

**Knowledge, attitude and use of mHealth technology among students aged 18 and above in
India: A Cross Sectional Study**

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfillment for the award of the degree of

Master of Business Administration (MBA)

in

Hospital and Health Management

by

Anubhav Sharma

Under the Supervision and Guidance of

Dr. Jagajeet Prasad Singh

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled **Knowledge, attitude, and use of mHealth technology among Students aged 18 and above in India: A Cross Sectional Study** is the bonafide record of my original researchwork. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished workof others has been duly acknowledged in the text.

Anubhav Sharma

Date: 30th June 2021

CERTIFICATE

This is to certify that Anubhav Sharma in partial fulfillment of the requirements for the award of the degree of **MBA Hospital and Health Management** from the IIHMR University, Jaipur has successfully completed his internship at Clarivate during **March 22, 2021 to June 19, 2021.**

Place:

Preceptor/Head of the Organization

Name of the organization

Date:

CERTIFICATE

This is to certify that dissertation titled is a record of the research work undertaken by **Anubhav Sharma** in partial fulfillment of the requirements for the award of the degree of **MBA Hospital and Health Management** from the **IIHMR University, Jaipur** under my guidance and supervision and his approach to the research study has been sincere, scientific, and analytical.

Faculty Guide

IIHMR University, Jaipur

Date

School Dean

IIHMR University, Jaipur

Date

ABSTRACT

Introduction

There is an increased use of mobile to seek health information online. The use of mobile phones to access healthcare, known as mHealth interventions, is gaining popularity throughout the world. College students can be major clients of mHealth adoption due to its technology-based applications, although research on this topic is rare in India. This research gives a snapshot of knowledge, attitude and use of mHealth technology among students aged 18 and above in India.

Methodology

Cross Sectional study was done among college students and data was collected between April and June 2021. Convenience sampling was used, and 384 responses were received who finished a self-administered questionnaire. Bi- Variate Analysis (Chi Square) was used to examine the differences between variables with $p < 0.05$ as significant.

Results

Knowledge regarding mHealth was found to be quite high among students. As more than 76 % of them currently use mHealth technology. The students are also quite aware about the various apps available in the market. The attitude regarding mHealth was found to be encouraging but Privacy, Personal Data and Information were found to be barriers to use of mHealth.

Conclusion

In conclusion this study shows that mHealth knowledge is widespread among college students and that it does not differ between boys and females. The survey discovered a significant frequency of mHealth use among Indian college students. The use of mHealth to search for Vaccine, Weight Loss and Mental Health suggests that adult students require more information regarding these topics. The general attitude and perception regarding mHealth is good among the respondents who use mHealth apps currently but the apprehensions regarding the privacy of their information and data is still there, and it is also becoming a barrier to its use in many cases. More studies are needed to be done in this area to find more evidence regarding correlation of Sociodemographic factors and use of mHealth applications.

Key words

India, mHealth, Knowledge, Utilization, College students

ACKNOWLEDGMENT

The internship and dissertation at **Clarivate** were a great learning opportunity for me. It provided me the necessary exposure to professionals throughout my internship period. It enabled me to widen my understanding of the Health care insurance system prevailing in India. Even when the world is fighting with a pandemic today, I was honoured to get an opportunity to work closely with wonderful people of **Clarivate** who mentored me and agreed to provide a necessary platform through online work from home summer training program even in these testing times.

I would like to take this opportunity to convey my deepest gratitude towards my organisational Mentor **Ms. Sonali Prusty, Director, U.S Managed Market Insights Team, India** for providing guidance and managing her busy schedule to facilitate my training.

I would also like to thank my guide **Ms. Nishitha Prabhu, Senior Analyst, Clarivate** for the constant guidance and supervision without which it would not have been possible to complete the internship with ease.

Special thanks to **Ms. Anush Bidappa, Senior Manager, HR, Clarivate** for her cooperation and help in easing me into the process so smoothly and efficiently.

I would also like to pay my regards towards my esteemed institution **IIHMR, Jaipur** for providing me with an opportunity and platform to help me further enhance my skills and gain much needed experience through Internship on a Work from home basis.

I would also like to thank and extend my heart felt gratitude towards my Institutional Mentor **Dr. Jagajeet Prasad Singh** for guiding me on the right path.

I am deeply moved by the constant support provided by my teammates **Ms. Indu Pillai, Ms. Parvathy Menon and Ms. Lobo Lonita** for their constant encouragement and insights and for providing me with their honest opinions and criticisms wherever needed, to enable me to perform better.

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CHAPTER 1

INTRODUCTION

COVID-19, a once in a century event has changed the way we look the world around us. In a span of a week, we went from preparing for our exams in college to being locked in our homes for three months. The country went into a sudden lockdown on **24th March 2020**. The word “National Lockdown” was something which most probably none of us had ever heard or had witnessed in real life. The news came as vacation for some and as a challenge for some. But as the saying goes “This too shall pass”. Eventually the time passed, and it has now been more than a year since first lockdown, and things are now looking better. We now have 2 vaccines i.e., COVISHIELD and COVAXIN (an indigenously developed vaccine) currently being administered in India, and 4 indigenous vaccines i.e., CORBEVAX, ZyCOV-D, GENNOVA (LiveMint, 2021) and BBVI154 Intranasal vaccine currently in development phase.

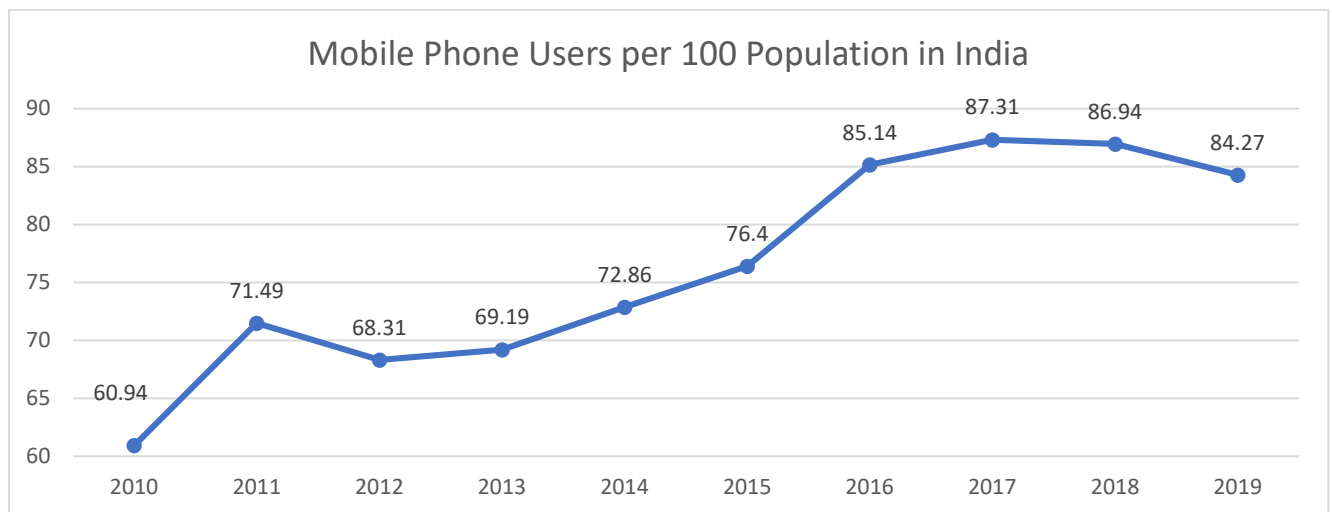
During the last one year the only thing which kept people connected was Mobile and Internet. Moreover, mobile is now no more just a tool for communication, it is now being used for various other purpose such as fitness, contact tracing, vaccine slot booking, patient monitoring, medicines delivery, online doctor consultation, other mHealth activities etc. And the most recent example of a successful mHealth app is National Informatics Centre's Aarogya Setu app for syndromic mapping, contact tracing and self-assessment. The app has been downloaded by more than 100 Million people since its launch. The Aarogya Setu (Ahaskar, 2021) app which was once mandatory for travel and other purposes but is now no longer mandatory to be installed due to public uproar over ambiguous privacy policy and apprehensions over data security

mHealth has been recognized by WHO as an effective public health tool. It defines mHealth to be **“medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices,”**

The use and capitalization of a mobile phone's fundamental skills, such as voice calls and short message service, as well as more sophisticated functions like GPRS, 3G and 4G, GPS, and Bluetooth, are all part of mHealth.

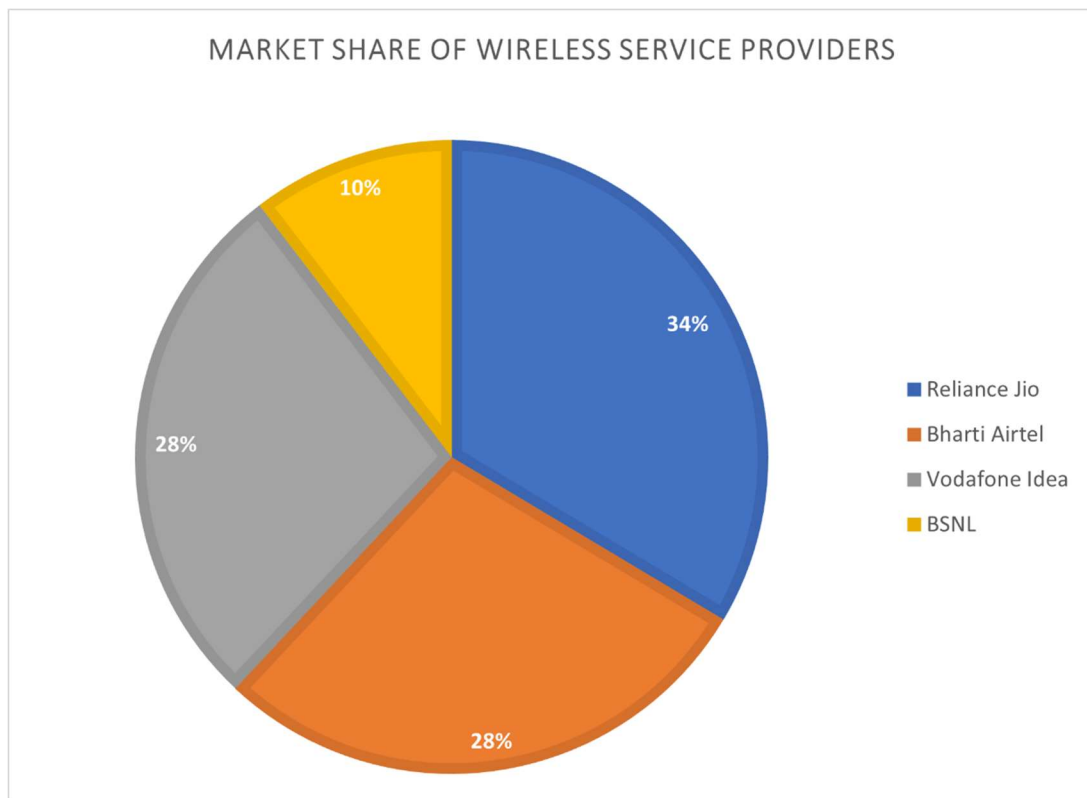
mHealth is one of the components of eHealth (WHO, 2021) There are over 8.2 billion wireless subscribers (WHO, 2021) with about 4.6 billion (Internet users in the world 2021 | Statista, 2021) that is around 60% of world population, have access to the Internet. Out of this 92.6 percent access internet through their Mobile Phones (Mobile cellular subscriptions - India, China | Data, 2021). With 1.15 billion mobile phone customers, India is the world's second largest mobile subscriber market, after China's 1.47 billion. (Mobile cellular subscriptions - India, China | Data, 2021). Tele density in India is 86.22 percent, with Urban Tele density being 138.25 percent and Rural Tele density being 59.96 percent. As of December 2020, India has approximately 75 Crore wireless data subscribers, out of which 72.6 Crore i.e., 96.5 percent have access to high-speed mobile broadband internet (TRAI, 2021)

The mobile phone users per 100 population in India, has been increasing rapidly since 2010. In 2010, 61 persons among every 100 persons were having a mobile phone, which has increased to 87.37 persons among every 100 persons in 2020. The growth in mobile phone can be attributed largely to increased globalization and commercialization in recent years. Also, with more youth population than older people, the acceptability to technology is high among Indians. Post the Introduction of cheap Internet by Jio in 2016, the growth in no of mobile phone users further increased at a very higher rate.



Source: World Bank Data

Figure 1: Line graph showing trend of Mobile Phone users per 100 population in India from the year 2010 to 2020 in Millions

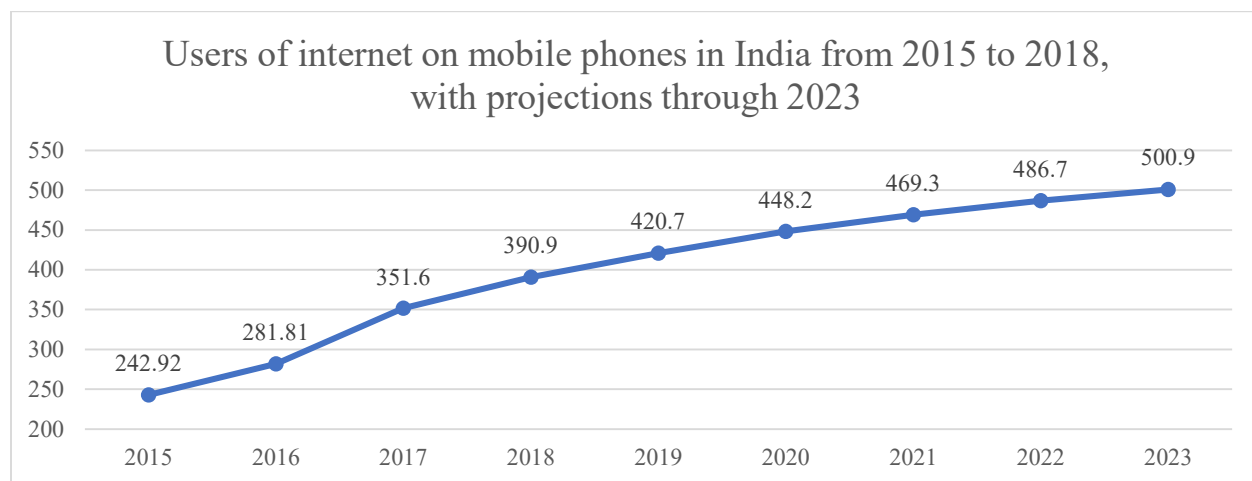


Source: TRAI Annual Report 2019-20 pg. 19

Figure 2: Pie Chart depicting Market Share of Mobile Phone Service Providers in India as of 31st March 2020

Jio came as a gamechanger in Mobile Internet market in India. It has acquired around 34 percent of Market Share since its inception. The growth can be largely attributed to cheap Internet and free voice calls introduced by Jio in the market. Bharti Airtel and Vodafone Idea both have 28 percent market share respectively.

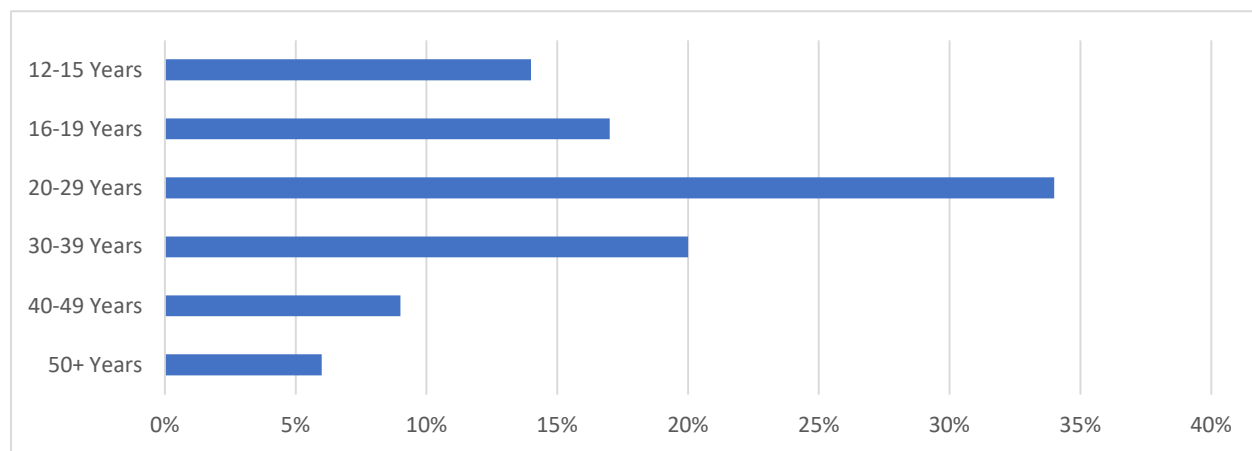
With increased mobile phone users, the use of Internet through mobile has also grown leaps and bound in India. There are more than 450 million mobile internet users currently in India, the number was just around 90 million a decade ago. With so many Internet users in India, it comes as an opportunity for Public Health professionals as they can use this in various ways in solving public health issues.



Source: Statista.com (Sandhya Keelery, 2021)

Figure 3: Line graph showing mobile phone internet users in India from the year 2013 to 2021, along with forecast until 2023 (in Millions)

Though with increasing mobile phone subscribers (Figure 1), increased internet usage (Figure 3), particularly in the age group 20-29 (Figure 4), there is not much literature and data available suggesting that how do people use Mobile Phone for seeking health related information, there is also less evidence available regarding the current knowledge of mHealth, and how do adults and students per se perceive the use of technology for seeking health information. With around 750 million people using Mobile Phone in India, it becomes important to understand its usage for seeking health information or using mHealth Apps, so that Public Health Information can be disseminated in a proper way, it can also help in better policy adaptations.



Source: IAMAI 2019 Round 2 Report, pg. 7

Figure 4: Distribution of Internet Users by Age in India

Because there is corroboration that mobile phone use among adults in India is quite high (Figure 4), it is essential to investigate how they are used for health-related activities and their existing mHealth knowledge. As a result, the goal of this study is to add to the current knowledge about mHealth technology, its knowledge, attitudes, and use among the college going adult population

Table 1: mHealth apps currently available in India

Focus Area	Application Name	Users (Downloads)
Online Doctor Consultation	Practo	5 Million+
	Medi Buddy	1 Million+
	Tata Health	100K+
	MFine	1 Million+
	Doctor 24x7	100K+
	DocsApp	5 Million+
	Apollo 24X7	5 Million+
	Lybrate	5 Million+
	Bajaj Finserv Online Doctor Consultation	500K+
Online Pharmacy	PharmEasy	10 Million+
	MedPlus Mart	1 Million+
	NetMeds	5 Million+
	Apollo 24x7	5 Million+
	1Mg	10 Million+
	SastaSundar	1 Million+
Health Tracking	Calorie Counter	10 Million+
	Step Tracker	10 Million+
	Aarogya Setu	100 Million+
	Flo	50 Million+

BROAD OBJECTIVE:

The study's objective is to assess the present level of knowledge, attitude, and use of mHealth technology among students aged 18 and above in India.

SPECIFIC OBJECTIVES:

- To assess the current usage of mobile for mHealth services/ mHealth apps among students, for seeking health information and health services.
- To assess current level of knowledge regarding various mHealth related apps
- To evaluate attitude regarding usage of mHealth apps.
- To assess challenges faced by end user in using mobile phones for using mHealth services /mHealth apps.

CHAPTER 2

REVIEW OF LITERATURE

Table 2: Review of Literature

Name of Author	Title of Study	Salient Features
Niranjjan Ramachandran, Pruthu Thekkur, Manikandan Srinivasan, Bijay Nanda Naik, Phoebe Johnson, and Palanivel Chinnakali, (Ramachandran et al., 2015) Year: 2015	Mobile Phone Usage and Willingness to Receive Health-Related Information Among Patients Attending a Chronic Disease Clinic in Rural Puducherry, India (Ramachandran et al., 2015)	Sample Size: 285 Sampling Technique: Maximum variation sampling technique was used with inclusion criteria as CVD, age, and sex. The remainder of the sample was taken via convenience sampling. Study Location: Puducherry, India Findings of the Study: • 108 (38%) patients were found to have personal mobile phone whereas for 124 (43.5%), their family members possessed cell phones. 171 (60%) of the patients reported their willingness to receive health information through their Mobile Phones. • Out of 171 patients, 90 patients (52.6%) of the patients responded that they prefer voice calls; 72 (42%) of them said that they prefer SMS, and only 9 (5%) said that they were okay with both the options; 160 (93.6%) patients said that they want health tip to be in local language. • The three most common topics of interest were Dietary Habits (38.6%), lifestyle modification (25.2%), and proper use of medication (21.6%), • Lower age group, Male gender, work level and formal education, are all factors that were found to be associate with mHealth use in bivariate regression analysis. • In a multivariate analysis, it was discovered that having a personal mobile phone and having a mobile phone with a family member were both independently linked with desire to receive health-related information. • Authors recommended trial of voice calls as a mHealth intervention as it was the most preferred mode. Limitation of the Study: • The limitation of the study was that it as it was conducted in a confined geographical area, hence the results could not be generalized.

Rebecca Smith, Jaideep Menon, Jaya G Rajeev, Leo Feinberg, Raman Krishan Kumar, Amitava Banerjee (Smith et al., 2015) Year: 2015	Potential for the use of mHealth in the management of cardiovascular disease in Kerala: a qualitative study (Smith et al., 2015)	Study Design: Qualitative, semi structured, individual interviews. Sample Size: 15 (5 Patients, 5 physicians and 5 ASHAs) Sampling Technique: Maximum variation sampling. Study Location: Kerala, India Findings of the Study: • The authors found out that patients were having poor disease knowledge, poor lifestyle and were facing difficulties in implementing primary prevention measures. • Patients recognized phone calls as the most as the preponderant function of cell phone. • ASHAs expect that use of mHealth can: help increase accessibility to healthcare; give reminders regarding medication, appointment, and lifestyle changes; which in turn can help reduce out of pocket expenditure, travel cost, time wastage. • Perceived barriers to mHealth as told by Physicians include fears of negative impact of mobile phones on physicians' roles, radiation, and human touch. • Authors concluded that mHealth can be used as a tool to enhance resource utilization, improve adherence by providing treatment reminders for better disease management. Limitation of the Study: • The limitation of the study was that it as it was conducted in a confined geographical area, hence the results could not be generalized.
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Clare Oliver-Willia, Elizabeth Brown, Isaac Holeman Cassandra Fairhead, and Sara Devereux (Oliver-Williams et al., 2017) Year: 2017	Using Mobile Phones to Improve Vaccination Uptake in 21 Low- and Middle-Income Countries: Systematic Review (Oliver-Williams et al., 2017).	Study Design: Systematic Review Sample Size: 21 (11 white papers and 10 peer reviewed research papers) Study Location: India, Pakistan, Malawi, Nigeria, Bangladesh, Zambia, Zimbabwe, and Kenya Findings of the Study: • There is huge gap in available indicating evidence of potential use of mHealth for improving Vaccination Coverage. • SMS Reminders were found to be effective in increasing vaccination coverage Limitation of the Study: • The research is preliminary and require further evaluation to examine effectiveness of mHealth interventions and comparative cost effectiveness of other interventions.
S Chadha, S B Nagaraja, K Sagili and A Trivedi (Chadha, Trivedi, Nagaraja and Sagili, 2017) Year: 2015	Using mHealth to enhance TB referrals in a tribal district of India. (Chadha, Trivedi, Nagaraja and Sagili, 2017)	Study Design: Mobile Application name ComCare was introduced and RCHPs were given training for its use. Sample Size: 30 Study Location: Jharkhand, India Findings of the Study: • Out of the 171-total trained RHCP, 30 were trained on mobile application. • RHCP trained on ComCare referred 35 patients, whereas there were only 4 referrals by RHCP not trained on Mobile Application • mHealth technology was found to be highly effective and it helped increase accountability and effectiveness of both private as well as public RHCPs. Limitation of the Study: • The authors claimed Selection Bias as the limitation of the study, as only RHCPs who volunteered were selected for the study.

M Shafiqur Rahman, Fatema Khatun, Syed Hanifi, Mohammad Iqbal, Tanvir Ahmed, Sabrina Rasheed, Shahidul Hoque, Tamanna Sharmin, Abbas Bhuiya, Nazib-Uz Zaman Khan, and Shehrin Shaila Mahmood (Rahman et al., 2017) Year: 2015	Knowledge, attitudes, and intention regarding mHealth in generation Y: evidence from a population based cross sectional study in Chakaria, Bangladesh. (Rahman et al., 2017)	Study Design: Cross Sectional Study Sample Size: 4909 Study Location: Chakaria, Bangladesh Findings of the Study: • Gen Y was found to have greater access to Cell Phones, and they had better knowledge regarding use of Mobile for accessing healthcare services. • Gen Y also had significantly higher knowledge about mHealth services as compared to older counterparts • Authors concluded that there is huge potential for mHealth services among younger population. Limitation of the Study: • Study was based out of remote rural area and thus cannot be generalised to Urban Areas. • Maximum questions in Knowledge section were Yes/No based and thus didn't correctly assess outcome measures.
Prince Peprah, Razak M Gyasi, Emmanuel Mawuli Abalo, Okwei Reforce, Julius Nyonyo, Williams Agyemang-Duah, Godfred Amankwaa, Paulinus Kaaratoore, and Jones Amoako (Peprah et al., 2019) Year: 2017	Knowledge, attitude, and use of mHealth technology among students in Ghana: A university-based survey (Peprah et al., 2019).	Study Design: Cross Sectional Study. Sample Size: 963 Sampling Technique: Simple Random Sampling Study Location: Ghana Findings of the Study: • Knowledge on mHealth was High and was found to be associated with respondent's year of study. • Overall knowledge about mHealth was found to be low among students. Limitation of the Study: • The study was conducted in University; hence the findings cannot be generalized.

Sunil Kumar Saha, Pragyan Paramita Parija, Priyanka Sharma, and Poornima Tiwari (Parija, Tiwari, Sharma and Saha, 2020) Year: 2020	Determinants of online health information-seeking behavior: A cross-sectional survey among residents of an urban settlement in Delhi (Parija, Tiwari, Sharma and Saha, 2020)	Study Design: Cross Sectional Survey. Sample Size: 321 Sampling Technique: Convenient Sampling Study Location: Delhi, India Findings of the Study: 88.2 % (283/321) of the study participants were using internet for seeking health information. The study also found that people in higher socioeconomic group and younger age group were found to access the internet to seek health information more than their counterparts. Limitation of the Study: - The study was based out of a small pocket of urban area and thus findings can and thus cannot be generalised to Rural Areas & the cross-sectional study design cannot be used to establish causal relationship.
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CHAPTER 3

METHODOLOGY

Table 3: Research Methodology

Research Question	What is the level of current usage, existing knowledge, attitude, and barriers faced, by students aged 18 and above regarding use of mobile for mHealth applications or seeking health information through Internet in India?
Study Design	Cross Sectional Study
Study Setting	India
Study Duration	22 nd March to 19 th June 2021
Inclusion Criteria	Any student above 18 years of Age having smartphone and willing to be part of the study.
Sample Size Calculation	$n = Z^2_{1-\alpha/2} p (1-p) / d^2 \{where (p = 50\% = 0.5, \alpha = 0.05, d = 5\%)\}$ $n = 1.96^2 * 0.5 (1-0.5) / 0.05^2$ $n = 384$
Sampling Technique	Convenience Sampling
Data Type	Primary Data
Study Tool	Online Survey Form designed on SurveyMonkey
Data Collection Method	A semi structured Questionnaire was sent through WhatsApp and Email to 118 friends/peers and they were then requested to forward it to at least 5 of their friends or cousins who are student as well as above 18 years of age. After regular follow up and reminders, was able to collect desired 384 responses.
Informed Consent Form	Hi, you do not have any moral obligation to be part of this study. You can choose not to participate. You have an option to leave the study at any time, and there is no penalty for doing so. The approximate time that it takes to complete the study is 7-8 minutes. The survey will not include any questions that may be used to personally identify you to protect your privacy. By consenting to go to the following page, you indicate that you are at least 18 years old, you have read the preceding information, and that you are willing to engage in the study freely.

CHAPTER 4

RESULTS

A total of 384 responses were received. Descriptive Univariate Analysis was performed for the Characteristics of the respondents' backgrounds. In the table below, the findings are given as a % distribution based on the various factors.

Table 4: Univariate Analysis of Respondents' Background Information

Variable	Response	<i>n</i> = 384 (%)
	<i>Response</i>	<i>Count (%)</i>
Gender	Male	147 (38.3 %)
	Female	237 (61.7%)
Age	18-21 years	129 (33.6 %)
	22-25 years	214 (55.7 %)
	26 & above	41 (10.7%)
Education Level	Secondary School	10 (2.6 %)
	Graduate	60 (15.6%)
	Postgraduate	298 (77.6%)
	PhD	16 (4.2 %)
Area of residence	Rural	93 (24.2%)
	Semi Urban	56 (14.6%)
	Urban	235 (61.2%)
Type of Health Insurance	Private Health Insurance	65 (16.9%)
	Government sponsored Health Insurance	43 (11.1%)
	Group Health Insurance through College	164 (42.7%)
	None of the Above	112 (29.1%)

Variable	Response	<i>n</i> = 384 (%)
Technology mostly used to access Internet	Mobile	174 (45%)
	Laptop	119 (31%)
	Desktop	53 (13%)
	Smart TV	10 (3%)
	Tablet	29 (8%)
Daily Internet Use	1-3 Hours	88 (22.9%)
	4-6 Hours	90 (23.2%)
	More than 6 Hours	206 (53.6%)

It is observed that majority of the respondents i.e., 61 percent were Females, whereas Males accounted for around 38 percent of the respondents. The mean age of the Male Respondents is 23.01 (SD 3.28), whereas for Female respondents it is 23.5 (SD 3.10). Majority i.e., 55.7 percent of the students fall under 22-25 years group, 33.6 percent fall under 18-21 years age group, and remaining 10 percent of the respondents were in the 26 and above age group. At the time of study 24.2 percent of the respondents were living in the Rural Areas, 14.6 percent were living in semi urban area, whereas the remaining 61.20 percent were from urban areas.

In analysis of education level of respondents, it was found that more than 77 percent were in post-Graduation, 15.6 percent were enrolled in a Graduation program, 4.2 percent of them were doing PhD and remaining 2 percent were enrolled in a Secondary School at the time of the study. Majority of the students were having Health Insurance, 16.9 percent of the students were having Privately bought Health Insurance, 11.1% of them were enrolled in a Government Sponsored Health Insurance Scheme, 42.7 percent of the students were having Group Health Insurance through their College 164, and 29.1 percent of them were not having any kind of Health Insurance. Mobile is the most preferred gadget among the respondents, as more than 45 percent prefer mobile to access Internet, Laptop is preferred by 31 percent, Desktop by 13 percent, Tablet by 3 percent and Smart TV by 3 percent if the total respondents. Daily Internet Usage is very high among the participants, where more than 53 percent have responded that they use the internet for more than 6 hours per day, with 23% using it for at least 4 to 6 hours per day and the remaining 22% using it for 1 to 3 hours per day

CURRENT KNOWLEDGE OF mHEALTH APPS BY GENDER AND AGE.

Table 5: Current use and knowledge of mHealth technology by Age and Gender

<i>Variable</i>	<i>Responses</i>	Knowledge of use of mHealth technology or internet for Health-Related Information			p-value
<i>Gender</i>		Yes	No	Total	<i>0.216</i>
		<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>	
	Male	118 (80.2%)	29 (19.8%)	147	
	Female	177 (74.6%)	60 (25.4%)	237	
	<i>Total</i>	<i>295 (100%)</i>	<i>89 (100%)</i>	<i>384 (100%)</i>	
<i>Age</i>	18-21 Years	97 (33.6%)	32 (36.0%)	129 (33.6%)	<i>0.596</i>
	22-25 Years	164 (55.6%)	50 (56.2%)	214 (55.7%)	
	26 & Above	34 (11.5%)	7 (7.9%)	41 (10.7%)	
	<i>Total</i>	<i>89 (100.0%)</i>	<i>295 (100.0%)</i>	<i>384 (100%)</i>	
	<i>*statistically significant at p<0.05</i>				

Bivariate Analysis was done along with Chi Square, and Table 5 presents student's knowledge on the Knowledge of use of mHealth technology or internet for accessing Health-Related Information based on age and gender. The overall knowledge about mHealth technology was high as 384,76.8 percent students have knowledge about use of mHealth Technology. Male Students (118, 80.2%) were more aware than females (177, 74.6%) regarding use of mHealth technology. The knowledge about mHealth was highest in 22-25 years Age Group (164, 55.6%) compared to 18-21 (97 33.6%) years and 26 (34, 11.5%) & Above years Age group. Though the result didn't reach significance level.

PATTERN OF mHEALTH USE BY GENDER AND AGE

Table 6: Current use and knowledge of mHealth technology by Gender

Variable	Responses	Gender			p- value
		Male	Female	Total (n= 384)	
Use of mHealth or Internet to seek Health Information	No	29 (19.7%)	60 (25.3%)	89 (23%)	0.216
	Yes	118 (80.3%)	177 (74.7%)	295 (77%)	
Frequency of use of mHealth		Male n = 118	Female n= 177	Total (n =295)	
	Once a day	7 (5.9%)	11 (6.2%)	18 (6.1%)	0.868
	Many times, a day	27 (22.9%)	48 (27.1%)	75 (25.4%)	
	At least once a week	51 (42.1%)	70 (39.5%)	121 (41%)	
	At least once a month	33 (28.0%)	48 (27.1%)	81 (27.5%)	
Health Topic Searched on Internet in last 12 month	About a specific disease	70 (59.3%)	90 (50.8%)	160 (54.2%)	0.189
	Vaccine	82 (69.5%)	105 (59.3%)	187 (63.4%)	0.085
	Weight Loss	62 (52.5%)	76 (42.9%)	138 (46.8%)	0.022*
	Drug/Medicine	61 (51.7%)	74 (41.8%)	135 (45.8%)	0.121
Technology Currently using for Health Management Activities other than mHealth apps	Medical Devices	69 (58.5%)	90 (56.6%)	159 (53.9%)	0.233
	Health Related Website	33 (28.0%)	36 (20.3%)	69 (23.4%)	0.160
	Social Media Applications	51 (43.2%)	62 (21.0%)	113 (38.3%)	0.179
Most preferred Online Platform for information related to Health	Facebook	16 (13.6%)	28 (15.8%)	44 (14.9%)	0.850
	Google	53 (44.9%)	79 (44.6%)	132 (44.7%)	
	Instagram	32 (44.4%)	40 (22.6%)	72 (24.4%)	
	Twitter	5 (4.2%)	9 (5.1%)	14 (4.7%)	
	WhatsApp	8 (6.8%)	9 (5.1%)	17 (5.8%)	
	YouTube	4 (3.4%)	11 (6.2%)	15 (5.1%)	

*statistically significant at $p < 0.05$

Table 6 presents student's knowledge on the pattern of use of mHealth technology or internet for accessing Health-Related Information based on age and gender. (Table 6 & Table 7) More than 72 percent of respondents used mHealth regularly i.e., at least once a day, many times a day or at least once a week. Males (118, 80.3%) use mHealth technology more than Females 177 (74.7%). The frequency of use is similar among Males and Females. The most searched Health Topic online was Vaccine (187, 63.3%) ($p = 0.022$), followed by search for a specific disease (160, 54.2%) and Weight Loss (138, 46.8%) which was found to statistically significant with Gender. Medical Devices are the most used technology for Health Management Activities and is used more by Males (69, 58.5%) as compared to Females (90, 56.6%). Male (51, 43.2%) tend to use Social Media Applications more than Females (62, 21.0%) for obtaining Health Related Information. Google is the most used platform for health-related information (132, 44.7%) Followed by Instagram (72, 24.4%) and Facebook (44, 14.9%). Some other commonly used online platform for health-related information is (17, 5.8%), YouTube (15, 5.1%) and Twitter (14, 4.7%). There was no significant difference among Males and Females and their choice of Online Platform for online Health Information search.

Table 7 presents student's knowledge on the pattern of use of mHealth technology or internet for accessing Health-Related Information based on age group (Table 7) More than 72 percent of respondents used mHealth regularly i.e., at least once a day, many times a day or at least once a week. Students in the Age group 22-25 Years (164, 55.6%) tend to use mHealth technology more than students in the age group 18- 21 (97, 32.9%) and 26 & Above (34, 1.5%). The most searched Health Topic online was Vaccine (187, 63.3%) which was found to statistically significant with Age ($p = 0.041$). It was searched most frequently by students in age group 26 & Above as 82.3 % of them have searched information regarding it online, 59.8% of the students in 18-21 Age group and 61.6% of the students in the Age group 22- 25 have searched for same. Information regarding Mental Health was most searched by students in Age group 26 & Above (23, 67.6%) followed by student in age group 18-21 (53, 54.6%) and 22-25 (85, 51.8%) age group.

Table 7: Current knowledge and use of mHealth technology by Age

<i>Variable</i>	<i>Responses</i>	<i>Age</i>				
		<i>18-21 Years</i>	<i>22-25 Years</i>	<i>26 & Above</i>	<i>Total</i>	<i>p-value</i>
<i>Use of mHealth or Internet to seek Health Information</i>	No	32 (35.9%)	50 (56.1%)	7 (7.8%)	89 (23.2%)	0.232
	Yes	97 (32.9%)	164 (55.6%)	34 (11.5%)	295 (76.8%)	
<i>Frequency of use of mHealth</i>		<i>Male</i>	<i>Female</i>	<i>Total (n =295)</i>		
	Once a day	5 (5.2%)	12 (7.3%)	1 (2.9%)	18 (6.1%)	0.754
	Many times, a day	22 (22.7%)	42 (25.6%)	11 (32.4%)	75 (25.4%)	
	At least once a week	39 (40.2%)	70 (23.7%)	12 (9.9%)	121 (41.0%)	
	At least once a month	31 (32.0%)	40 (24.4%)	10 (29.4%)	81 (27.5%)	
<i>Health Topic Searched on Internet in last 12 month</i>	About a specific disease	52 (53.6%)	85 (51.8%)	23 (67.6%)	233 (45%)	0.247
	Mental Health	53 (54.6%)	85 (51.8%)	23 (67.6%)	161 (54.6%)	0.233
	Vaccine	58 (59.8%)	101 (61.6%)	28 (82.3 %)	187 (63.3%)	0.041*
	Weight Loss	46 (47.4%)	72 (43.9%)	20 (58.8%)	138 (46.7%)	0.279
	Drug/Medicine	45 (46.4%)	71 (43.3%)	19 (55.9%)	135 (55.9%)	0.410
<i>Technology Currently using for Health Management Activities other than mHealth apps</i>	Medical Devices	52 (17.6%)	85 (51.8%)	22 (64.7%)	159 (53.9%)	0.375
	Health Related Website	19 (19.6%)	40 (13.6%)	10 (29.4%)	69 (23.4%)	0.497
	Social Media Applications	37 (38.1%)	60 (36.6%)	16 (47.1%)	113 (38.3%)	0.528
<i>Most preferred Online Platform for information related to Health</i>	Facebook	15 (15.5%)	23 (14.0%)	6 (17.6%)	44 (14.9%)	0.927
	Google	40 (41.2%)	77 (47.0%)	15 (44.1%)	132 (44.7%)	
	Instagram	27 (27.8%)	37 (22.6%)	8 (23.5%)	72 (24.4%)	
	YouTube	3 (3.1%)	10 (6.1%)	2 (5.9%)	15 (5.1%)	
	Twitter	4 (4.1%)	8 (4.9%)	2 (5.9%)	14 (4.7%)	
	WhatsApp	8 (8.2%)	8 (4.9%)	1 (2.9%)	17 (5.8%)	

*statistically significant at $p < 0.05$

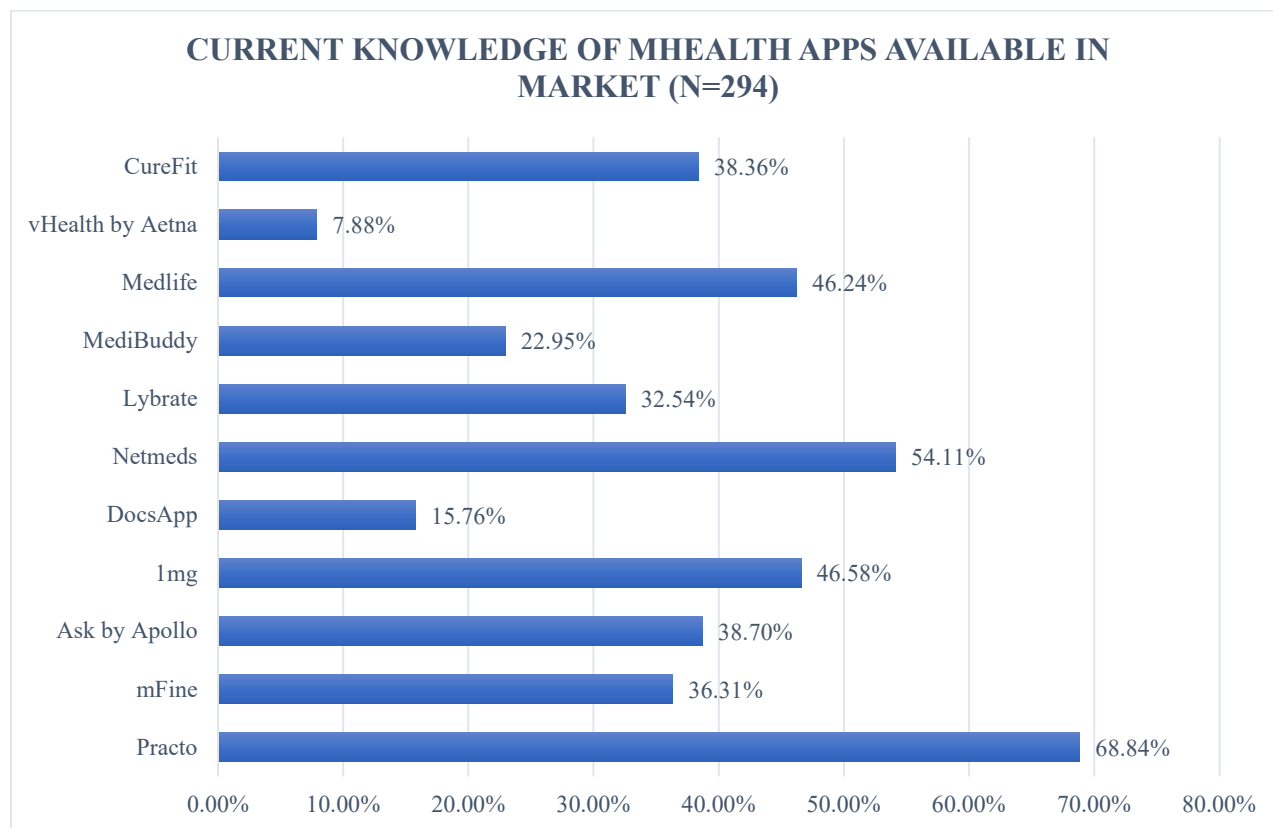


Figure 5: Current level of Knowledge regarding mHealth apps

Current knowledge of mHealth apps currently available in Market is also quite high (Figure 11). More than 68 percent of the respondents have heard about Practo, and there is also high level of awareness about other apps such as Curefit (38.6%), MediBuddy (22.95%), Netmeds (54.11), 1mg (46.58%) among others. This shows that there is high knowledge about mHealth apps, and they can be used to disseminate health related information and other health related surveillance.

ATTITUDE TOWARDS mHEALTH APPLICATIONS

Table 8: Attitude towards mHealth among Students currently not using any mHealth technology
by Gender

Variable	Responses				
		Male (29,32.6%)	Female (60,67.4%)	Total 89	p- value
<i>I don't use any mHealth Technology because I am concerned about my privacy</i>	Completely Agree	2 (6.9%)	13 (21.7%)	15 (16.9%)	0.429
	Somewhat Agree	9 (31.0%)	20 (33.3%)	29 (32.6%)	
	Neutral	6 (27.0%)	8 (15.0%)	15 (16.9%)	
	Somewhat Disagree	4 (13.8%)	6 (10%)	10 (11.2%)	
	Completely Disagree	8 (27.6%)	12 (20%)	20 (22.5%)	
<i>I don't use any mHealth technology because I am concerned that what others might do with my data</i>	Completely Agree	7 (24.1%)	12 (20%)	19 (21.3%)	0.754
	Somewhat Agree	10 (34.5%)	25 (41.7%)	35 (39.3%)	
	Neutral	3 (10.3%)	4 (6.7%)	7 (7.9%)	
	Somewhat Disagree	4 (13.8%)	6 (10%)	10 (11.2%)	
	Completely Disagree	6 (20.7%)	14 (23.3%)	20 (22.5%)	
<i>I don't want to put any information online that may personally identify me</i>	Completely Agree	9 (31.0%)	12 (20%)	21 (23.6%)	0.312
	Somewhat Agree	10 (36.7%)	22 (36.7%)	29 (32.6%)	
	Neutral	4 (13.8%)	3 (5.0%)	7 (7.9%)	
	Somewhat Disagree	1 (3.4%)	5 (8.3%)	6 (6.7%)	
	Completely Disagree	5 (17.2%)	18 (30%)	23 (25.8%)	
<i>*statistically significant at $p < 0.05$</i>					

Key concerns concerning students' attitudes about mHealth among students that don't use any mHealth app currently were observed. Bivariate Analysis was done with respect to Gender and it was found that both Males and Females (44, 49.5%) were in concerned about the Privacy and it is one of the reasons that they don't use any mHealth apps currently. The students were also concerned about the fact that what others may do with their data (54,60.6%), and they are also concerned to put any data or information online that may personally identify them (50, 56.2%). Females (53, 55%) are more concerned about their privacy than Males (11, 37.9%). Whereas Males (19, 67.7%) are privier about putting any information online that may personally identify them, than Females (34, 56.7%).

Table 9: Attitude towards mHealth among Students currently using any mHealth technology by Gender

Variable		Gender	Completely Agree	Somewhat Agree	Neutral	Somewh at Disagre e	Completely Disagree	Total	p-value
I think my mHealth apps have adequate data protection measures and my data is safe with them	Male		21	35	12	23	27	118	0.252
			17.7%	29.6%	10.1%	19.4%	22.8%		
	Female		29	74	13	24	37	177	
			16.3%	41.8%	7.3%	13.4%	20.9%		
I will be okay if my Healthcare Providers use my mHealth app data	Male		12	69	23	23	50	118	0.065
			11.0%	58.4%	19.4%	19.4%	21.2%		
	Female		13	61	8	11	25	177	
			7.3%	34.4%	4.5%	6.2%	14.1%		
I think using mHealth technology is convenient	Male		30	35	11	9	7	118	0.362
			25.4%	29.7%	9.3%	7.6%	4.0%		
	Female		51	40	19	7	60	177	
			28.8%	22.6%	10.7%	4.0%	33.9%		
*statistically significant at $p < 0.05$									

Key concerns concerning students' attitudes about mHealth among students who are already use any mHealth app were observed. Bivariate Analysis was done with respect to Gender and it was found that more Females (103, 58.1%) than Males (56, 47%) are in the opinion that their information is safe with their mHealth. Males (81, 68%) are agreeing more to share their data with their healthcare providers than Females (74, 41%). When asked about convenience to use mHealth technology Males (65, 55.1%) find it more convenient than females (91, 51.4%).

Though the general attitude and perception among current users is that their data is currently safe, and they believe that their mHealth apps have necessary measure but seeing the apprehensions some more measures should be provided my mHealth apps. As those who

currently use mHealth apps or Mobile to seek Health Information want following improvements, some of which are that they want their apps to be *“Easier to use”, “better reach”*. They also want their apps to have *“Better customer support, quicker turnaround time”*. One of the respondents also said that *“Privacy concerns is in the priority list. So, make sure that, consumers have full faith and satisfaction while using those apps. And make that transparency.”* One of them also said that there should be *“Stricter Accountability policies”*, Another respondent said that *“Government should educate more people about its use providing awareness about these apps as people lack knowledge and lack understanding about benefits.”*

Another main concern among respondents is *“Policy changes in privacy and data security”, “More promotion”, “Spreading word of mouth that it's safe to use”, “Promoting this as safer option”, “More Transparency”*

So, privacy is the main issue and concern among both users as well as non-users, mHealth application developers should surely keep this in mind while designing their apps.

BARRIERS FACED IN USING mHEALTH APPLICATIONS

Table 10: Barriers in using mHealth Technology among students by Age and Gender

Responses (n=89) (Males 29, Females 60)

<i>Gender</i>	Credibility	Internet Issues	Lack of Government's role in mHealth promotion	Lack of understanding	Price	Privacy Concern	Scientific Evidence	p-value
<i>Male</i>	11	3	6	15	18	15	7	0.078
	37.9%	10.3%	20.6%	51.7%	62%	51.7%	22.5%	
<i>Female</i>	4	10	4	32	38	42	3	
	6.6%	16.6%	6.6%	53.3%	65.0%	70%	5%	

The students currently not using any kind of mHealth Technology were asked about the reasons which led them to not use an mHealth technology. Bivariate Analysis was done with respect to Gender and Age and it is presented in Table 10. It is found that Lack of understanding of benefits of mHealth is the most common reason of not using any mHealth technology. It was seen in both Males (15, 51.7%) and Females (53.3%). Price was another big factor that inhibits students from using mHealth applications as both Males (18, 62%) and Females have shown apprehension regarding that. Privacy is also another major factor, and females 42 (70%) are more concerned about their Privacy as compared to Males (15, 51.7%). Another factor includes Credibility, Internet Issues, and Lack of scientific evidence.

DISCUSSION

The study is a cross-sectional study on mHealth knowledge, attitude, and usage among students aged 18 and up in India, and it is most likely the first study on mHealth knowledge and use among college students in India. The study shows difference in Knowledge, Attitude and use across different Gender and Age. According to the findings of the study, there is indeed high level of mobile usage for mHealth apps or seeking health information across genders, academic level, states, and area of residence. The current self-assessed health status among students is low, (Table 5) the most common answer is Good (147, 38.3% n=384), 117 (30.5%, n= 384) students answered that they are feeling Fair and 30 (7.8%, n=384).

India has four mobile network providers, namely Jio, Vodafone Idea, Airtel and BSNL. Through mobile-based health interventions, these mobile networks provide a one-of-a-kind chance to reduce the numerous obstacles to healthcare delivery and health promotion in India. Because they satisfy the first criteria for mHealth implementation, the high frequency of mobile phone use (Figure 1, Figure 3) shows that the general community is ready to adopt mHealth.

The overall usage of mHealth was found to be high as more than 76 % respondents are currently using or have recently used any kind of mHealth technology. Among Male 118 (80.3%) and Female (177, 74.7%) respondents there was no statistically significant difference found in use and knowledge, which is indeed good sign., but it is quite different to studies earlier done in Ghana (Peprah et al., 2019). and Bangladesh (Rahman et al., 2017). This is a good indicator since mHealth may be utilized for female-targeted programmes for reproductive health, maternity, neonatal, and child health (MNCH), and immunization are just a few of the topics covered. As a result, this may be used as proof for future mHealth innovations.

Though high, but it is low as compared to a study done among Adults in Delhi (Parija, Tiwari, Sharma and Saha, 2020), which reported that more than 88% Adults use any kind of mHealth apps.

The research respondents' ideal knowledge and awareness of the use of mHealth also correlates to its optimal use, as more than 72 % of the students who used mHealth use it on a regular basis used, that is almost half of them only use it once a month. This is quite opposite to a study done among University students in Ghana (Peprah et al., 2019).

Not unexpectedly, the current study also found evidence that students frequently use Google, Instagram, YouTube, WhatsApp, and Twitter to get mHealth information on their phones. (Table 6) and the finding is quite like a study done among University students in Ghana (Peprah et al., 2019).

In a systematic review regarding Use of Mobile Phone to increase Vaccine Uptake (Oliver-Williams et al., 2017). It was found that SMS reminders were found to be effective in increasing vaccination coverage and found out a huge gap for more evidence use of mHealth for increase in Vaccine uptake in India, Pakistan and other Low- and Middle-Income Countries. Though this current study doesn't focus on this issue, but it was found that there was a high search frequency regarding Vaccine among respondents, and it was even found statistically significant with Age of the respondents.

In a previous study done in India regarding mHealth in Puducherry, India (Ramachandran et al., 2015), three most common topics of interest were Dietary Habits (38.6%), lifestyle modification (25.2%), and proper use of medication (21.6%) In this study among students' similar results were found as Weight loss (44.89%), Drug/Medicine (50.34%), Nutritional Benefits of Food and Nutraceuticals (13.94 %) were found to be the most common topic of Interest.

Significant difficulties with students' attitudes toward and perceptions of mHealth were discovered. Students have assessed mHealth services and can grade their efficacy, convenience, safety, and information sharing capability, according to the research. Students who currently use mHealth, find it to be a convenient option for getting healthcare information, they are ready to share their information with their healthcare providers and they are relieved that their data is safe with their mHealth application providers according to the research. Privacy was found to be the main barrier towards not using mHealth applications among the students who do not currently use any mHealth application.

Findings of this study will help programmers and implementers develop future mHealth policies to enhance mHealth Knowledge and Use. It can also be suitable to launch mHealth programmes

that can reach and be used by students.

This study has certain limitations, such as its use of a cross-sectional survey methodology among college going students. Different circumstances may exist outside of the academic community, such as higher access and knowledge of mHealth technology. The other drawback is that the findings may be vulnerable to response bias and social desirability bias because they were obtained from respondents' self-reports of mobile health.

CONCLUSION

In conclusion this study shows that mHealth knowledge is widespread among college students and that it does not differ between boys and females. The survey discovered a significant frequency of mHealth use among Indian college students. The use of mHealth to search for Vaccine, Weight Loss and Mental Health suggests that adult students require more information regarding these topics. The general attitude and perception regarding mHealth is good among the respondents who use mHealth apps currently but the apprehensions regarding the privacy of their information and data is still there, and it is also becoming a barrier to its use in many cases. More studies are needed to be done in this area to find more evidence regarding correlation of Sociodemographic factors and use of mHealth applications.

SUGGESTIONS

- The evidence government should focus more on public health initiatives that are linked to mobile health.
- The concerned authorities should ensure that there are stringent laws in place to protect user data.
- Integration of mobile health programmes into the country's healthcare system can also be done to improve healthcare services.
- There should be more government role in promotion of mHealth applications.
- There should also be checks and balances on the information regarding health on Internet, as wrong information can lead to detrimental conditions.

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