



**ORIGINAL RESEARCH PAPER**

**Statistics**

**THE FACTORE ANALYSIS APPROCH OF STUDYING HEALTH HAZARDS ASSOCIATED TO THE USAGE OF CELL PHONE ON PG STUDENTS OF GULBARGA UNIVERSITY, KALABURAGI**

**KEY WORDS:** Cell phone, Health Hazards, Gender, Factor Analysis, KMO and Bartlett's test, Principle Component Analysis

**Dr. C.P.S. Hungund**

Professor, Department of Statistics, Gulbarga University Kalaburagi-585106

**Ashwini S. R\***

Research Scholar, Department of Statistics, Gulbarga University Kalaburagi-Karnataka State, India. \*Corresponding Author

**Parvati S. M**

Department of Statistics, Gulbarga University Kalaburagi- Karnataka State, India.

**ABSTRACT**

Science has proved that mobile phones act like a microwave transmitter bearing a cancer warning. It has been reported that these frequencies cause several other diseases such as dry eyes, computer vision syndrome, weakness of thumb and wrist, neck pain and rigidity, tactile hallucinations, monophobia, insecurity, delusions, auditory sleep disturbances, insomnia, lower self-confidence, and mobile phone addiction disorders by intercepting in the body the nodes with cellular DNA. The present study is aimed to study the health hazards by using mobile phone among the PG students of Gulbarga University, Kalaburagi. The most influencing health hazard factors are identified and analyzed through the factor analysis by using SPSS package.

**1. INTRODUCTION**

Mobile/hand phones are powerful communication devices, first demonstrated by Motorola in 1973, and made commercially available from 1984. In the last few years, hand phones have become an integral part of our lives. The number of mobile cellular subscriptions is constantly increasing every year (ICT Facts & Figures-2015). Around 206 published survey reports suggest that 50% of teens and 27% of parents feel that they are addicted to mobiles. The recent studies also reported the increases of mobile phone dependence, and this could increase internet addiction.

Advances in mobile phone technology have resulted in maximum usage of mobile phones worldwide. Even in developing countries the mobile phones has gone from being an expensive item used by elite to a personal communication tool for the general population. However, the impact of regular use of mobile phone has raised concern about the potential health hazards.

Cell phones are being used by each and everyone today. Their use without any knowledge of their harmful effects is unsafe. In recent years, mobile telecommunication systems have grown significantly, to the point where more than a sixth of the world's populations use mobile phones. There is concern that microwaves might induce or promote cancer, and the symptoms associated with their use include sleep disturbance, memory problems, headaches, nausea, and dizziness, and blood pressure have also been reported.

The main aim and objective study are

- To estimate the percentage of PG students of science faculty, Gulbarga University, Kalburagi who have awareness of the hazards of mobile phone.
- To identify which of the health hazards of mobile phone has great effect on PG students of science faculty of Gulbarga University, Kalburagi by using factor analysis.
- To estimate how many students actually practice any safety measures to minimize the unwanted effects of mobile phones.

**2. Survey of Literature**

**Subramani Parasuraman, et al (2017):**

The paper "Smartphone usage and increased risk of mobile phone addiction: A concurrent study" aimed to study the mobile phone addiction behavior and awareness on electromagnetic radiation (EMR) among a sample of Malaysian population. The study instrument comprised eight segments, namely, informed consent form, demographic details, habituation, mobile phone fact and EMR details, mobile phone awareness education, psychomotor (anxious behavior) analysis, and health issues. Frequency of the data

was calculated and summarized in the results. Totally, 409 respondents participated in the study. The mean age of the study participants was 22.88 (standard error = 0.24) years. Most of the study participants developed dependency with Smart phone usage and had awareness (level 6) on EMR. The study participants were aware about mobile phone/radiation hazards and many of them were extremely dependent on smart phones. One-fourth of the study population were found having feeling of wrist and hand pain because of Smartphone use which may lead to further physiological and physiological complication.

**Zahid Naeem (Oct-Dec 2014):** The paper "Health risks associated with mobile phones use" deals with health hazards with mobile phone. The authors state that mobile or cell phones are now a day's an integral part of modern telecommunications in every individual life. As billions of people use mobile phones globally, a small increase in the incidence of adverse effects on health could have major public health implications on long term basis. Besides the number of cell phone calls per day, the length of each call and the amount of time people use cell phones are important factors which enhance the health related risk.

**3. Data collection and Methodology**

For the present study we have surveyed science departments in Gulbarga University, Kalburagi. A random sample of 100 PG students from science departments was surveyed and each student was asked to report the Age, Gender, Course, Year of joining the course etc.

The questionnaire to understand the level of health hazards by using mobile phones was developed on socio-demographic factors and determinants of health hazard factors identified from review of literature and qualitative study.

**4. METHODOLOGY**

The data was analyzed by using factor analysis approach.

Factor analysis is a technique that is used to reduce a large number of variables into fewer numbers of factors. This technique extracts maximum common variance from all variables and puts them into a common score. As an index of all variables, we can use this score for further analysis. Factor analysis is part of [general linear model \(GLM\)](#) and this method also assumes several assumptions: there is linear relationship, there is no multicollinearity, it includes relevant variables into analysis, and there is true correlation between variables and factors. Several methods are available, but principle component analysis is used most commonly.

**5. Frequency and percentage distribution of the respondents various factors of usage of mobile with gender.**

The collected data further classified and presented basing on

demographic factors and various determinants of usage of mobile phones. The frequency and percentage distribution under each category was obtained and preliminary statistical analysis was done.

**Table 5.1 Frequency and percentage distribution of various factors of usage of mobile with gender**

Variables	Gender		Total
	Male	Female	
<b>Number of years using cell phone</b>			
1	3 (27.3%)	8 (72.7%)	11 (100%)
2	7 (36.8%)	12 (63.2%)	19 (100%)
3	9 (30.0%)	21 (70.0%)	30 (100%)
4 and above years	16 (40.0%)	24 (60.0%)	40 (100%)
<b>How many cell phones use currently</b>			
1	30 (34.1%)	58 (64.9%)	88 (100%)
2	2 (22.2%)	7 (77.8%)	9 (100%)
More than Two	3 (100.0%)	0 (0%)	3 (100%)
<b>Average number of calls received daily</b>			
Below 5	6 (31.6%)	13 (68.4%)	19 (100%)
5-10	11 (44.0%)	14 (56.0%)	25 (100%)
10-15	11 (36.7%)	19 (63.3%)	30 (100%)
Above 15	7 (26.9%)	19 (73.1%)	26 (100%)
<b>Average number of dialed calls daily</b>			
Below 5	5 (22.7%)	17 (77.3%)	22 (100%)
5-10	8 (32.0%)	17 (68.0%)	25 (100%)
10-15	14 (53.8%)	12 (46.2%)	26 (100%)
Above 15	8 (29.6%)	19 (70.4%)	27 (100%)
<b>Average talk duration in minutes</b>			
50-100	8 (38.1%)	13 (61.9%)	21 (100%)
100-150	9 (42.9%)	12 (57.1%)	21 (100%)
150-200	6 (30.0%)	14 (70.0%)	20 (100%)
200-250	7 (33.3%)	14 (66.7%)	21 (100%)
250-300	5 (29.4%)	12 (70.6%)	17 (100%)
<b>Average number of SMS received/sent daily</b>			
50-100	12 (50.0%)	12 (50.0%)	24 (100%)
100-150	7 (28.0%)	18 (72.0%)	25 (100%)
150-200	10 (38.5%)	16 (61.5%)	26 (100%)
200 and above	6 (24.0%)	19 (76.0%)	25 (100%)

**Analysis**

From the table 4.1 we can see that 16 male and 24 female students are using cell phone since 4 and above years and only 3 male and 8 female students using cell phone since from one year. There are 30 male and 58 female students are using currently one cell phone. Only 3 male students are only using currently more than two cell phones. Nearly 8 male and 19 female students receive and dialed maximum calls that are above 15 calls, daily. Only 5 to 6 male students and 13 to 17 female students receive and dialed minimum number of calls, that is below 5 calls, daily.

There are 5 male and 12 female students talk on an average two fifty to three hundred minutes daily which is maximum and 8 male and 13 female students talk on an average fifty to hundred minutes daily which is minimum duration of talking time. Maximum number, that is above 200 f SMS received/sent by the students are 6 males and 19 females. 12 members of male, female students received/sent daily 50-100 SMS.

**6. Factor Analysis**

The testing of association between health hazard factors with gender has been done by C.P.S.Hungund..et al (2019) , the results reveals that there is a significant association between the health hazards factors, fatigue, sleep disturbance and constipation with respect to gender. The main objective of the present section is to identify and analyze the most decisive health hazards associated to the usage of cell phones among PG students of Gulbarga University, Kalburagi through factor analysis by using SPSS package. This study is useful to the general population particularly to the students deter from using mobile phone. This study offers new insight into level of perception of mobile phone hazards among university students.

**6.1 KMO and Bartlett's Test**

The KMO measures the sampling adequacy which should be close than 0.5. For satisfactory factor analysis KMO 0.5 and Bartlett's value < 0.05. This significance paves the way for factor analysis.

**Table 6.1.1 : KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.761	
Bartlett's Test of Sphericity	Approx. Chi-Square	122.625
	Df	21
	Sig.	.000

From the above table the KMO calculated value 0.761 is greater than 0.5, which indicates that the data is adequate. Bartlett's test of Sphericity is used to test the null hypothesis that correlation matrix is an identity matrix, since calculated P value 0.000 is less than 0.05, which indicates multi normality among the variables.

**6.2 Analysis of Descriptive Statistics**

The results of analysis of descriptive Statistics are presented below

**Table 6.2.1: Descriptive Statistics**

	Mean	Std. Deviation	Analysis N
FATIGUE	2.82	1.218	100
SLEPDIS	1.98	1.101	100
DIZZINESS	2.73	1.179	100
MEMORYLOSS	2.59	1.240	100
HEADACHE	2.07	1.075	100
TACHYEARDIA	2.76	1.182	100
CONSTIPATION	3.41	1.334	100

The table 6.2.1 is a table of descriptive statistics for all the variables which shows the mean rating and standard deviations of 7 factors regarding health hazards associated to

the cell phone usage. The mean ranged from 1.98 to 3.41; standard deviation from 1.075 to 1.334 .

**Table 6.2.2 Correlation matrix for health hazards factors.**

		FATIGUE	SLEPDIS	DIZZINESS	MEMORYLOSS	HEADACHE	TACHYEARDIA	CONSTIPATION
Correlation	FATIGUE	1.000	.231	.339	.225	.365	.215	.220
	SLEPDIS	.231	1.000	.206	.371	.257	.291	.184
	DIZZINESS	.339	.206	1.000	.324	.198	.359	.238
	MEMORYLOSS	.225	.371	.324	1.000	.446	.380	.384
	HEADACHE	.365	.257	.198	.446	1.000	.284	.198
	TACHYEARDIA	.215	.291	.359	.380	.284	1.000	.390
	CONSTIPATION	.220	.184	.238	.384	.198	.390	1.000

In the above correlation matrix the principle diagonal elements are one. The correlation coefficient above and below the principle diagonal are same.

TACHYEARDIA	1.000	.459
CONSTIPATION	1.000	.352

Extraction Method: Principal Component Analysis.

**6.3 The Initial Factor Analysis Solution (Extraction Method:PCA)**

The table 6.3.1 shows the initial and final communalities for each factor. The variables with high values, that is greater than 0.5, are well represented in the column of the extraction space.

From above table of communalities which shows how much of the variance in the variables has been accounted for by the extracted factors. For instance the variance in the factor memory loss it is accounted for 54.4%. The communality value which should be more than 0.5 to be considered for further analysis.

**Table 6.3.1 : Communalities**

	Initial	Extraction
FATIGUE	1.000	.326
SLEPDIS	1.000	.321
DIZZINESS	1.000	.361
MEMORYLOSS	1.000	.544
HEADACHE	1.000	.398

**6.4 Total Variance Explained**

The table 6.4.1 shows the eigen values and the amount of variance explained by each successive factor. The factor greater than 1 are considered as most influencing factors. This is determined by examining the total variance explained shown in the table 6.4.1 The eigen value table is divided into three sub sections, i.e. Initial eigen values, Extraction Sums of Squared Loadings and Rotation Sums of Squared Loadings

**Table 6.4.1: Total Variance Explained**

Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Memory loss	2.762	39.462	39.462	2.762	39.462	39.462
Tachyardia	.928	13.261	52.724			
Headache	.874	12.486	65.209			
Dizziness	.771	11.011	76.220			
Constipation	.665	9.503	85.723			
Fatigue	.587	8.386	94.109			
Sleep disturbance	.412	5.891	100.000			

Extraction Method: Principal Component Analysis.

Extraction Method: Principal Component Analysis.

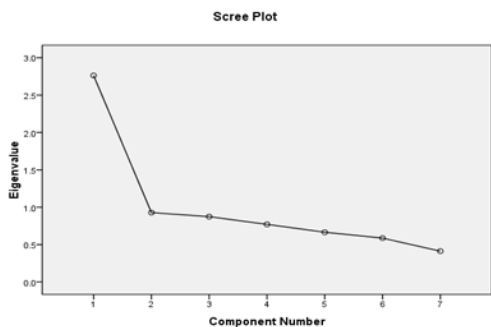
There are as many components extracted during a principle components analysis as there are variables that are put into it. In our study, we used 7 variables and 1 component is extracted.

variance and from second component onwards we can see the curve is almost in decreasing pattern. We are interested in keeping only those principle components whose eigen values are greater than one.

**Scree test:** In the context of factor analysis or principal component analysis, scree plot help us in the analysis to visually assess which component or factor explain most of the variability in the data.

**6.5 Component matrix**

The principle component matrix gives the component matrix which is rotated using the Varimax with Kaiser Normalization rotation technique which gives the rotated component matrix with factor loading values. Rotation of factors helps in the better interpretation of factors. The following table represents the components loadings for item (prior to rotation). The factor with highly loaded factor value (which are greater than 0.5) is considered first and the next highest and similarly for all the factors.



**Fig - 6.4.2: Scree plot**

From the above scree plot graph, it is clear that the first components viz; memory loss accounts for maximum

**Table 5.5.1: Component Matrix**

	Component
	1
FATIGUE	.571
SLEPDIS	.567
DIZZINESS	.601
MEMORYLOSS	.738
HEADACHE	.631
TACHYEARDIA	.678
CONSTIPATION	.593

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

The results showed that only one new factor was identified and assigned as the factor affecting the health hazard by using mobile phone. Since only one factor is extracted which suggests that all factors fit into a single component, which means there is only one dominant factor, that is, memory loss is present in the population and there is no need to rotate for further reduction.

**7. Awareness about unwanted effects of the usage of cell phones**

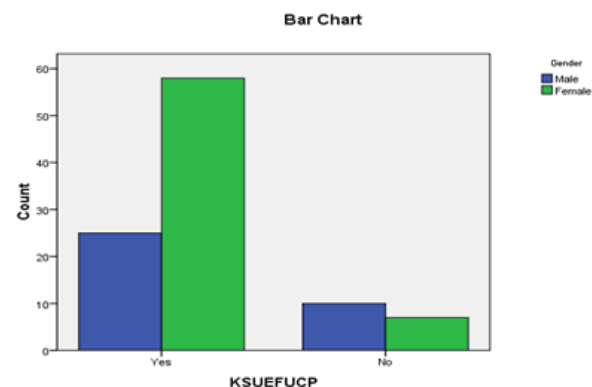
The awareness among the student population about the unwanted effects by using the cell phone are analyze in the section

**7.1 The frequency and percentage distribution of the factor awareness of the unwanted effects by using cell phone with respect to Gender**

**Table7.1 Distribution of awareness of the unwanted effects by using cell phone**

Awareness of unwanted effects by using cell phone			Gender		Total
			Male	Female	
Yes	Count		25	58	83
	% within Gender		30.1%	69.9%	100.0%
No	Count		10	7	17
	% within Gender		58.8%	41.2%	100.0%
Total	Count		35	65	100
	% within Gender		35.0%	65.0%	100%

**Frequency distribution of awareness of the unwanted effects by using cell phone and**



**Analysis**

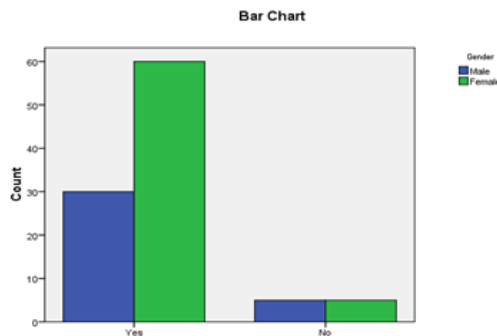
From the above table 6.1 one can observe that female students are more aware about the unwanted effects of cell phones. We can see that there are 25 male students and 58 female students aware about the unwanted effects of usage of cell phones. Only 10 males and 7 female students are not aware about the unwanted effects of usage of cell phone.

**7.2 The frequency and percentage distribution of the factor minimizing the unwanted effects by decreasing the talking duration with respect to gender**

**Table 7.2 Distribution of minimizing the unwanted effects by decreasing the talking duration and gender**

Decreasing the talking duration			Gender		Total
			Male	Female	
Yes	Count		30	60	90
	% within Gender		33.3%	66.7%	100.0%
No	Count		5	5	10
	% within Gender		50.0%	50.0%	100.0%
Total	Count		35	65	100
	% within Gender		35.0%	65.0%	100%

**Frequency distribution of minimizing the unwanted effects by decreasing the talking duration and gender**



**Analysis**

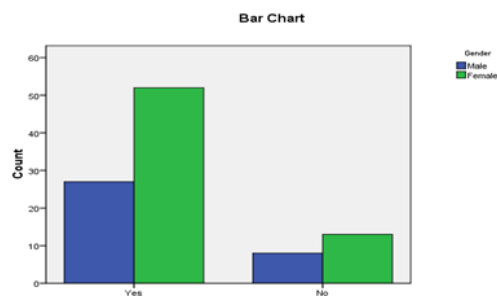
From the above table 3.4 one can observed that 30 male students and 60 female students state that they are decreasing the talking duration to minimize the unwanted effects by using cell phone. Only 5 male and female students expressed that they are unable to decrease the talking duration to minimize the unwanted effects by using cell phone.

**7.3 The frequency and percentage distribution of minimizing the unwanted effects by increasing the length of hands free from cell phone with respect to Gender**

**Table 7.3 Distribution of minimizing the unwanted effects by increasing the length of hands free from cell phone and Gender**

Increasing the length of hands free			Gender		Total
			Male	Female	
Yes	Count		27	52	79
	% within Gender		34.18%	65.82.0%	100%
No	Count		8	13	21
	% within Gender		38.09%	61.91%	100%
Total	Count		35	65	100
	% within Gender		35.0%	65.0%	100.0%

**Frequency distribution of minimizing the unwanted effects by increasing the length of hands free from cell phone and Gender**



**Analysis**

From the above table 6.3 we can see that nearly 27 male students and 52 female students are increasing the length of hands free to minimize the unwanted effects of by using cell phone and 8 male and 13 female students are unable to increase the length of hands free to minimize the unwanted effects of by using cell phone.

**8. CONCLUSION**

The present study included 100 random samples of PG students of science faculty of Gulbarga University, Kalaburagi. The perception of cell phone hazards among PG students was found to be 83 percent which indicates that PG students of science faculty of Gulbarga University are well aware of the unwanted effects of the usage of cell phone. It is evident from the above measures result that 30 percent of male and 70 percent of female students are aware of the side effects of the usage cell phone. The study also reveals that 90

percent of the students are practicing decreasing the talking duration and 79 percent of students are practicing increasing the length of hands free to minimize the unwanted effects by using cell phone.

The most deceive health hazards are identified through factor analysis. The results showed that only one factor of health hazards that is memory loss is identified and is assigned as the factor affecting by using cell phones.

Though the maximum numbers of students are aware of the unwanted effects by the usage of cell phone, some of the facts and results showed that majority of female students received and dialed on an average more than 15 calls per day and also their maximum average talking duration is 250-300 minutes. Average number of SMS received and sent daily is 200 and above, which indicates that today's younger generation is likely to have many of the adverse health effects by the usage of cell phones. Hence students need cell phone awareness program.

**Cell phones –What Are the Dangers?**

The major problems that have been linked to excessive cell phone usage are

1. Damaged blood vessels that translate to loss of protection to bran
2. Cancer
3. Brain Tumor
4. DNA damage – resulting in tumors and cancers
5. Sleep disorders
6. Irreversible fertility
7. Skin problems – caused mainly by overheating of cell include rashes, sores, and even skin tumors
8. Hearing loss due to overheating of ear drums
9. Damage to red cells – slowing down blood circulation and thereby exposure to other diseases

**9. Recommendations**

The following recommendations are suggested:

- Shortening the duration of mobile phones per day may reduce any risk associated with exposure to radiations from mobile phones. Therefore, it is highly recommended to limit the duration of conversation on mobile phones.
- People can carry on a cell phone conversation only for 19 minutes at a time without harming themselves.
- Since in vitro studies suggest that mobile phones may have thermal effect on sensitive parts of the body, such as, eyes and testis, it is recommended to minimize exposure to such body parts to be on safe side.
- Another in vitro study, also, suggests that growing and highly proliferating cells are much more prone to the effect of mobile phones. Therefore, it is recommended to keep children from getting exposed to radiations of mobile phones.

**REFERENCES**

- 1] Abdul Raouf Khan, et al (2009): Health hazard linked to mobile phones. International Journal of information and communication Technology. Vol.2, No.2, 101-108.
- 2] C.P.S.Hungund, et al (2019): The perception of health hazards associated to the usage of cell phone on pg students of gulbarga university, kalaburgi- a case study, Journal of Computational and Graphical Statistics (paper communicated).
- 3] Subramani Parasuraman, et al (2017): Smartphone usage and increased risk of mobile phone addiction: A concurrent study. Articles from International of Pharmaceutical Investigation. Vol. 7 9 3 : 1 2 5 - 1 3 1 . DOI:10.4103/jphi.JPHI\_56\_17.
- 4] Zahid Naeem, (2014): Health risks associated with mobile phones use. International Journal of Health Sciences. Vol.8, No.4, p.5.

**WEBSITES**

- 1] <https://doi.org/10.1155/2018/9242718>.
- 2] <http://www.who.int/mediacentre/factsheets/fs193/en/>
- 3] <http://www.edition.Cnn.Com/2016/05/03/health/teens-cell-phone-addiction-parents>