Eliciting User Requirements to Design a Microsleep Application: A Focus Group Study with Microsleep while Driving.

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Abstract

Objective: This project is build to explore the user's experience in Microsleep or a moment of feeling sleepy throughout the day that happen among the vehicle's driver and how they getting rid of it with technology that can help them stay awake.

Methods/Statistical Analysis: Interviews were conducted and some questions were asked about Microsleep and also to find out how someone had experienced Microsleep while driving. We also distribute some online surveys to collect information about Microsleep.

Findings: Result indicated that Microsleep has experienced the most among long distance driver. Microsleep can be prevented in certain ways such as changing their lifestyle, planning activities or setting their sleeping schedule. For some people suffering from insomnia, sleep apnea or sleep deprived and any other symptoms may be consulted by a doctor.

Application/Movement: A framework for designing for Microsleep prevented will be created.

Keywords: Microsleep, technology, insomnia, sleep apnea, sleep deprived, consulted.

1. Introduction

Malaysia has the third highest fatality rate from road traffic accidents in Asia and Asean, behind Thailand and Vietnam. Fatigue and drowsiness which leads to microsleep among the drivers has been identified as one of the main reasons behind fatal crashes and injuries especially driving in a long and monotonous straight highway.

According to a study in United Kingdom (UK), 20 percent accidents due to fatigue, lack of sleep which is estimated to be one of the causes of microsleep. United Kingdom's statistics recorded 7,152 in 2016 and 6740 in 2017 and estimated to be the eight percent of the accident caused by microsleep [15]. According to Index of Accidental Road Death, as a result of a study conducted by the Ministry of transport in Malaysia, the

death index in 2016 has been revealed to be 2.59 with the death stood of 7, 152 people with the number of registered vehicles accumulating in 2016 amounting to 27,613,264 vehicles [17]. Microsleep is one of the causes of this accident.

Microsleep are short bursts of sleep, unintended loss of attention, head snapping or doze off while trying to stay awake that often experienced without the awares that took place among the drivers. This can be experienced by the drivers who is tired, fatigue and the individuals most at risk who had a sleep disorder like insomnia, sleep apnae or sleep deprived. Microsleep took place of a less than 10 second to two minutes and that person is not aware that a microsleep has occurred. While experienced microsleep, a person fails to respond to outside information.

Recently, there are latest cases affected by microsleep happened during Hari Raya where many urban migrants will be driving back to their hometowns to celebrate with their families. The incident and the tragic loss of life of Dnars Skincare founder Faziani Rohban Ahmad, 39, on the morning of May 18 showed that microsleep could actually happen during the day due to fatigue. The driver, Faziani's husband, Ahmad Shah Rizal Ibrahim, 42, admitted to drowsiness and was drowned.

According to a study by the university's Sleep Research Center on 1000 drivers, 45 percent of men admit to having microsleep while driving compared to 22 percent of women. Also, the director of the Loughborough University of the United Kingdom (UK) Sleep Research Center, Prof Jim Horne, said young drivers are also at risk for such conditions because they need adequate sleep. He said it was estimated that over 20 percent of road accidents due to sleep factors. Sleep does not come suddenly, you cannot consciously drive within a minute and fall asleep afterwards. There are times when you realize that you are so sleepy then.

He advised if a person was drowsy, stopped, parked the car safely and took a drink containing about 150 milligrams of caffeine.

Advancement to the digital era in this 21st century enables the majority of the people to own personal computers, laptops and smart phones. This has helped to pave the way for implementations of web or mobile-based self-care applications to better manage an individual's health. These self-care applications enable the individuals to use them to fit into their own daily lifestyle patterns to manage their health conditions. Example of applications that are targeted for microsleep include Steer and StopSleep. Steer is a device that will warn you with vibration and gentle electric impulse, so you do not fall asleep while driving [1] and StopSleep is an anti-sleep alarm regonises the loss of concentration and prevents microsleep [2].

Self-care applications impose greater responsibility on health-care consumers to manage their health. It is also true that it is not possible to treat or prevent microsleep without changing the individual's behaviour and habits. This means that the health-care consumers must be able to use the self-care applications continuosly and the self-care

applications should be a good assistant to the consumers to change their behaviour and habits.

Despite all the advice had be given, miscrosleep is still a hot topic that happened in our country. Researcher are still finding and researching for a solution that can prevent this to happen.

However, this solution still need to be emphasized more. Not all driver can adapt with all of those prevention. Sometimes in some emergency situation, they need to force themselves to drive even in a bad condition. In a hurry situation, almost all of those advice can't be adapted or being used. Precautionary measure is not enough to deter this phenomenon to occur. Drivers need some digital hardware that can help them stay awake for the whole journey. A mechanism that can force them to not be sleepy at all time.

The goal of this study is to obtain a clear understanding of the requirements for microsleep self-care application from the user's perspective. Hence, we conducted Focus Group Discussion (FGD) to explore the users' insights about their lifestyles that contributes to behaviour change via a microsleep self-care application. In addition, we identified specific components that are to be incorporated in the application such as self-monitoring, exercise, personal data, driving planning, goal settings, social support, alert & reminders, medication, email and rewards.

FGD technique was selected because it is an informal technique that can help to assess the user needs by bringing out the users' spontaneous reactions and ideas on a selected topic. It also allows in-depth discussions and to draw out subjective opinions of the participants. This technique enabled us to gather the user requirements from the participants easily through the candid discussion among the peers.

This paper will discuss the findings of the FGD and is organised as follows. The first section describes the materials and methods that were used in conducting the data collection session. The subsequent section reports the results or findings of the FGD. The next section involves the discussion of the key findings and implications of the FGD. The conclusion section is inclusive of both summary and future work.

2. Materials and Methods

We conducted three FGD with 18 participants, most of it are among public through advertisement. All of the participant are among drivers. The selected participants are of various ages groups, gender and ethnicities, who have encounter microsleep or not.

Each FGD session lasted for 40 - 60 minutes and was facilitated by a moderator. There were two sessions for "Experience Microsleep" and "None Experience Microsleep". At the beginning of each FGD session, a consent form was distributed to each of the participant to sign. At the end of the discussion, a token of appreciation was given to the participants to thank them for their effort and participation.

a warm-up and introductory session, the participants introduced themselves and briefed others on their history and experience encounter microsleep. Open-

ended questions were used to prompt the discussion session and facilitate it. The participants were encouraged to give their own comments and opinions throughout the discussion.

At the end of the discussion, a slip consisting of self-care application components was given to each participant to determine important components to be included into a microsleep self-care application based on their opinion. The participants ranked the components with numbers at the space provided. The most important components were ranked as '1', followed by '2' and so on by the participants. The least important components were ranked '5'. Later, the rankings were assigned with specific values and the average value for each component was calculated. Finally, the percentage of each component was calculated. Finally, the percentage of each component was identified. The findings were divided into two separate sections: experience microsleep and never experience microsleep.

Each discussion was audio-recorded and transcribed later. The facial expressions during the discussion were also observed and taken into consideration. Notes from each focus group discussion were compared for accuracy with the audio-recordings. The transcripts were coded, categorized, and analysed by identifying the recurrent themes and assigning categorization codes. Each group was analysed individually and then compared with other groups. The conclusions were extracted independently by one researcher and verified by another research team member.

3. Result

Twelve participants were scheduled for the microsleep FGD, but only 11 participated. Eleven participants were selected; All the participants have experiences microsleep while driving. Characteristics of the participants are displayed in Table 1. The outcome of the FGD is divided into six themes – lifestyle and self-monitoring, education and awareness, motivation and commitment, attitude, social support and coaching, and technology. These themes emerged from the responses of the participants.

Table 1. Characteristics of the 18 participants.

Category	No. (%)
Age (years):	
18-20	2
21-30	5
31-40	8
41-70	3
Gender	
Male	14
Female	4
Patient type:	
None experiences microsleep	11
Experiences microsleep	7

3.1 Lifestyle and Self-Monitoring

All the participants mentioned that lifestyle needed to be changed in order to manage and prevent the microsleep. Proper diet and physical exercise need to be taken care of to keep the body feels fresh all the time. One

participants shared the reason he experiences microsleep: “I’m a single man. I always eat outside instead of cooking at home. Therefore, I often eat unhealthy foods and do not count the calories taken throughout the day. As a result, I gain weight becase I did not exercise. Having a heavy body makes me feel tired easily. Therefore, sometimes I do have microsleep problems while driving to work early in the morning”.

All the participants were strongly in favour for proper diet and exercise to manage and prevent the microsleep. They shared that they always were on the lookout and were alert on what they were eating. The changed their lifestyle by eat in small portions and get the food that can help them feel fresh for a day while they are driving. Eight participants shared that they always take caffeine when start feel drowsy while driving. Some of them drink cold water and chew a gum to stay alert. One of the participants mentioned: “Not all the five fingers are the same. Everyone’s lifestyle is different”.

Besides that, 6 out of the 18 participants exercise frequently. They either do brisk walking, jogging, swimming, breathing exercise or simple stretching, at least 3 times a week. This exercise helps them manage their concentration when they tend to do something. One out of 6 participants shared: “I work out often and it helps me feel good after sweating. And when I’m doing activities all day that make me tired, it helps me get a good night’s sleep. So, I woke up for next day feeling refreshed!”.

Another participant shared that in his early years, he used to play football and he was eating well. But after he became ages, he started lose focus while driving. He easily gets sleepy after 30 minutes of driving.

Overall, the study indicated that engagement in self-management behaviours is the proximal outcome influencing the outcome of improved health status: managing a proper lifestyle and self-monitoring is essential in taking responsibility for one’s own health.

3.2 Education and Awareness

The participants claimed that there was less awareness about microsleep and the factors that causes microsleep many years ago. Now, there is much awareness created about the disease and managing the lifestyle. Currently, there are also more talk and discussion sessions organised by many government and non-government organisations to educate the public. The participants said mass media are actively educating people how to avoid microsleep happen while driving. One of the participants said that: “When you read or heard about the microsleep it will tell you how dangerous microsleep which it can lead to dead, how to prevent microsleep happen when you are driving”.

By reading all these talks, the participants more aware of the microsleep and how lifestyle changes can prevent the microsleep. One of them shared that: “Now before we drive, we make sure that we get enough sleep for 8 hours and plan ahead our journey by what time will we start drive and when the estimate time to arrive”. Nevertheless, one microsleep participant said there must be more awareness created among the younger generation. She

mentioned: “if we can get more information easily about microsleep, even from social media and all that, it will be good to create the awareness and realization among the drivers”.

3.3 Motivation and Commitment

There are a number of factors that contribute towards the participants being motivated and staying committed to the lifestyle changes. They indicated that motivation is important to change their behaviours. Thoughts about family, awareness towards the future, education on the proper lifestyle, fear of death and tragic accident makes them to stay motivated to stay alert about the microsleep. They also said that the interest to change must come from within themselves. Self-discipline is deemed as being very important. One of the participants shared that: “I feel motivated is outside in, inside out. If you ask me, I feel motivated to start driving carefully while thinking about my family. I should reach to my destination safely for the sake of my family. I need to stay safe and not make my family worries thinking about me while I reach to my destination”.

3.4 Attitude

Four participants who are student in course of Architecture indicated that lack of sleep is the main cause that microsleep occurs. After they changed their attitude to be more relaxed and the perspective on how they viewed their life, they could manage their sleeping schedule and start doing timetable to organize their time. One of the participants shared that: “A lot of assignment, chasing the deadline of the project that seems never end makes us student stays up all night and fatigue for the next day”.

Apart from that, two participants emphasized on not getting angry and follow the timetable that he has made explained that: “Positive attitude means always being aware. As student, we must aware with all the assignments and project deadline, that’s why we need to organize timetable to keep our work on track”.

3.5 Social Support and Coaching

Eight of 18 participants shared that they need some kind of social support from either family, friends or a support group. Family is a institustion whereby they stay together, so they needed support from their family.

Sixteen of the participants shared that they prefer to discuss things with others and listen to other’s sharing. By this way, they learn a lot of people’s experiences and get motivated. Moreover, all the participants would like to hear more about microsleep, they would like to get more information that related to microsleep continously.

3.6 Technology

When technology was mentioned, 15 participants gave positive responses. About 72% of the participants wear a watch. In this modern are, there is a smart watch connected to the phone where it can detect our heart rate and our daily activities. One of the participants shared how he uses his watch for his daily activities: “I am using smart watch for track the frequency of my

brain function and detect my heart rate. I can hear the beep sounds when I start sleepy and keep yawning. It will start vibrates when I continuously yawning. It will wake me up from being sleepy because I could feel the shock and pain provided by the watch. Very helpful".

Ten participants browse about microsleep through websites and use the search engine Google to find information and news about microsleep that happens on the road. One participants always read news through online website, since then he gets to know more about the causes that leads microsleep.

Seven participants claimed that they get the information they need very fast from the internet and through Whatsapp. Upon reading about it, especially the parents they will advise the younger generations to drive carefully, pull over cars when you feel tired and get a nap. A participants shared his viewpoint: "Nowadays, older generations read information through Whatsapp, some of them do not know how to use the search engine Google. So, it we can get information easily, it will be better".

The participants said that usage of smart phones and Internet often helps them in many ways. They said a self-care application will be a good assistant to monitor their activities to avoid microsleep occurs. A microsleep experinces shared her concern that the self-care application should be multi-lingual so that many could use it. In addition, some of them also mentioned that it would be good if the self-care application can give them which road the drivers should avoid to prevent being sleepy on the traffic congestion.

Components of the Proposed Self-care Application: The participants highlighted the important components they wanted in a self-care application by ranking the components. The priorities of the self-care applications components have been devided: experiences microsleep and none-experiences microsleep. Priorities here means the most imporant to least important components from the participants' viewpoints. Table 2 shows the percentage of experiences microsleep and none-experiences microsleep who have chosen each component. Figure 1 illustrates the comparison between the experiences microsleep and none-experiences microsleep on their priorities.

Components of Self-care Application	None Experiences Microsleep (%)	Experiences Microsleep (%)
Self-monitoring	100	100
Exercise	90	50
personal Data	92	77
Driving planning	95.8	88.9
Goal settings	85.5	75.8
Social Support	90.2	75.2
Alert/Reminders	100	76.3
Medication	49.9	32
Email	87.7	67.2
Rewards	80	71

Table 2. Priorites of experiences microsleep and none-experiences microsleep on self-care application components.

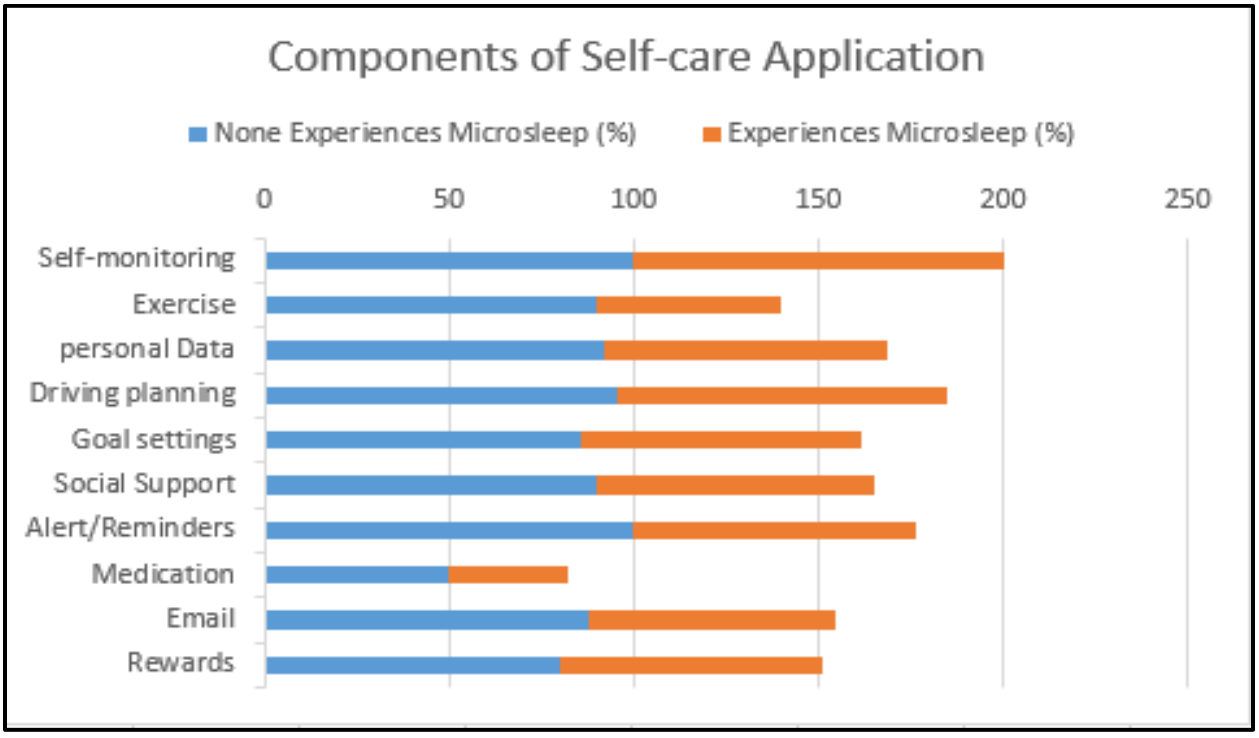

Figure 1. Comparison between experiences microsleep and none-experiences microsleep on self-care application components.

Based on the participants' choices, self-monitoring and alerts/reminders stays as the top priority for both groups. This followed by personal data, driving planning, social support, exercise, email, goal settings, rewards and medication for none experinces microsleep. Meanwhile, for experiences microsleep, self-monitoring is followed by driving planning, personal data, alerts/reminders, goal settings, social support, rewards, email, exercise and medications. It is interesting to note that medication is not being considered as one of the top priority for experinces microsleep compared to none experinces microsleep. None experinces microsleep have chosen personal data, driving planning, social support, exercise as their top priorities because they would like to have a self-care application which is personalised to them and keep track their activities while driving.

The medication system is the least priority for both groups. They mentioned that they should be self-motivated through the thought about their own awareness and not through medication. Besides that, alerts/reminders are higher priority for none experiences microsleep than experiences microsleep. It is also seen that rewards there is not much different between both groups.

4. DISCUSSION

These FGD results highlight that majority of the participants would like to use technology as their aid to prevent microsleep. All the participants take self-responsibility towards their safety. They prefer the idea of a self-care application which can be a 'one-stop centre' for all their needs as it can save life. Most of the people are not aware about the conundrum of microsleep and its reversal possibility stage. During our selection session for drivers, we found that most people are not aware that they are in microsleep state. Some are not willing to admit that they are in a condition of suffering from a lack of sleep and try to force one to stay awake. For these reasons, we strongly feel that a preventive self-care application will be a good tool to prevent microsleep as the application will be personalised to each individual with their own personal data and to monitor their sleep. They still can get support and coaching online without meeting face-to-face with people.

Online education will be helpful in creating awareness and as a source of knowledge to the drivers to gather more knowledge. Microsleep can be managed, if and only if, the drivers are willing to change their lifestyle and behaviour. In order to this, they need knowledge and awareness about the causes and its prevention. The majority of drivers mentioned that they normally experienced microsleep in circumstances such as driving at night or a long distance commute, night shift work and etc. Most of the drivers choose these factors as the reason they have experienced microsleep while driving. These are the several reason for instance lack of sleep, fatigue, sleep disorder and effect of medication.

Since most of the participants agreed that they need to get sufficient sleep, drive with a partner or drink caffeine as a preventive measure. A companion that would support and accompany them to stay awake. An alert message can be sent to the device of the user. They also mentioned that

they would appreciate direct coaching sessions with doctors, so that they can discuss with their doctors about medication or any health related issues they are facing in their daily life.

Goal setting and driving planning also play a vital role in self-care applications. This is because in the process of managing their sleep, the non-experienced set their own target sleep hours to achieve in a period of time, for instance 7 to 8 hours. To achieve their target hours, they plan their schedule to follow proper rest and sleep. Adding these features will help them to keep track of their goals and manage them more effectively.

As for the idea of adding reward system into the self-care application, they did not show much interest as they said that the idea to change should come from within. If a person is not interested, then nobody can change him or her. Despite getting positive feedbacks on the idea of developing a self-care application for microsleep, about 15% of the participants showed less interest in a self-care application either because they are not technology savvy and do not own a smart phone or because of their advanced age status.

5. Conclusion and Future Work

Getting the users' feedback on the idea of developing a selfcare application for microsleep and their requirements for the application is essential to understand the needs and expectations of the target users so that a good selfcare application can be designed for them to manage their health independently. Although our FGD study was based on a small sample size, it provided us with valuable insights into participants' lifestyles, microsleep awareness, and how they could be motivated to change their behaviour before start a long journey. This feedback is very helpful in determining their expectations of existing web technologies to maintain their consciousness while driving during fatigue. The FGD results support our hypothesis that self-awareness applications are an appropriate tool to help driver who had a long and exhausted day before they started their driving to prevent microsleep. Our study also shows that the use of technology is low among older people but not all older. Some of the same age group are smart technologies. The FGD results will be used to develop a framework that incorporates behavioural change theory to design personal care applications for prediabetes.

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