like spreadsheet, phrase processing, and games, and the cognition of conducting active video conferences. Some smart mobile handsets have keypads that contain alphanumeric keys, which allow users to dial phone numbers and enter messages with the same keypads. Some smart mobile phones have in-built small keyboard on the front of the handset or keyboard that slides in and out from back of the smart phone. Some of the smart phones have touch screens, which is used to make choices and enter text through a screen pop-up keyboard. Users at times transfer messages to others by entering letters on keys on their clever phone‘s keypads instead of calling them with their smart phone or cell phone by using alphanumeric keys on the tiny keyboards, or images on a visible display pop-up keyboard. Categories of mails users transpose with smart phones comprise instant text mails, icon messages, book messages, and video recording messages (Shelly et al., 2011;Shelly et al., 2012).

2.2.2 Personal Digital Assistant (PDA)

Individualised digital assistant provides sequestered information direction functions like a location book, a calendar, a planning book, a processor, and a notepad. Most individual digital assistants tender comprise of other software program application such as spreadsheet, word processing, personal finance, and clever video games. Stylus is a common input device for a personal digital assistant. Most personal digital assistants have a built-in mini keyboard or an on-screen keyboard. Some personal digital assistants also back voice recording input, have built-in cameras, and can role as a movable media player. Majority of personal digital assistants are Internet enabled which allow users to check e-mail and access the World Wide Web. Some personal digital assistants also provide phone capabilities. As smart phones and personal digital assistants remains a trend of merging which is becoming gradually difficult to distinguish between the two gadgets. This has steered some manufacturers to refer to personal digital assistants and smart phones simply as handhelds (Shelly et al., 2011;Shelly et al., 2012).

2.2.3 Palmtop/Handheld Computers

Palmtop computers are sometimes referred to as an Ultra-Mobile Private Processing Machines. It is a processing machine, which is portable to fit in the palm of an individual. Most handheld computers communicate with other devices or computers wirelessly, which also comprise a stylus for input. Several handheld computers have mini or specialized keyboards. Numerous portable computers are industry explicit and serve the desires of transportable workers like meter checkers and tiny gift distribution individual whose tasks as workers expect them to travel everywhere (Shelly et al., 2011;Shelly et al., 2012).

2.2.4 Transportable Media Players

Transportable media converter is a smart movable gadget on which users may save, organise, and process electronic media files. Users can enjoy sounds, watch recorded videos, movies, and digital television programmes and watch digital pictures on the gadget. Most of the device allows users to copy the electronic media files from a personal computing gadget to the transportable media processor. Most of the portable media players are Internet enabled which allow users to search through Web sites and send electronic mail messages straight from the electronic gadget. It offers private information control functions such as a time calendar, contacts, and includes a range of games and other programs. Takeout media players at times include a set of ear buds, which are tiny speakers that fit region of each ear duct. Certain of the movable clever media players are touch sensitive screens while others have touch-sensitive pads that users operate with their stylus or finger to browse through a couple of electronic media files (Shelly et al., 2011;Shelly et al., 2012).

2.2.5 Digital / Electronic Cameras

Digital or electronic camera is a portable clever device that permits users to capture images and save the snapped pictures electronically. Most digital cameras are built into smart phones and other smart mobile devices. Digital cameras have some quantity of internal storage to capture and store images although couple of owners saves images on tiny erasable storage media such as flash reminiscence chips. Digitally handy picture cameras

normally permit owners to view and at times improve images whereas they are in the digital cam. Some digital cameras communicate with a computer or printer wirelessly, which allows owners to print hard copies or view images directly from the electronic printer. Few of the digital cameras can link to a network wirelessly in order that owners could share pictures straight from the flash memory chip in the handy camera to the Internet without using an electronic device. Sometimes owners like to retrieve snapped images from the handy tiny electronic camera to the laptop processing machine. Owners may eject the erasable media for example a flash reminiscence chip from the handy tiny electronic camera and fix it in a portable chip reader or connect to the laptop or desktop processing machine (Shelly et al., 2011;Shelly et al., 2012).

2.2.6 Game Console

Gamey console is a clever movable processing device intended for individual-player or several players recorded video games. Normal portable gamy relieves use handheld organizer as an input gadget and uses digital flat telecasting visible display as an output gadget. It also uses permanent storing disks drives, optical read-only disks, and retention cards for saving. It is not very heavy and its weight on an average is between two to nine pounds. The compressed size of portable gamey relieves makes them cool to practice at individual households, at a hotel, in the wagon, or at locations that have electrical outlet.

The three most common models of gamey relieves are Xbox 360 recorded video from Microsoft, Wii recorded video game by Nintendo, and PlayStation from Sony (Shelly et al., 2011;Shelly et al., 2012).

A palmtop game relieve is portable to be in owners‘ palm, making it more portable than the normal game console. Control screen, and speakers are built into the handheld game console. The screens are small because of their reduced size. Most of the prototypes use cartridges to store games whereas others use a storage chip or a mini optical disk. Most of the palmtop game relieves may communicate with other similar gamey relieves wirelessly for several player gaming. Examples of such common prototypes are DS Lite and Play Station versions, which are movable. Some portable multimedia game console models let owners listen to music in addition to gaming, enjoy movies, regular exercise, and connect and browse the Internet (Shelly et al., 2011;Shelly et al., 2012).

2.3 The usage of smart mobile devices

Mobile devices are everywhere in the world today (Goundar, 2011). Wireless users are mainly high among adults under thirty years of age. Adults who fall between the ages of eighteen and twenty-nine years of age form the majority of wireless Internet users (Lenhart et al., 2010).

Blacks are the most active users of mobile Internet on portable gadgets and their use is growing at a faster rate than mobile Internet use on portable devices among whites and Hispanics (Lenhart et al., 2010). The results from the cross-sectional study conducted by Boruff (2014), shows that bio-medical students, medical practitioners and clinical instructors used their transportable gadgets to respond to scientific enquiries in a diversity of ways (Boruff, 2014).

2.3.1 Smart Mobile Phones

Smart mobile phone comes with cellular phone features, alongside with digital transportable camera, personal digital assistant and motion picture experts layer three processors. It also supports access to the Internet connection. Owners of the smart mobile phone can retrieve recorded sound or cinematic lectures, small size shows, revise text files, deliver instant text messages and also use the handset for keeping information. It also backs communicative education because it permits global partnership. It may combine a host of choices and features in an effortlessly portable gadget. Typing and browsing is often not easy due to the issue of small screen. The price of certain advanced smart phones is fairly expensive (Jacob & Issac, 2008).

Scientific research study findings direct that the patronage of smart portable phones might result into a great number of signs and symptoms such as head pains, reduced concentration and memory loss, and also tiredness (Khan, 2008).

From table 2.1, the age interval of twenty-five to thirty-four years group was found to have the greatest percentage of Smartphone usage rate of sixty-two percent. Fifty percent (50%) of smartphone users had Android operating system on their devices whilst 43% of the users younger than thirty-four years used Apple iPhone operating system. Most of the smartphone users (53%) were males with forty seven percent (47%) being females (Davey & Davey, 2014). Clever phone technology is growing at a speedy rate. Nevertheless, the progression of the new technology is not what is frightening, but rather individual‘s ill use and unnecessary engagement with their gadgets, because of this most of adolescents are wide-open to the media uses and immediate mobile broadband admittance involved with the progression of clever phones (Davey & Davey, 2014).

Table 2.1: Demographic profile of worldwide usage of smartphones

Variables	Percentage of usage
Age group of usage 11 – 24	72
25 – 34	62
35 – 44	56
45 – 54	39
55 – 64	30
65+	38
Average good usage by Gender Male	53
Female	47
Mobile Worldwide statistics of usage People who use smartphone on the average per day (%)	89
Users who use Smart phone for text messages Percentage	92
Users who use Smart phone for browsing Internet Percentage	84

Source: (Davey & Davey, 2014)

Smart mobile devices such as smartphones are relatively prevalent in our current society (Kinser, 2015). The frequent and longer duration of smartphone usage could lead to a higher chance of smartphone addiction. Approximately eighty percent of the world's population use smartphones of which the United States of America has about 91.4 million

users. Majority of health trainees currently have smartphones and use applications with a trend towards increasing usage (Franko & Tirrell, 2012).

The usage of wireless, mobile, and portable digital devices is growing in all major sectors, as well as health institutions and colleges of education. The escalation in smart mobile phone usage has gradually drawn most healthcare trainees‘ and patients‘ thoughtfulness to smartphones capability as a promoter of health promotion through education in Ghana (Aryee, 2014).

Inventive role of clever phone expertise and its use in scientific research study, learning and material distribution makes smart mobile phones an imminent of ophthalmology and treatment (Zvornicanin et al., 2014).

2.3.2 Tablets, Laptops/Notebooks

Notebook computer is the supreme useful of all the smart portable gadgets and possess all the specifications of a workplace personal computer. It emanates with a wireless and cable linkage provision for Bluetooth device, Ethernet and Wi-Fi connectivity. Tablets computers incorporate vocal sound recording to text transformation and handwriting recognition for feedback. These processing nodes may back online browsing, email, word processor, instantaneous text messaging, voice over Internet protocol connectivity and numerous added programs. The notebook computer offers the utmost commanding processing surroundings with smart portable devices. The enormous size and deficiency of movement on transporting limits the connectivity usage, especially wherever portable wireless connectivity facilities are accessible (Jacob & Issac, 2008).

It is significant to note that young adults who are under thirty years of age are considerably more expected than all other adults to own a netbook, and among this group, notebooks have overtaken desktops in acceptance. Among adults between the ages of eighteen to twenty-nine years form the majority of laptop owners while just fifty-three percent of the same age range owns desktop computer. Smart mobile phones and computer ownership proportions increase with rising educational attainment and richness (Lenhart et al., 2010).

With the increasing popularity of touch-screen tablet computers for personal, school, and even employment usage, it is pertinent to address the risk factors associated with muscles and skeletal signs and symptoms in the neck and upper extremities during the use of these devices. Studies have revealed that females and individuals with current muscles and skeletal signs and symptoms are more possible to be at risk for upper extremity and neck symptoms during use of touch-screen tablet computers. Another significant risk factor associated with symptoms during use is female gender. In regards to sitting positions, sitting without back support and sitting with the device in the lap were significantly associated with symptoms. After considering the possible interactions among the risk factors in the regression model, sitting without back support is the strongest postural predictors for symptoms during use. Other postures, including lying on either side and lying on the back, were also associated with symptoms during use in the univariate model (Blair et al., 2015).

Sleep instabilities and limited enactment for men was prospectively associated with period spent on overall notebook processor use. Using the personal computing device deprived of breaks is a threat influence for numerous emotional healthiness consequences for women.

Using computers at night and subsequently lacking good sleep is related to most emotional health consequences for both women and men (Thomée et al., 2012).

2.3.3 Personal Digital Assistant (PDA)

Personal digital assistants form a decent fusion of electronic storage alongside with processing supremacy. They have net access, cable less communication entrance through Wi-Fi connectivity or Bluetooth connectivity, and stylus pen feedback interface, alongside with added word processing stuffs. It allows owners‘ to have access to electronic mail and web contents and can be used to play sound and movie or recorded video documents. It backs shared and group studies. Personal digital assistants stand as a favourite choice because text and information entries are possible through the visual screen keyboard or stylus pen and also integrate communication tools in it. They could be a little huge for a standard sized pockets (Jacob & Issac, 2008).

2.3.4 IPod / MP3 Players

IPod is a handy media processor that permits owners to transfer audio books, song, podcasts, and other audiovisuals. Most Undergraduates can download speech notes, audio and video recording lecture notes. Users can read electronic books due to bigger screens of iPods. Owners may transfer information, files, work as a group on projects and offer visual instructions or may link with the iPod over a microphone. It aids as a training backing device, since the Lecturers in a college might give the video or audio lectures to the undergraduates as a free file transfer. The price tag can be an influence where most of the undergraduates might not have enough money to use one. It is not able to provide

communication with other devices and the visual display size is mostly insignificant to read bulky amounts of data (Jacob & Issac, 2008).

IPod and MP3 players are particularly common with young adults. Three-quarters of eighteen to twenty-four year olds own mp3 player. Most people who fall within the age group interval of twenty-five to twenty-nine years old use mp3 and iPod than adults who fall between thirty to forty years or older (Lenhart et al., 2010).

2.3.5 Video Game Console

Young adults are passionate users of game console devices both wired and portable. Majority of Teenagers between the ages of twelve and seventeen years own a portable game consoles like Wii, Xbox or PlayStation. Younger and older teenagers are similarly expected to have a game console. Schoolboys are more to be expected than schoolgirls to own portable game consoles. High percentage of boys has a game console while significant number of girls report ownership of video game consoles. Younger teenagers are more to be expected to own game consoles than older teenagers. Most teenagers have a portable gaming device like a play station portable, Nintendo DS or a Gameboy. Unlike other technology devices, handy gaming gadgets are more rarely possessed by younger teenagers, with two-thirds forming the majority of teenagers with ages twelve to thirteen owning a portable game player compared with minority falling between fourteen to seventeen years olds. Boys are more expected to own a portable gaming device than girls. Apart from age and gender differences in ownership of portable and game consoles platforms are similarly expected to be found in homes or households irrespective of tribe, ethnic group, household financial status or parents‘ educational level (Lenhart et al., 2010)..

2.4 Effects of the excessive use of smart mobile devices on health

Research findings from Khan (2008), specify that the habit of portable phones use may result to a number of signs and symptoms such as memory loss, head pains, diminished concentration and also tiredness (Khan, 2008).

The outcomes of the current study from Khan (2008) again show that clever portable phones play a greater part in the everyday life of bio-medical undergraduates. The Researcher recommended that the influence on mindset and healthiness must be deliberated among undergraduates to avoid the dangerous special effects of clever portable phone use (Khan, 2008).

A cross-sectional study carried out to explore the potential influence of extensive term use of portable phone on eyes reviewed that there is no influence on inflammation on the eyes and visual disruption, but a number of statistical confirmations establish that smart portable phone use might result inflammation in the eyes, clouding of vision, discharge of the eyes, and lacrimation of the eyes (Balik et al., 2005).

Contact to electromagnetic field from an energetic smart portable phone could cause a conceivable decline in local cerebral blood flows (Haarala et al., 2003). Extensive term use of portable phones could increase the threat of auditory neuroma (Lönn et al., 2004). There are conceivable confirmation connecting portable clever phone use to an augmented threat of tumors (Myung et al., 2009). Mobile phone is a threat factor for health menaces. Extensive term or extreme use of portable movable phones must be eluded (Al-Khlaiwi, 2004).

2.5 The prevalence of sleeping disorders

Sleep conditions are exceedingly common in the overall populace and could resort to substantial illness. Sleep disturbances long-lasting at least a number of nights per month have been reported by thirty percent of the United States of America citizens (Panossian & Avidan, 2009). Sleep disorders may cause previous therapeutic and mental state conditions are linked with extraordinary rates of hopelessness, nervousness, and weakened daylight functioning (Panossian & Avidan, 2009). These might result to deprived industrial performance, mechanical vehicle traffic incidence, circulatory and endocrine conditions, or delicate pain discernment (Panossian & Avidan, 2009).

The sleep conditions Association of the United States of American has categorised over seventy different types of sleeping conditions in the year 2000. Most prevalent sleep conditions consist of insomnia, sleep apnoea, and narcolepsy (Searle, 2000). Disrupted and Poor sleep practices may result in harms with bodily and emotional activity. Youngsters may present to conceptual health clinicians with miserable signs and symptoms demonstration that are worsened by poor sleep (Adams et al., 2013).

2.5.1 Insomnia

Afternoon sleepiness is very common, devastating and possibly hazardous signs and symptoms, that is probable to be less than recognised. This may be triggered by numerous contributors, generally intruding with sleep quality and quantity (Slater & Steier, 2012).

Insomnia is one of the supreme recurrently occurring sleeping conditions in the world. Nearly one third of young adults and grownups are confronted by primary insomnia at a point during their existence (Mayo Clinic, 2009). Common insomnia is mostly well

explained as insufficient nap worth or trouble initiating sleep and above all supporting sleep for a month and beyond (Randall et al., 2008). It is categorised into twofold distinctive sub sets; sleep inception sleeplessness and sleep conservation insomnia. Sleep inception insomnia wrecks the capability meant for persons to go to sleep (*Sleeping pills*, 2008).

Primary sleeplessness may be affected by psychophysiological elements such as jet lag. Sedative-hypnotic drugs are often pre- scribed for the treatment of insomnia. It is, however, necessary to understand the differential diagnosis of insomnia before treating it symptomatically as symptomatic treatment often removes the impetus to diagnose and relieve underlying causes (Janus, 2003).

Studies from several scholars have established the evidence that the hindrance of melatonin secretion rhythms and body heats have a relation with sleep inception sleeplessness (Lack, L., & Wright, 2007). Sleep preservation sleeplessness disturbs an individual‘s capacity to maintain sleeping throughout the night-time (*Sleeping pills*, 2008). It has been estimated that ten to fifteen percent of grownups tussle with sleep upkeep sleeplessness (Mayo Clinic, 2009). Most of the causes of sleeplessness channel from a range of further illnesses. Other causes which may largely be responsible for sleep-onset insomnia are stress, anxiety, depression, and caffeine, and a host of others which are unknown (Mayo Clinic, 2009). Notwithstanding the commonness of insomnia in grownup persons, it might affect people of all age groups. Modern survey conducted using 2,082 Nurses on insomnia disorders in the United States of America, concluded that twenty-seven percent suffered from insomnia (Amschler & McKenzie, 2010). Similarly, thirty-two percent experienced difficulty

remaining asleep. Sleep disorder correlated with a greater percentage of mistakes in the nurses‘ dispensing of drugs and their patients‘ health chart records (Amschler & McKenzie, 2010).

A significant form of confirmation currently associates quick nap duration in grownups and youngsters with an increased threat of heaviness and relationship that evidently has extensive range healthiness consequences (Owens, 2015).

2.5.2 Obstructive Sleep Apnoea

Sleep apnoea is one of the sleeping disorders which is described by disturbed inhalation during sleep (Searle, 1995). The tonsils, tongue and lenient palate restrict the airborne from passing inside and outside of the esophagus in most of the time during sleep. This situation usually results from accumulated fatty muscles in the collar area caused by being overheavy or obese. Nevertheless, a further severe type of sleep apnoea entitled principal sleep apnoea happens as soon as the quota of the brain accountable for directing inhalation does not recall to initiate the upper body muscles and diaphragm to start inhalation (Stoepker, 2010).

Interpretations of wheezing occurrence do not expose the occurrence of disruptive sleep apnoea amongst university undergraduates. The interpretations suggest that this condition might not be frequent amongst young strong university undergraduates as it is occasionally expected (Hershner & Ronald, 2014).

There is increased occurrence of disruptive sleep apnoea in fat people but does not completely justify for the augmented quantities of daylight drowsiness in people (Slater & Steier, 2012).

2.5.3 Narcolepsy

The term Narcolepsy is added unrest change where an individual instrument prettifies overly sleepy headed during the waking hours (Searle, 1995). Narcolepsy is regarded as a nervous condition, which results from the mentality's incapability to correctly set quietus and ignite cycles. Due to this, people excruciation from narcolepsy braving haphazard, overwhelming bouts of rest. As shortly as the impulse to rest becomes too zealous, an individual will doze off to sleep at anywhere from a few seconds up to any proceedings. In dicey cases, a mortal may come dozy for a minute or more (National Institute of Neurological Disorders and Stroke, 2009).

Laterally with daylight nap bouts, there are three another starring symptoms that characterise narcolepsy. An early sign that often times occurs in agreement with narcolepsy is cataplexy, which is an impulsive experience of charitable force manner. The subsequent sign is bright illusions that occur when initiating sleep or instantly once waking in the dawn. Last but not least indication is occurrences of transitory paralysis of the whole body either preceding to dozing to sleep or instantly before getting up of bed. Diagnosing of Narcolepsy commonly takes ten to fifteen years to detect an individual after recognising the primal of these indications. Despite the fact that investigation has created countless retorts to queries about the living process tangled with narcolepsy, the cause of it remains mysterious. Most scholars are doubtful that an amalgamation of issues involving sleep turbulences and

neurological dysfunctions could be liable for the cause of narcolepsy (National Institute of Neurological Disorders and Stroke, 2009).

The sleep disorder, Narcolepsy with cataplexy is rare. Narcolepsy affects roughly very small percentage of the entire inhabitants in Europe and United States of America (Panossian & Avidan, 2009). The occurrence ranges from as little as 0.002% in Israel to 0.15% in Japan (Panossian & Avidan, 2009).. Narcolepsy may be present at any age but it is typically diagnosed before age 25 years. In terms of gender occurrence, men are slightly more probable to be affected than Women (Panossian & Avidan, 2009).

Asymmetrical nap schedules, afternoon drowsiness, and sleep withdrawal are exceedingly widespread amongst institution undergraduates with most of them reporting daytime sleepiness whilst the majority attained insufficient sleep (Hershner & Ronald, 2014). The concerns of nap deficiency and afternoon drowsiness are particularly challenging to university learners. This may end up in worse grade point means, increased threat of educational disappointment, conceded learning, weakened mood and amplified threat of motor vehicle coincidences (Hershner & Ronald, 2014).

2.6 Association between Smart Mobile Device usage Duration and Excessive Daytime Sleepiness, Sleep Duration and Sleep Quality

The findings from Rensselaer Polytechnic Institute's Lighting Research Center established that clever movable phones can extremely disturb nap rounds (Khan, 2008).

Mobile phone usage is evolving as an imperative issue which affects with equally sleep excellence and magnitude, mainly as clever movable phones become extensively obtainable to teenagers (Adams et al., 2013). The use of movable processing devices, and TVs on larger quantities has been linked to hindered sleeping and waking strategies and

wake lag with possibly harming healthiness and instructive results (Gamble et al., 2014). A study conducted by Adams & Kisler, (2013), examined two key things; associations between technology use for the period of nap time, nap excellence, and hopelessness or nervousness and wakeful time due to technology consumption, reviewed that out of a total of 236 university learners, most of them testified nocturnal-time getting up to answer text transcript messages whiles some testified getting up to answer movable phone requests. According to the same authors, regression interpretations designated that higher stages of technology use before and after the inception of siesta anticipated worse sleep excellence. Moreover, Adams & Kisler (2013) continued that sleep quality was a mediator between technology use after the onset of sleep and depression/anxiety. They concluded that College students who had difficulty setting restrictions around technology use could be at high risk for psychological health concerns (Adams & Kisler, 2013).

Several adolescents used many forms of technology late into the night and at the same time drank coffee drinks. Consequently, the ability of the adolescents to stay attentive and completely efficient during the daylight was decreased by extreme afternoon drowsiness (Calamaro, Mason, & Ratcliffe, 2015). Sleepiness was extra common in those who reported symptoms of hopelessness or nervousness conditions and significantly influences their quality of life (Slater & Steier, 2012).

Youngsters consumed a greater volume of time through the day and at sleep time using digital gadgets. Bedtime and daytime use of digital gadgets were equally associated with sleep procedures, with an augmented threat of long nap onset latency, short sleep duration,

and amplified sleep insufficiency (Hysing, et al., 2015). Other vulgar manifestations of period drowsiness include inadvertent slumbering and going to sleep at unsuitable periods during the daytime. Specified exuberant somnolence can make multiethnic and occupational difficulties as symptomless as low attentiveness (Ancoliisrael, 2010).

Extreme afternoon drowsiness is a major community health issue with its incidence in the public projected to be as great as eighteen percent. Drowsiness is triggered by irregular nap quality or quantity. Threat issues for extreme drowsiness include heaviness, hopelessness, old age and inadequate sleep (Slater & Steier, 2012).

Adverse special effects were discovered amongst nap quality, daytime drowsiness and nap length and augmented interface displays watching of diverse types of digital gadgets (Mak et al., 2014).

Deprived nap excellence is associated with prehypertension in strong adolescents. Scarce nap quality is related to high lifeblood pressure (Javaheri et al., 2008).

2.7 The relationship between the usage of smart mobile devices and sleeping disorders

Absence of sufficient nap accumulation over a period of time may result to more sleep liability. This may lead to bigger negative concerns among individuals. People may not be able to concentrate very well due to the impact of lingering nap deficit as a result of the accumulation of sleep debt (Dehmler, 2009). There are many negative consequences of nap insufficiencies comprising of school absenteeism, drowsiness, weariness, reduced incentive, and trouble directing attention, feeling and performance. Nap insufficiencies may trigger someone to have trouble with continuous thoughtfulness, intellectual

promptness and exactness, operational reminiscence, feedback time, and overall interactive capability, often deprived of the nap depressed individual being conscious of the insufficiencies (Dehmler, 2009). Common symptoms of prolonged nap deficiency comprise of petulance, trouble focusing or making judgments, deficient of short-range memory retention. Outcomes of further current research study designate that nap deficit may be connected to augmented vulnerability to corporate viral ailments, diabetes, heaviness, cardiovascular ailment, and hopelessness (Dehmler, 2009).

Information Technology use close to bedtime is exceedingly common in United States of America (Gradisar et al., 2013). Amongst a variety of information communication skills, communicating high-tech gadgets are greatest powerfully related to nap grievances (Gradisar et al., 2013). Information communication skill practice through bedtime duration was much sophisticated than imagined by the researchers. Examination of diverse year groups confirmed that individuals who practice information communication technologies in the last minute before going to bed were younger than thirty years old (Gradisar et al., 2013). The same groups also reported the biggest amount of sleep disorders. The various findings suggested that information skill practice is evolving as a conceivable causative issue to nap disruption in the 21st era (Gradisar et al., 2013).

Young male adults play electronic portable games and use the Internet more frequently than young female adults whose clever movable phone usage, which was more exhaustive. Information Technology usage is connected with lowly professed wellbeing mostly simply when it harmfully exaggerated napping habits which is also linked with amplified wake up

time weariness. The relations are sex explicit particularly amongst young adults (Raija-Leena, 2006).

The effect of information communication skill on nap is a subject of massive concern in current media and must be made easily accessible to the whole community in a thoughtful style to provide persons opportune contact to recent tendencies (Adams et al., 2013).

Majority of studies reviewed (such as Gradisar et al., 2013;Adams et al., 2013) tend to explore the use of mobile phones or smart mobile phones and its association with sleep complaints or disturbances and disorders. The new thing that this study seeks to address is to determine the level of all smart mobile devices usage and their impact on sleep complaints or disturbances leading to a poor sleep quality among health trainees. Since smart mobile phone is not the only smart mobile device, this study would consider all smart mobile devices and their impact on sleep quality that could lead to any sleep disorder.

2.8 Pittsburgh Sleep Quality Index (PSQI)

The PSQI has a great test and retest dependability and a decent legitimacy for clients with primary sleeplessness (Backhaus et al., 2002). The PSQI assesses nap quality and disruption from the past over a month dated using individual information (Buysse et al., 1989). The reading defined nap in a diverse section of breast tumor clients by using the PSQI and observed the association between nap disruption and wellbeing related worth of lifetime (Fortner et al., 2002).

The PSQI examines the worth of sleep over the previous month and comprises of nineteen items of individual evaluation, the overall total ranges from zero to twenty-one, the lower mark the better quality of sleep. Participants with decent sleep quality (good sleepers) are

those with marks under five, and those with reduced sleep quality display marks over five (poor sleepers) (Mesquita & Reimão, 2007). The PSQI is purposely used to calculate sleep and extreme afternoon drowsiness in older age grownups (Spira et al., 2012). The PSQI was developed with several goals; (i) to provide a reliable, valid and standardised measure of sleep quality; (ii) to discriminate between ―good‖ and ―poor‖ sleepers; (iii) to provide and index that is easy for subjects to use and for clinicians and researchers to interpret; and (iv) to provide a brief, clinically useful assessment of a variety of sleep disturbances that might affect sleep quality (Buysse et al., 1989). The

Index comprises 19 items, which measure different sleep problems during the last month. There are seven subscales: subjective sleep quality, sleep latency, sleeps duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. A total score, ranging from 0 to 21, can be calculated by summing the score for each subscale, a high score indicating more severe problems. The index has been validated in several samples (Buysse et al., 1989)

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter deals with the research methods used for this particular study. In other words, the chapter on research methodology, which covers areas such as:

- Research design
- Population and sample
- Research instrument
- Procedure for data collection

3.2 Research Design

Cross-Sectional study design was used to assess the evidence of relationship between smart mobile device usage and sleep duration, subjective sleep quality, daytime sleepiness, and sleep quality index, of respondents as well as their demographic characteristics. Numerical responses on surveys using questionnaire was used to gather data from respondents for assessment.

This study design was adopted because the researcher wanted to compute the sleep quality index of the respondents and their usage of smart mobile devices to ascertain if there was any effect of using smart devices, which could inhibit the sleep pattern of the respondents at a point in time. The internationally accepted tool for assessing sleep quality index from the Pittsburgh University was used to determine the score of respondents‘ sleep quality index. The Pearson correlation was also used to assess the evidence of any relationship

between using smart devices and sleep quality index of the respondents. The results obtained from this study was compared with a pilot study survey conducted among trainees at Techiman Nurses' Training College to ascertain the reliability and validity of the results obtained for generalization.

3.3 Study Population and Sampling

The research was conducted at the College of Health and Well-being among the trainees from different programme of study comprising a sample of 500 students. Stratified sampling method was used to group the health trainees based on their gender (male and female). The males formed about sixty percent (60%) whiles females formed about forty percent (40%) of the total population of the school. Simple random sampling method was then used to select five hundred (500) health trainees (males and females) based on their proportions of the main population. The respondents were chosen for convenience, ease of access and availability to cooperate with the study.

Four hundred and ninety (490) of the respondents responded and completed the questionnaire. The response rate was ninety-eight percent (98%) comprising of two hundred and one (201) females and two hundred and eighty-nine (289) males. An online sample size was used to estimate the sample with a confidence level set at 99%, margin of error set at 5% and a population size of two thousand (2000), the sample size was estimated at five hundred (500).

Pilot study sample size of two hundred (200) health trainees was selected randomly comprising of one hundred and ten (110) females and ninety (90) males from the Techiman Nurses' Training College.

3.4 Data Collection Methods / Instruments

A standardised questionnaire from the Pittsburgh University was used to assess the sleep quality of the respondents and a self-designed questionnaire using the likert scale reference standard was also used to collect data on smart devices and their usage. The inclusion criteria were as follows: all second and third year students of any age from College of Health and Well-being and was ready to answer the Pittsburgh Sleep Quality Index (PSQI) after sample selection. Pittsburgh Sleep Quality Index was used to evaluate the sleep-wake cycle pattern (the usual sleeping and waking time) of the Participants to determine the prevalence of sleep disorders.

The standardized PSQI questionnaire which includes 19 closed-ended questions was used to measure and provide information about habits and sleep quality of the Participants on sleeping and waking time during the last month (Buysse et al., 1989). The same questionnaire was used for the Pilot study survey.

3.4.1 Questionnaire

Pittsburgh Sleep Quality Index

The Pittsburgh sleep quality index questionnaire was used to determine the sleep quality index score of the respondents. The respondents were given a consent form to fill together with the Pittsburgh Sleep Quality Index form.

3.5 Validity and Reliability

The PSQI was initially read along with the students, allowing doubt clarification.

Majority (98%) of the respondents completed the questionnaire accurately and submitted them. The respondents were all literate and understood the questionnaire well before answering the questions. The sample size was large enough to represent the entire population in terms of gender, age and programme of study.

3.6 Data analysis and interpretation

Data collected were analysed with the aid of Microsoft Access 2010 to determine Pittsburgh sleep quality index scores of the respondents. This was done through the use of some logical programming _if statements‘ that was able to compute the scores of respondents‘ sleep quality index. The Pittsburgh sleep quality index scores of respondents, the demographic data of respondents, and their smart mobile device usage responses were analysed using Statistical Package of the Social Sciences (SPSS). Data were interpreted using chi-square testing to assess the relationship between the variables into tables (e.g. smart device usage and PSQI scores). Graphpad prism version six was used to interpret data into graphs. The results or findings were presented using frequency tables and graphs for proper interpretation (Appendix A).

3.6.1 Body Mass Index (BMI) Calculation

The weight of the respondents were taken using the bath room weighing scale. The heights of the respondents were also taken using a tape measure mounted on a wall. The total length was up to two metres long.

The body mass index of the respondents was calculated by dividing weight of the respondents by the height squared. The Obesity index was categorized as; Underweight, healthy weight or normal weight, Overweight and Obese.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1.1 Demographic Characteristics

The College of Health and Well-Being is one of the biggest health training institutions in Ghana. It has a population of two thousand (2000). Majority (60%) of the Trainees are males whiles the minority (40%) form the females probably due to the preventive nature of the training at the college. The general characteristics of the study population are shown in Table 4.1. The age range of the respondents was between 19 to 42 years. The majority fall between the age twenty to twenty-five years (64.3%). Only 8% of the respondents were below the age of 20 years. The males formed 59% of the total respondents. The various programmes of study at the College were all involved in the study. The second year group formed the majority of the respondents (71%). Most of the respondents had a normal or healthy weight (57%) with 2.4% being underweight and 12% of them being obese (Table 4.1).

Table 4.1: General Demographic Information of Respondents

Parameter	Frequency (N=490)	Percentage (%)
Age Range		
<20 years	8	1.60
20 - 25 years	315	64.30
26 - 30 years	120	24.50
>30 years	47	9.60
Gender		
Male	289	59.00
Female	201	41.00
Course Distribution		
Health Information	101	20.60
Disease Control	101	20.60
Nutrition	77	15.70
Direct Medical Assistant	55	11.20
Health Promotion	49	10.00
Field Technician	52	10.60
Health Records Management	55	11.20
Year of Study		
2nd year	348	71.00
3rd year	142	29.00
Obesity Index		
Underweight	12	2.40
Healthy Weight	282	57.60
Overweight	137	28.00
Obese	59	12.00

Data is presented in frequencies and percentages

4.1.2 The Types and Usage of Smart Mobile Devices among the Respondents

The type of smart mobile devices used mostly by respondents was smart mobile phone (93.3%). Females use smart mobile phones than males, 94.5% and 92.4% respectively (Table 4.2). The females‘ use of tablet computers was significantly higher than males (pvalue <0.05). Males‘ use of video game consoles was rather significantly higher than females (p-value<0.01). The two groups did not differ significantly (p=0.464, p=0.519 and p=0.102) when it comes to the use of smart mobile phones, mobile computers and electronic music devices respectively (Table 4.2).

The respondents use their smart mobile devices for different types of activities (Table 4.3). The results show that males browse on the Internet with their smart mobile devices, which is significantly higher than females browsing on the Internet with their smart mobile devices (p<0.01). The study also confirmed that respondents use their smart mobile phones for activities such as reading e-books/news (p=0.01), assessing emails (p=0.009), and facebooking (p<0.05) of males than females (Table 4.3). Females however, performed whatsapping activity significantly (p=0.054) more than males with their smart mobile devices. However, the respondents did not use their smart mobile phones to perform activities such as playing video games (p=0.108), doing assignment (p=0.311), making/receiving calls (p=0.477), listening to music (p=0.704), and watching movie (p=0.925) (Table 4.3). Majority of the respondents use smart mobile phone to perform

activities such as whatsapping (76.5%), browsing on the Internet (73.2%), making/receiving calls (68.1%) and listening to music (59.9%) (Table 4.4).

Table 4.2: Ownership of Smart Mobile devices by Sex

Parameters	**Total/% n/%**	**Males n/%**	**Females n/%**	***P-Value***
Smart mobile phone	457(93.30)	267(92.40)	190(94.50)	0.464
Mobile Computer	227(46.30)	130(45.00)	97(48.30)	0.519
Tablet	57(11.60)	25(8.70)	32(15.90)	0.015
Electronic music device	64(13.10)	44(15.20)	20(10.00)	0.102
Video game console	23(4.70)	20(6.90)	3(1.50)	0.004
Others	19(3.90)	11(3.80)	8(4.00)	1.000

Table 4.3: Use of Smart Mobile devices by Sex

Parameters	Total n/%	Males n/%	Females n/%	*P-Value*
Browsing on the Internet	378(77.10)	238(82.40)	140(69.70)	0.001
Watching movie	193(39.40)	113(39.10)	80(39.80)	0.925
Making/Receiving Calls	352(71.80)	204(70.60)	148(73.60)	0.477
Playing video games	119(24.30)	78(27.00)	41(20.40)	0.108
Reading e-books/news	145(29.60)	98(33.90)	47(23.40)	0.012
Assessing emails	144(29.40)	98(33.90)	46(22.90)	0.009
Listening to music	309(63.10)	180(62.30)	129(64.20)	0.704
Doing assignment	269(54.90)	153(52.90)	116(57.70)	0.311
Whatsapping	388(79.20)	220(76.10)	168(83.60)	0.054
Facebooking	253(51.60)	160(55.40)	93(46.30)	0.043

Table 4.4: Types of Smart Mobile Devices and their uses by Respondents

Parameters	Smart Mobile Phone n/%	Mobile Computer n/%	Tablet n/%	Electronic music device n/%	Video game console n/%	Others n/%
Browsing on the Internet	358(73.20)	182(37.20)	48(9.80)	56(11.50)	18(3.70)	12(2.50)
Watching movie	188(38.40)	130(26.60)	24(4.90)	31(6.30)	9(1.80)	13(2.70)
Making/Receiving calls	333(68.10)	174(35.60)	42(8.60)	51(10.40)	16(3.30)	11(2.20)
Playing video games	112(22.90)	64(13.10)	13(2.70)	23(4.70)	16(3.30)	8(1.60)
Reading e-books/news	136(27.80)	84(17.20)	16(3.30)	19(3.90)	5(1.00)	9(1.80)
Assessing emails	136(27.80)	86(17.60)	22(4.50)	27(5.50)	7(1.40)	10(2.00)
Listening to music	290(59.90)	162(33.10)	41(8.40)	53(10.80)	12(2.50)	10(2.00)
Doing assignment	254(51.90)	144(29.40)	35(7.20)	40(8.20)	10(2.00)	12(2.50)
Whatsapping	374(76.50)	181(37.00)	48(9.80)	56(11.50)	19(3.90)	12(2.50)
Facebooking	244(49.90)	122(24.90)	33(6.70)	43(8.80)	10((2.00)	10(2.00)

4.1.3 The Prevalence of Primary Insomnia among the Respondents

The prevalence of poor sleepers (primary insomnia) among the respondents was (52.24%) and this formed the majority of the respondents. There was a significant association between both the type of course and year of study of the respondents with poor sleepers ($p<0.01$). Health Information programme respondents had the highest rate of poor sleepers (21.88%) (Table 4.5). Respondents in the second year group formed the majority (77.34%) of the poor sleepers (primary insomnia).

Age of respondents ($p=0.120$), gender ($p=0.140$), and obesity index ($p=0.827$) chisquare testing did not show any strong association with poor sleepers (primary insomnia). Table 4.5 clearly shows that there are poor sleepers (primary insomnia) among the respondents.

Table 4.5: Prevalence of Insomnia among Respondents

Parameter	**Frequency**	**Percentage (%)**	***P-Value***
Total Poor Sleepers	256	100	
Age Range			
<20 years	6	2.34	0.120
20 - 25 years	160	62.50	
26 - 30 years	59	23.05	
>30 years	31	12.11	
Gender			
Male	159	62.10	0.140
Female	97	37.90	

Course			
Health Information	56	21.88	0.001
Disease Control	42	16.41	
Nutrition	39	15.23	
Direct Medical Assistant	29	11.33	
Health Promotion	30	11.72	
Field Technician	39	15.23	
Health Records Management	21	8.20	
Year of Study			
2nd year	198	77.34	0.001
3rd year	58	22.66	
Obesity Index			
Underweight	7	2.73	0.827
Healthy Weight	147	57.42	
Overweight	74	28.91	
Obese	28	10.94	

4.1.4 Association between Smart Mobile Device Usage Duration and Excessive Daytime Sleepiness, Sleep Duration and Sleep Quality

Table 4.6 shows the association between smart mobile device usage duration and excessive daytime sleepiness sleep duration and sleep quality. The minutes spent on smart mobile device before a respondent fell asleep had a significant positive correlation with sleep duration ($p<0.01$), daytime dysfunction ($p<0.01$), and subjective sleep quality ($p<0.01$). How often respondents had trouble sleeping due to use of smart mobile device 30 minutes before bed was significantly associated with sleep duration

($p<0.05$), sleep disturbance ($p<0.05$), daytime dysfunction ($p<0.01$) and subjective sleep quality ($p<0.01$). How often respondents woke up in the middle of their sleep to use their smart mobile devices significantly correlated with only daytime dysfunction ($p<0.05$) and subjective sleep quality ($p<0.01$).

The number of times that respondents woke up when sleeping due to their smart device had some significance difference with daytime dysfunction ($p<0.01$) and subjective sleep quality ($p<0.01$).

Table 4.6: Partial correlation coefficients of PSQI and Smart mobile device usage by Respondents.

Parameters	MSDA	HOTSDSD	HOWMSSD	HMTWSSD	SD	SDB	SL	DD	HSE	SSQ	UOM	PSQI
MSDA		0.24**	0.15**	0.18**	0.10**	0.06	0.18**	0.16**	0.12**	0.11**	0.06	0.22**
HOTSDSD			0.28**	0.24**	0.08*	0.09*	0.21**	0.17**	0.04	0.15**	0.00	0.21**
HOWMSSD				0.49**	0.06	0.07	0.08*	0.09*	-0.01	0.14**	-0.01	0.13**
HMTWSSD					0.05	0.04	0.12**	0.11**	0.03	0.13**	-0.01	0.14**
SD						0.09*	0.04	0.08*	0.20**	0.19**	-0.01	0.44**
SDB							0.18**	0.27**	0.04	0.24**	0.11*	0.43**
SL								0.17**	0.14**	0.15**	0.08	0.42**
DD									0.07	0.14**	0.10*	0.47**
HSE										0.09*	0.01	0.29**
SSQ											0.09*	0.47**
UOM												0.25**

MSDA-Minutes spent on device before fall asleep, HOTSDSD-How often had trouble sleeping due to use of smart device 30mins before bed, HOWMSSD-How often waken up in the middle of sleep to use smart device, HMTWSSD-How many times waken up when sleeping due to smart device, SD-Sleep duration, SDB-Sleep disturbance, SL-Sleep latency, DD-Daytime dysfunction due to sleepiness, HSE-Habitual sleep efficiency, SSQ-Subjective sleep quality, UOM-Use of Medication, PSQI-Pittsburgh Sleep Quality Index. P is significant at *0.05; **0.01

4.1.5 The relationship between the usage of smart mobile devices and sleeping disorders (Primary Insomnia)

Figure 4.1 depicts the relationship between the usage of smart mobile devices and Pittsburgh sleep quality index (PSQI). The Pittsburgh Sleep Quality Index scores for diagnosing insomnia of respondents were grouped in the following range for the quartiles (0-3, 4-5, 6-7 and 8-21), which was categorized as (Good sleepers, Fairly Good Sleepers, Moderate Insomnia and Severe Insomnia) respectively. A score of 0-5 indicates good sleepers whiles 6-21 indicates poor sleepers (primary insomnia). The scores were further grouped into quartiles and related to the usage of smart mobile devices. The impacts of the use of smart mobile devices were tested with chi-square to find any evidence of relationship between usage of smart mobile devices and poor sleepers (primary insomnia).

Figure 4.1 _A' shows the chi-square test results of the number of smart mobile devices used and PSQI scores. There was evidence of a linear by linear relationship (p-trend =0.008). Those who used more than two smart mobile devices fell more in the moderate insomnia and severe insomnia (poor sleepers).

Figure 4.1 _B' shows the results of the Pilot study survey from the Trainees of Techiman Nurses' Training College. This was the results of the chi-square testing of the number of smart mobile devices used and PSQI scores. There was also strong evidence of a linear by linear relationship (p-trend < 0.01). Those who used more smart mobile devices experienced moderate and severe insomnia (poor sleepers).

Figure 4.2 _A' shows the chi-square test results of the number of activities respondents performed with their smart mobile devices and PSQI scores. There was no substantial evidence of a linear by linear relationship (p-trend = 0.490).

Nevertheless, respondents who used more smart mobile devices also fell in the fairly good sleepers, moderate insomnia and severe insomnia. Respondents who used four devices or more formed the majority of the respondents in the severe insomnia category (poor sleepers).

Figure 4.2 _B' shows the results of the Pilot study survey from the Trainees of Techiman Nurses' Training College. This was the results of the chi-square testing of the number of activities respondents performed with their smart mobile devices and PSQI scores. There was also evidence of a linear by linear relationship (p-trend < 0.045). Those who performed more activities with their smart mobile devices experienced moderate and severe insomnia (poor sleepers).

A: Results from College of Health Trainees (Main Work)

B: Results from Techiman Nursing College Trainees (Pilot study)

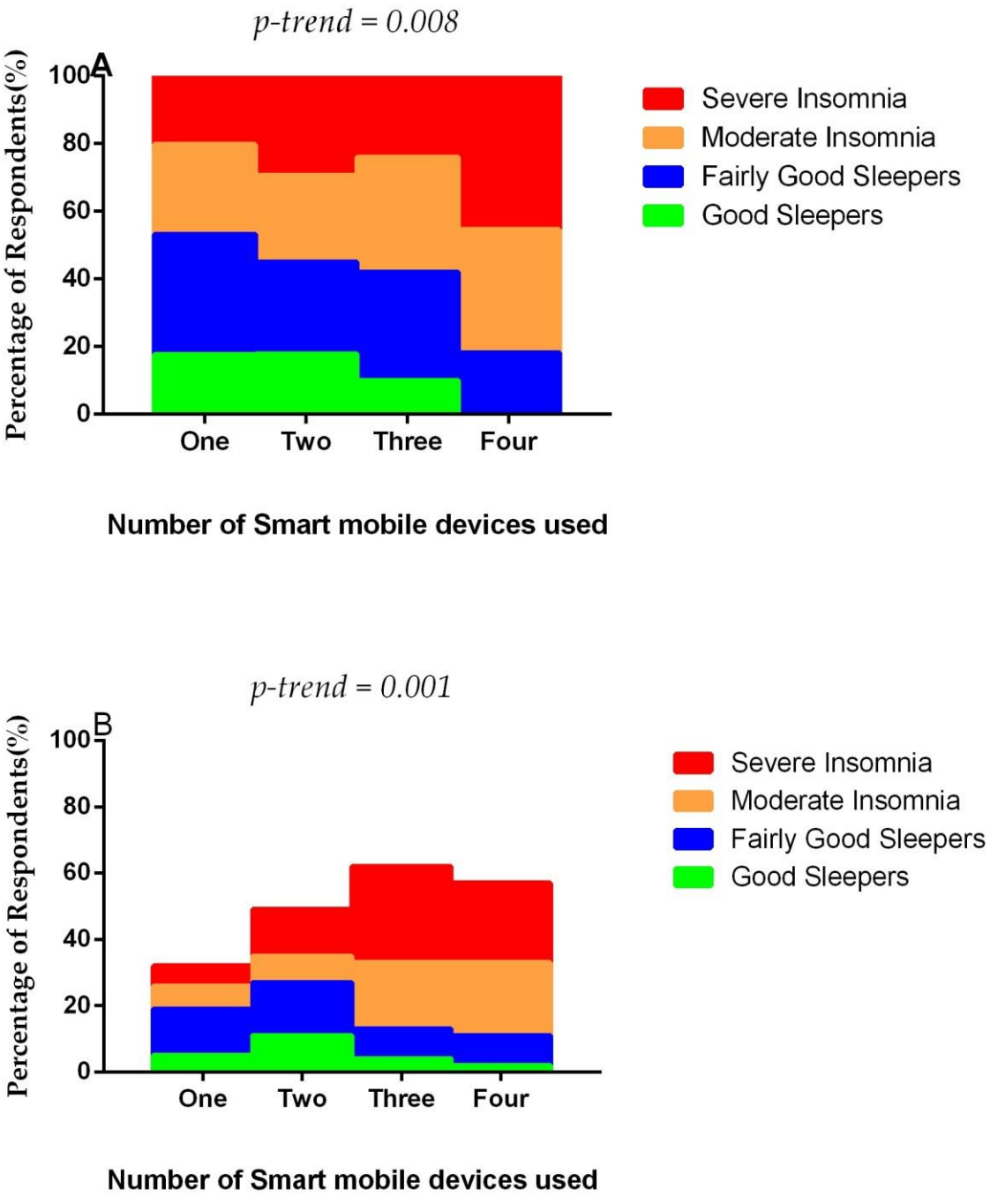

Figure 4.1: The relationship between the number of smart mobile devices used and sleeping disorders (Primary Insomnia)

A: Results from College of Health Trainees (Main Work)

B: Results from Techiman Nursing College Trainees (Pilot study)

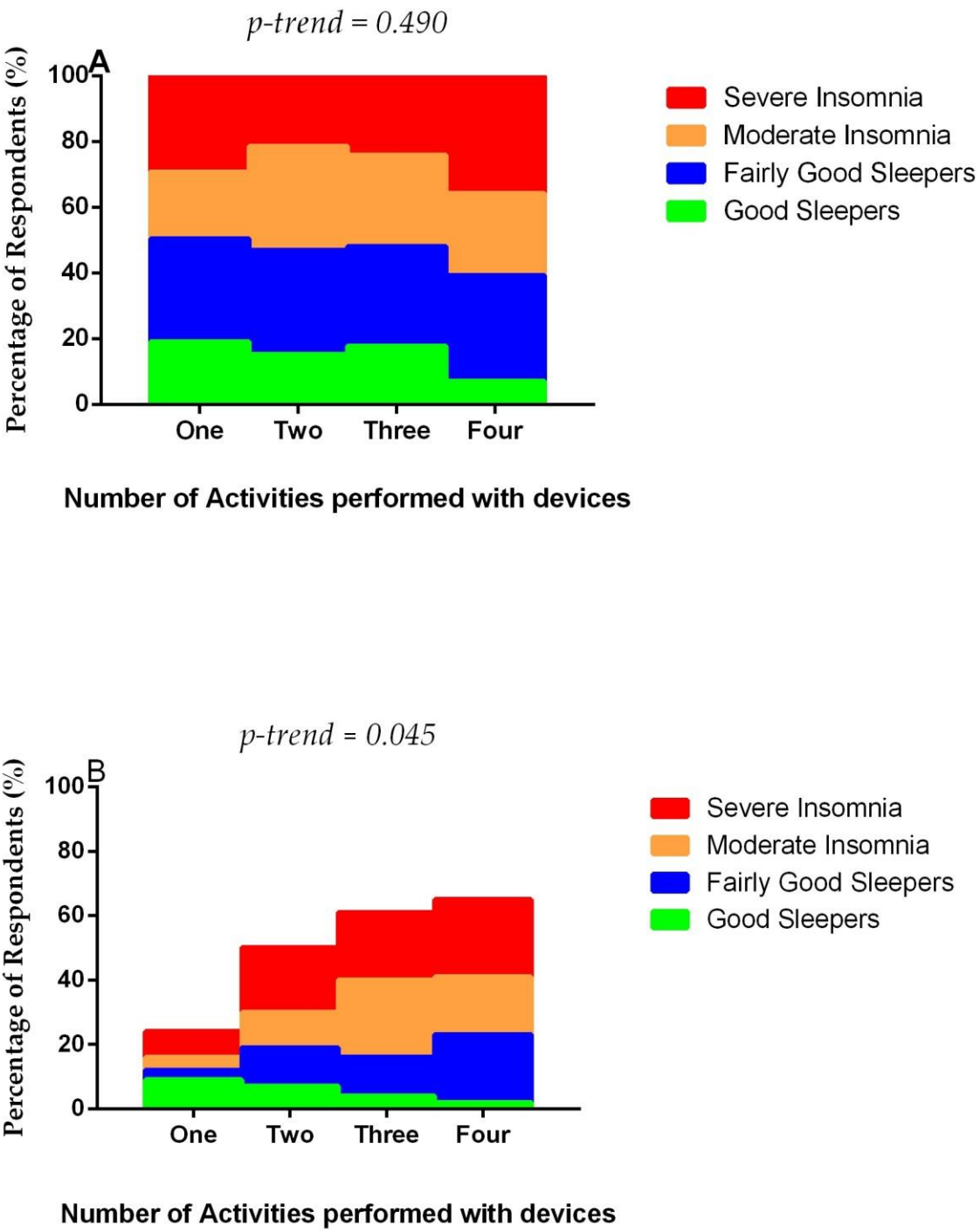

Figure 4.2: The relationship between the activities performed with the smart mobile devices and sleeping disorders (Primary Insomnia).

4.2 DISCUSSION

4.2.1 Types and Usage of Smart mobile devices among the Respondents

There were a lot of smart mobile devices that respondents used at their various hostels and everywhere on the school premises. The type of smart mobile device used mostly by respondents was smart mobile phone, which recorded a little over ninety-three percentage (93.3%) (Table 4.2). This confirms the prevalence of smart mobile phone everywhere in the world, which was stated in the research by (Kinser, 2015). Approximately eighty percent (80%) of the world populations use smart mobile phones of which the United States of America has about 91.4 million users of smart mobile phone (Davey & Davey, 2014). The usage of wireless, mobile, and portable digital devices is growing in all major sectors, as well as health institutions and colleges of education. The escalation in smart mobile phone usage has gradually drawn most healthcare trainees‘ and patients‘ thoughtfulness to smart phones capability as a promoter of health promotion through education in Ghana (Aryee, 2014).

More females (94.5%) used smart mobile phones than males (92.4%). This was contrary to what was reported by Davey & Davey, (2014) who stated that males used smart mobile phones than females. Majority of health trainees currently have smart phones and use applications with a trend rising (Franko & Tirrell, 2012). Perhaps there could be some extraneous variables that might be causing the differences in results. Moreover, smart mobile phones are not very expensive as compared to previous years when it was a prestige to use a smart device. Mobile computers

(laptops, notebooks, netbooks) were the second highest smart mobile devices used by the respondents (46.30%) (Table 4.2). It is significant to note that young adults who are under thirty years of age are

considerably more expected than all other adults to own a netbook, and notebooks. Adults between the ages of eighteen to twenty-nine years formed the majority of laptop owners. Smart mobile phones and computer ownership proportions increase with rising educational attainment and richness (Lenhart et al., 2010).

Tablet computer was not the most used smart mobile device by respondents but it was discovered that females used the smart device more than males. The present study showed that more females used tablet computer more than their males' counterpart ($p<0.05$). Males patronise playing video games than females was confirmed with the correlational results that proved that males used video game consoles more than females ($p<0.01$). The two groups did not differ significantly ($p=0.464$, $p=0.519$ and $p=0.102$) when it comes to the use of smart mobile phones, mobile computers and electronic music devices respectively. This indicates that gender does not matter or influence the use of smart mobile phones, mobile computers such as (laptops, notebooks and netbooks) especially among the young adults since the majority of the respondents were young adults.

The respondents used their smart mobile devices for different types of activities. From table 4.3 males browse on the Internet with their smart mobile devices, which is significantly ($p<0.01$) evidential than females browsing on the Internet with their smart mobile devices. Majority (84%) of smart phone users in the world use their smart device for browsing on the Internet (Davey & Davey, 2014). The study also confirmed that respondents mainly males used their smart mobile phones for activities such as reading e-books/news ($p=0.01$), assessing emails ($p=0.009$), and facebooking ($p<0.05$) than females. Study has shown that most (92%) smart phone users in the world used their smart phone for text messaging. There was significant evidence that females performed whatsapping activity ($p=0.054$) more than males with their smart mobile devices. However, the respondents hardly

used their smart mobile phones to perform activities such as playing video games (p=0.108), doing assignment (p=0.311), making/receiving calls (p=0.477), listening to music (p=0.704), and watching movie (p=0.925) (Table 4.3). Majority of the respondents used their smart mobile phones to perform activities such as whatsapping (76.5%), browsing on the Internet (73.2%), making/receiving calls (68.1%) and listening to music (59.9%) (Table 4.4). This confirms the fact whatsapp messaging is indeed a very popular social media platform that helps people of all class to share information and communicate affectionately.

Males also patronised the using either of their smart devices for assessing facebook social media platform most of the times than females who preferred whatsapping. In all it can be concluded that respondents who were mostly within the young adult stage used smart mobile devices of various forms to perform a lot of activities such as whatsapping, facebooking, making calls/receiving calls, assessing emails, watching movies, browsing on the Internet, playing video games, reading e-books and listening to music. The most common smart mobile devices used by respondents were smart mobile phones, mobile computers (laptop, notebook, netbooks), tablet computers, electronic music device, video consoles and others.

4.2.2 Prevalence of sleeping disorders (primary insomnia) among the Respondents

The total score ranges from 0 – 21, 0-5 as good sleepers whiles 6-21 as poor sleepers. The total response rate was four hundred and ninety respondents. There are a lot of sleep disorders in the world but this research concentrated on insomnia since the Pittsburgh sleep index questionnaire can only be used to diagnose primary insomnia as

an example of sleep disorder. Most prevalent sleep conditions consist of insomnia, sleep apnoea, and narcolepsy (Searle, 2000). The prevalence of poor sleepers (primary insomnia) among the respondents was 256 (52.24%) out of a total of 490 respondents. This shows that a lot of the respondents have problem with their sleep or do not get enough quality sleep. Sleep conditions are exceedingly common in the overall populace and could resort to substantial illness. Sleep disturbances longlasting at least a number of nights per month have been reported by thirty percent of the United States of America citizens (Panossian & Avidan, 2009). Sleep disorders may cause previous therapeutic and mental state conditions which are linked with extraordinary rates of hopelessness, nervousness, and weakened daylight functioning (Panossian & Avidan, 2009). Insomnia is one of the supreme recurrently occurring sleeping conditions in the world. Nearly one third of young adults and grownups are confronted by primary insomnia at a point during their existence (Mayo Clinic, 2009).

The respondents with poor sleep quality scores (poor sleepers) were grouped bases on the course of study to ascertain if the course that they are studying has any influence on their poor sleeping habits. They were also grouped based on the year of study or level of the respondents. The course distribution and year of study of the respondents had strong evidence of relationship with poor sleepers ($p<0.01$). This means that the course that the respondents are pursuing may have a negative link with their poor sleep. It could be that base on the level of study and the course of study a respondent may stay awake to learn during the night and this might have influence on the respondent‘s sleep quality index. It was not so surprising to discover that Health Information programme respondents had the majority of poor sleepers (21.88%) (Table 4.5). This is because their programme of study makes use of computers a lot for data processing and information dissemination and management. Studies from several scholars have

established the evidence that the hindrance of melatonin secretion rhythms and body heats have a relation with sleep inception sleeplessness (Lack, L., & Wright, 2007).

Second year group of the respondents formed the majority (77.34%) of the poor sleepers (primary insomnia). Common insomnia is mostly well explained as insufficient nap worth or trouble initiating sleep and above all supporting sleep for a month and beyond (Randall et al., 2008).

The ages, gender and obesity index of the respondents who were poor sleepers were compared with their sleep quality index score through chi-square testing. The ages of the respondents (p=0.120), gender (p=0.140), and obesity index (p=0.827) showed any weak evidence of any relationship with poor sleepers (primary insomnia) sleep quality index scores. This means that ages of respondents, gender of respondents and obesity index of respondents did not have much influence on the respondents being poor sleepers or having insomnia. Table 4.5 clearly showed that there are poor sleepers (primary insomnia) among the respondents. Other causes which may largely be responsible for sleep-onset insomnia are stress, anxiety, depression, and caffeine, and a host of others which are unknown (Mayo Clinic, 2009).

4.2.3 Association between Smart Mobile Device Usage Duration and Excessive Daytime Sleepiness, Sleep Duration and Sleep Quality

The excessive use of smart mobile devices has become an alarming issue throughout the world at large. A lot of teenagers and young adults have become addicted to using these smart mobile devices. The excessive use of these smart mobile devices can extremely disturb the sleep duration of users (Khan, 2008).

The results of this research from table 4.6 showed the association between smart mobile device usage duration and excessive daytime sleepiness sleep duration and sleep quality. Correlational matrix was used to determine the evidence of any significance relationship that exist between using smart mobile devices excessively and having trouble sleeping and feeling sleepy during the day. The minutes spent on smart mobile device before a respondent fell asleep had a strong evidence of relationship with sleep duration ($p<0.01$), that is respondents could not sleep for longer period due the use of their smart mobile devices. For instance instead of a respondent spending about eight hours to sleep, the excessive use of the smart mobile devices can reduce the time of actual sleep to about five hours. The number of minutes a respondent spent on his or her smart mobile devices also had an evidence of relationship with respondents spending less time sleeping. How often respondents had trouble sleeping due to the use of their smart mobile devices 30 minutes before bed affected their sleep duration significantly. Youngsters consumed a greater volume of time throughout the day and at sleep time using digital gadgets. Bedtime and daytime use of digital gadgets were equally associated with sleep procedures, with an augmented threat of long sleep onset latency, short sleep duration, and amplified sleep insufficiency (Hysing, et al., 2015). Daytime dysfunction due to excessive sleepiness was also compared with the minutes respondents spent on smart mobile devices before falling asleep, how often respondents had trouble sleeping due to the use of smart mobile devices 30 minutes before bed, how often respondents woke up in the middle of their sleep to use smart mobile devices and how many times respondents woke up when asleep due to their smart mobile devices all had strong evidence of relationship ($p<0.01$ as shown in table 4.6) that caused respondents to feel sleepy during the day. Extreme afternoon drowsiness is a major community health issue with its incidence in the public projected to be as great as

eighteen percent. Drowsiness is triggered by irregular nap quality or quantity. Threat issues for extreme drowsiness include heaviness, hopelessness, old age and inadequate sleep (Slater & Steier, 2012).

The respondents were asked to grade their own sleep quality which is termed as subjective sleep quality. Respondents subjective sleep quality had strong evidence of relationship with the minutes respondents spent on smart mobile devices before falling asleep, how often respondents had trouble sleeping due to the use of smart mobile devices 30 minutes before bed, how often respondents woke up in the middle of their sleep to use smart mobile devices and how many times respondents woke up when asleep due to their smart mobile devices. How often respondents had trouble sleeping due to use of smart mobile devices 30 minutes before bed was significantly associated with sleep duration ($p<0.05$), sleep disturbance ($p<0.05$), daytime dysfunction ($p<0.01$) and subjective sleep quality ($p<0.01$). How often respondents woke up in the middle of their sleep to use their smart mobile devices significantly correlated with only daytime dysfunction ($p<0.05$) and subjective sleep quality ($p<0.01$). The results in table 4.6 clearly showed that there was evidence of relationship between smart mobile device usage duration and excessive daytime dysfunction due to sleepiness, sleep duration and subjective sleep quality and this could lead to serious sleep disorders if not addressed quickly. Lack of sleep can seriously affect the academic performance of students and could even cause headaches and body pains and low self esteem.

Adverse special effects were discovered amongst nap quality, daytime drowsiness and nap length and augmented interface displays watching of diverse types of digital gadgets (Mak et al., 2014).

Deprived nap excellence is associated with prehypertension in strong adolescents. Scarce nap quality is related to high lifeblood pressure (Javaheri, Storfer-Isser, Rosen, & Redline, 2008). Extreme heaviness is connected to an augmented threat of sleep difficulties (Beebe et al., 2007).

4.2.4 Relationship between the usage of smart mobile devices and sleeping disorders (Primary Insomnia)

The Pittsburgh Sleep Quality Index (PSQI) standard questionnaire was given to respondents to answer and results were computed for all the respondents. The questionnaire can only be used to diagnose a patient, client, or respondent of insomnia. Other sleep disorders like obstructive sleep apnoea and narcolepsy need further clinical and psychological diagnosis in order to confirm the sleep disorder. These sleep disorders are more serious than insomnia. Figure 4.1 depicts the relationship between the usage of smart mobile devices and Pittsburgh sleep quality index (PSQI). The Pittsburgh Sleep Quality Index scores for diagnosing insomnia of respondents were grouped in the following range for the quartiles (0-3, 4-5, 6-7 and 821), which was categorized as (Good sleepers, Fairly Good Sleepers, Moderate Insomnia and Severe Insomnia) respectively. The Pittsburgh Sleep Quality Index scores were grouped into quartiles and categories (Good sleepers, Fairly good sleepers, Moderate insomnia and Severe insomnia). In two groupings a score of 0-5 indicates good sleepers whiles 6-21 indicates poor sleepers (primary insomnia). The quartiles represent whether a respondent‘s sleep quality fell under the following; good sleepers, fairly good sleepers, moderate insomnia and severe insomnia respectively according to the arrangement of the quartiles.

The number of smart mobile devices that respondents used before going to sleep was counted to know the total number of smart mobile devices that they used. The smart mobile devices were grouped as; 1, 2, 3 and 4 devices. The number of activities that respondents performed with their smart devices (whatsapping, facebooking, emailing, etc.) were also grouped into four (1-3, 4-6, 7-9 and 10-12 activities) as 1, 2, 3, and 4 respectively.

The quartiles of the insomnia levels were related to the usage of smart mobile devices usage. The impacts of the use of smart mobile devices were tested with chi-square to find any evidence of relationship between usage of smart mobile devices and poor sleepers (insomnia). From the figure 4.1 A and B, the quartiles are on the y-axis with colours; red representing 4^{th} quartile (severe insomnia), orange representing 3^{rd} quartile (moderate insomnia), blue representing 2^{nd} quartile (fairly good sleepers) and green representing 1^{st} quartile (good sleepers). Figure 4.1 A and B, showed the total number of smart mobile devices used by respondents are represented on the x-axis.

The linear–by-linear chi-square testing between the quartiles and the total number of smart mobile devices used by the respondents had a p-trend of 0.008 and <0.01 respectively indicating that there was evidence of relationship from the main work and the Pilot study results. This bring to the conclusion that the more smart mobile devices respondents used before sleeping had influence on their sleep quality level whether they have insomnia or not. Figure 4.1 section A and B, showed clearly that the respondents who used less number of smart mobile devices had good sleep quality whiles those who used three or more smart mobile devices fell more under moderate or severe insomnia. Small number of the respondents in figure 4.1 _B‘ who used up to four smart mobile devices had good sleep quality. Both results from figure 4.1 _A‘ and _B‘ showed

evidence of a linear by linear relationship (p-trend =0.008 and p-trend < 0.01) respectively. Those who used more than two smart mobile devices fell more in the 3rd and 4th quartiles (poor sleepers) in both surveys.

The activities that respondents performed with their smart mobile devices were also compared with the insomnia levels of respondents and were tested using chi-square to find any evidence of relationship. Figure 4.2 _A' showed the chi-square testing of the number of activities respondents performed with their smart mobile devices and PSQI scores. There was no substantial evidence of a linear by linear relationship (p-trend = 0.490) in the main survey but the survey from the Pilot study results showed evidence of relationship (p-trend = 0.045). Nevertheless, respondents who used more smart mobile devices also fell in the categories (fairly good sleepers, moderate insomnia and severe insomnia) 2nd, 3rd and 4th quartiles respectively in the main survey (figure 4.2 _A'). Respondents who used four or more devices formed the majority of the respondents in the 4th quartile (severe insomnia).

Absence of sufficient nap accumulation over a period of time may result to more sleep liability. This may lead to bigger negative concerns among individuals. People may not be able to concentrate very well due to the impact of lingering nap deficit as a result of the accumulation of sleep debt (Dehmler, 2009). There are many negative consequences of nap insufficiencies comprising of school absenteeism, drowsiness, weariness, reduced incentive, and trouble directing attention, feeling and performance. Nap insufficiencies may trigger someone to have trouble with continuous thoughtfulness, intellectual promptness and exactness, operational reminiscence, feedback time, and overall interactive capability, often deprived of the nap depressed individual being conscious of the insufficiencies (Dehmler, 2009). Common symptoms of prolonged nap

deficiency comprise of petulance, trouble focusing or making judgments, deficient of short-range memory retention. Outcomes of further current research study designate that nap deficit may be connected to augmented vulnerability to corporate viral ailments, diabetes, heaviness, cardiovascular ailment, and hopelessness (Dehmler, 2009).

This is the first time a study on the impact of smart mobile devices on sleep quality that can lead to a sleep disorder has been done in Ghana. The strength of the study was that the frequent use of different smart mobile devices had a positive relationship with those who had moderate insomnia, and severe insomnia levels according to their sleep quality index. The results from the main work was also compared with a survey data from a different health training school in the same region to proof the reliability of the results obtained from the min survey. However, prospective cohort studies could be carried out among other populations in Ghana to establish the actual relationship between smart mobile devices usage and sleep disorders.

CHAPTER FIVE

CONCLUSIONS RECOMMENDATIONS AND SUMMARY OF FINDINGS

5.0 Introduction

In line with the objective of finding the impact of smart mobile devices usage on sleep quality that might lead to a sleeping disorder (insomnia), it was discovered that the strength of the study was that the frequent use of different smart mobile devices had a positive relationship with those who had moderate insomnia, and severe insomnia levels according to their sleep quality index scores.

This chapter of the research work concentrates on the summary of the findings of the objectives, the conclusions and recommendation for further research study in this area.

5.1 Conclusion

1. This study revealed the evidence of the impact or effects of smart mobile devices on sleep quality that leads to insomnia but this cannot be used to measure causes and effect until an experimental research is done.
2. There was evidence of a linear by linear relationship between the frequency of the number of smart mobile devices usage and respondents with insomnia. The Pilot study survey results support the reliability and validity of the work done and the conclusion of this study.
3. The sleep quality worsens with increasing addiction of smart mobile device usage.

5.2 Recommendations

The following recommendations were based on the knowledge gained from this study:

1. It is important to conduct similar investigations at other tertiary institutions in other regions of Ghana in order to obtain regional prevalence of smart mobile devices usage addiction the link with sleep disorders among the youth of Ghana.
2. It is recommended that the guidance and counseling unit in health institutions and other tertiary institutions should educate students on the effects of smart mobile devices use addiction and the need to have good quality of sleep.

5.3 Recommendations for further studies

1. It is recommended that further studies should be conducted on the impact of smart mobile devices on sleep quality and its health implications on a larger study population.
2. Further studies should also be steered towards the effects of smart mobile devices on insomnia and the impact on students‘ academic performance in both senior high and tertiary education.
3. A prospective cohort studies should be carried out among other populations in Ghana to establish the actual relationship between smart mobile devices usage and sleep disorders.

5.4 Summary of findings

The majority of the respondents were males with the minority being females. The general characteristics of the study population are shown in table 4.1. The age range of the respondents was between 19 to 42 years with most of them falling between twenty

to twenty-five years (64.3%). Only 8% of the respondents were below the age of 20 years.

The main findings of the study based on the objectives are as follows;

1. The type of smart mobile device used most by respondents frequently was smart mobile phone (93.3%).
2. Primary insomnia was the most prevalent sleep disorder among the respondents (52.24%) and this formed the majority of the respondents.
3. The minutes spent on smart mobile device before a respondent fell asleep had a strong evidence of relationship with sleep duration ($p<0.01$), that is respondents could not sleep for longer period due to the use of their smart mobile device.
4. Daytime dysfunction due to excessive sleepiness was also compared with the minutes respondents spent on smart mobile device before falling asleep, how often respondents had trouble sleeping due to the use of smart mobile device, 30 minutes before bed. Frequency of respondents waking up in the middle of their sleep to use smart mobile device and how many times respondents woke up when asleep due to their smart mobile devices all had strong evidence of relationship ($p<0.01$ as shown in table 4.6) that caused respondents to feel sleepy during the day.
5. How often respondents had trouble sleeping due to use of smart mobile device 30 minutes before bed was significantly associated with sleep duration ($p<0.05$), sleep disturbance ($p<0.05$), daytime dysfunction ($p<0.01$) and subjective sleep quality ($p<0.01$). How often respondents woke up in the middle of their sleep to use their smart mobile devices significantly correlated with only daytime dysfunction ($p<0.05$) and subjective sleep quality ($p<0.01$).

6. The respondents who used up to four or more smart mobile devices had poor sleep quality. There was a strong evidence of a linear by linear relationship (ptrend =0.008). Those who used 2-3 smart mobile devices fell more in the 3rd and 4th quartiles (poor sleepers). This meant that the greater number of smart mobile devices respondents used, the more their sleep quality worsens.
7. The linear–by-linear chi-square testing between the sleep quality levels and the total number of smart mobile devices used by the respondents had a ptrend of 0.008 and <0.01 (Figure 4.1) respectively indicating that there was evidence of relationship from the main work and the Pilot study results.
8. The activities that respondents performed with their smart mobile devices were also compared with the insomnia levels of respondents and were tested using chi-square to find any evidence of relationship. Figure 4.2 section A showed the chi-square testing of the number of activities that respondents performed with their smart mobile devices and PSQI scores. There was no substantial evidence of a linear by linear relationship (p-trend = 0.490).

   Nevertheless, respondents who used more smart mobile devices also fell in the 2nd, 3rd and 4th quartile, which means that those who used more devices experienced some moderate and severe insomnia.
9. The Pilot study results showed evidence of linear-by-linear relationship (ptrend = 0.045) (Figure 4.2, Section B) of the number of activities performed by respondents with their smart devices and sleep quality levels.

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APPENDIX A

QUESTIONNAIRE

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DEPARTMENT OF  **COMPUTER SCIENCE** 

MASTER OF SCIENCE IN HEALTH INFORMATICS

QUESTIONNAIRE

I am **Mr. Owusu-Marfo Joseph**, a Master of Science student of the Department of Computer Science, Kwame Nkrumah University of Science and Technology, Kumasi. I am currently working on a thesis entitled: "Impact of the use of Smart Mobile Devices on Sleep Quality Among Health Trainees at College of Health and Well-Being, Kintampo". I require some information for this research work and would be glad if you could respond to this questionnaire. All information you provide, will be treated with utmost confidentiality and anonymity.

CODE #: **Date:** **Age:** **Weight:** **Height:**

Mobile: **POS:** **Level:** **BMI:** **Sex:**

Instructions:

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the Most accurate reply for the majority of days and nights in the past month.

Please answer all questions that are applicable by ticking (√) your answers where appropriate.

1. During the past month, when have you usually gone to bed at night? USUAL BED TIME:_____

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night? NUMBER OF MINUTES:_____

3. During the past month, when have you usually gotten up in the morning? USUAL GETTING UP TIME:_____

4. During the past month, how many hours of actual sleep did you get at night?(This may be different than the number of hours you spend in bed.)

HOURS OF SLEEP PER NIGHT:_____

For each of the remaining questions, check the one best response. Please answer all questions. 5.

During the past month, how often have you had trouble sleeping because you…

a. Cannot get to sleep within 30 minutes?

Not during the past month ☐ **Less than once a week** ☐ **Once or twice a week** ☐

b. Wake up in the middle of the night or early morning?

Not during the past month ☐ **Less than once a week** ☐ **Once or twice a week** ☐

c. Have to get up to use the bathroom?

Not during the past month ☐ **Less than once a week** ☐ **Once or twice a week** ☐

d. Cannot breathe comfortably?

Not during the **Less than** **Once or**

past month ☐ once a week ☐ twice a week

e. Cough or snore loudly?

Not during the past month ☐ Less than once a week ☐ Once or twice a week

f. Feel too cold?

Not during the past month ☐ Less than once a week ☐ Once or twice a week

g. Feel too hot?

Not during the past month ☐ Less than once a week ☐ Once or twice a week

h. Had bad dreams?

Not during the past month ☐ Less than once a week ☐ Once or twice a week

i. Have pain?

Not during the past month ☐ Less than once a week ☐ Once or twice a week

j. Other reason(s), please describe?

_____

How often during the past month have you had trouble sleeping because of this?

Not during the past month ☐ Less than once a week ☐ Once or twice a week

6. During the past month, how would you rate your sleep quality overall?

Very good ☐ Fairly good ☐ Fairly bad

7. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?

Not during the past month ☐ Less than once a week ☐ Once or twice a week

8. During the past month, how often have you had trouble staying awake while reading, eating, or engaging in social activity?

Not during the past month ☐ Less than once a week ☐ Once or twice a week

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

No problem at all Only a very slight problem

A very big problem

Somewhat of a problem

10. Do you have a bed partner or roommate?

No bed partner or roommate Partner/roommate in other room

Partner in same room, but not same bed Partner in same bed

If you have a roommate or bed partner, ask him/her how often in the past month you have had… a. Loud snoring?

Not during the past month Less than once a week Once or twice a week

b. Long pauses between breaths while asleep?

Not during the past month Less than once a week Once or twice a week c.

Legs twiching or jerking while you sleep?

Not during the past month Less than once a week Once or twice a week

d. Episodes of disorientation or confusion during sleep?

Not during the past month Less than once a week Once or twice a week

e. Other restlessness while you sleep; please describe

_____

Not during the past month Less than once a week Once or twice a week

B. SMART MOBILE DEVICE USAGE

11. Do You use any of the ff. smart mobile devices?

i. Smart mobile phone ii. Mobile Computer

iii. Tablet iv. Electronic Music device vi. Other

v. Video game console Specify:_____

12. How many of the listed smart devices do you use in your bedroom doing the last hour before going to sleep?

_____

_

13. What do You use the device for?

i. Browsing on the Internet ii. Watching movie

iii. Making Calls/Receiving calls iv. Playing video games

v. Reading e-books/news vi. Assessing emails

vii. Listening to music viii. Doing Assignment

ix. Watsapping x. Facebooking

14. How long have you used your smart device?

i. Less than 6 months ii. 6-11 months

iii. 1 - 3years iv. Over 3 years

15. During the past month, how often have you used your smart device?

i. Never ii. Rarely/Sometimes

iii. Almost every night iv. Every Night

16. During the past month, how many minutes did you spend on your device before you fall asleep?

i. <= 15 minutes ii. 16-30 minutes

iii. 31 - 60 minutes iv. > 60 minutes

17. During the past month, how often have you had trouble sleeping because you use your smart device 30 minutes before bed?

i. Never ii. Rarely/Sometimes

iii. Almost every night iv. Every Night

18. During the past month, how often have you waken up in the middle of your sleep to use your smart device?

i. Never ii. Rarely/Sometimes

iii. Almost every night iv. Every Night

19. During the past month, how many times have you waken up in your sleep due to your smart device?

i. Never ii. 1 - 9 times

iii. 10 - 18 times iv. 19 - 27 times

THANK YOU

APPENDIX B

If Statements for computing PSQI Scores of Respondents

PSQI_DURA NAP DURATION

IF question four ≥seven, THEN value is set to zero

IF question four greater than or equal to seven and ≥ six, THEN value is set to 1

IF question four is less than six and ≥ five, THEN value is set to 2

IF question four is less than five, THEN value is set to 3

Least Result is equal to zero (good); Highest Result is equal to three (poor)

PSQI_DIST DISTURBANCES OF NAP

IF question five b (5b) plus question five c (5c) plus question five d (5d) plus question five e (5e) plus question five f (5f) plus question five g (5g) plus question five h (5h) plus question five i (5i) plus question five j (5j) IF question five j COM (5JCOM) is empty or question five j (5j) is null, add 0 to question five j and set the value to zero of Q5j to 0) = 0, THEN assign value set to 0

IF question five b (5b) plus question five c (5c) plus question five d (5d) plus question five e (5e) plus question five f (5f) plus question five g (5g) plus question five h (5h) plus question five i (5i) plus question five j (5j) IF question five j COM

(5JCOM) is empty or question five j (5j) is null, add 0 to question five j and set the value to zero of Q5j to 0) >= 1 and <=9, THEN assign value set to 1.

IF question five b (5b) plus question five c (5c) plus question five d (5d) plus question five e (5e) plus question five f (5f) plus question five g (5g) plus question five h (5h) plus question five i (5i) plus question five j (5j) IF question five j COM (5JCOM) is empty or question five j (5j) is null, add 0 to question five j and set the value to zero of Q5j to 0) >=9 and <=18, THEN assign value set to 2.

IF question five b (5b) plus question five c (5c) plus question five d (5d) plus question five e (5e) plus question five f (5f) plus question five g (5g) plus question five h (5h) plus question five i (5i) plus question five j (5j) IF question five j COM (5JCOM) is empty or question five j (5j) is null, add 0 to question five j and set the value to zero of Q5j to 0) >18, THEN assign value set to 3.

Least Result equal to zero (better); Highest Result equal to three (worse)

PSQI_SLATENCY NAP LATENCY

Initial stage, recode question two into q2_new:

IF question two (Q2) greater than or equal to zero and less than or equal to fifteen, THEN value of q2_new is set to 0

IF question two (Q2) greater than fifteen and less than or equal to thirty THEN value of q2_new is set to 1

IF question two (Q2) greater than thirty and less than or equal to sixty THEN value of q2_new is set to 2

IF question two (Q2) greater than sixty THEN value of q2_new is set to 3

NEXT

IF question five a (5a) plus q2_new is equal to zero, THEN value is set to 0

IF question five a (5a) plus q2_new is greater than or equal to one and less than or equal to two, THEN value is set to 1

IF question five a (5a) plus q2_new is greater than or equal to three and less than or equal to four, THEN value is set to 2

IF question five a (5a) plus q2_new is greater than or equal to five and less than or equal to six, THEN value is set to 3

Least Result equal to zero (better); Highest Result equal to three (worse)

PSQI_DAYTDYS DAYTIME DYSFUNCTION DUE TO DROWSINESS

IF question eight (Q8) plus question nine (Q9) is equal to zero, THEN value set to 0

IF question eight (Q8) plus question nine (Q9) is greater than or equal to one and less than or equal to two, THEN value set to 1

IF question eight (Q8) plus question nine (Q9) is greater than or equal to three and less than or equal to four, THEN value set to 2

IF question eight (Q8) plus question nine (Q9) is greater than or equal to five and less than or equal to six, THEN value set to 3

Least Result equal to zero (better); Highest Result equal to three (worse)

PSQI_HSEF NAP EFFICIENCY

Secdiff is equal to seconds difference between day and period of the day question one (Q1) and day question three (Q3)

hrsdiff is equal to Total value of Secdiff / 3600

new_tib is equal to IF hrsdiff greater than twenty-four, then new_tib is equal to hrsdiff minus twenty-four

IF hrsdiff less than or equal to twenty-four (24), THEN new_tib = hrsdiff

(NOTE, THE ABOVE JUST CALCULATES THE HOURS BETWEEN GNT (Q1) AND GMT (Q3))

temhse question four divided by new_tib (Q4 / new_tib) multiplied by 100

IF temhse >= eighty-five (85), THEN value is set to 0

IF temhse less than eighty-five (85) and >= seventy-five (75), THEN value is set to 1

IF temhse less than seventy-five (75) and >= sixty-five (65), THEN value is set to 2

IF temhse less than sixty-five (65) THEN value is set to 3

Least Result equal to zero (better); Highest Result equal to three (worse)

PSQI_SLPQUAL **OVERALL NAP QUALITY**

Q6

Least Result equal to zero (better); Highest Result equal to three (worse)

PSQI_MEDS **NEED MEDS TO NAP**

Q7

Least Result equal to zero (better); Highest Result equal to three (worse)

PSQI **TOTAL**

ALL THE SEVEN COMPONENTS ABOVE ARE ADDED

Least Result equal to zero (better); Highest Result equal to twenty-one (worse)
Explanation:

TOTAL RESULT <= five (5) is linked with good nap quality

TOTAL RESULT is greater than five (>5) is linked with poor nap quality (Buysse et al., 1989)

APPENDIX C

PSQI PERMISSION LETTER

From: Gasiorowski, Mary <GasiorowskiMJ@upmc.edu>

To: 'joeool@yahoo.co.uk'

Sent on behalf of Dr. Buysse

Dear Joseph,

You have my permission to use the PSQI for your research study. You can find the instrument, scoring instructions, the original article, links to available translations, and other useful information at www.sleep.pitt.edu under the Instruments tab. Please ensure that the PSQI is accurately reproduced in any on-line version (including copyright information). We request that you to cite the 1989 paper in any publications that result. Note that Question 10 is not used in scoring the PSQI. This question is for informational purposes only, and may be omitted during data collection per requirements of the particular study.

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Sincerely,

Daniel J. Buysse, M.D.

Professor of Psychiatry and Clinical and Translational Science

University of Pittsburgh School of Medicine

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