Internship Training

at

Doctor Alliance

A survey of Indian Population on Smartwatch uses in Remote Health Monitoring

by

Dr. Azmin Sheikh

PG/21/023

Under the guidance of

Dr. Rupsa Banerjee

Post-Graduate Diploma in Management (Hospital and Health)

2021-2023

International Institute of Health Management Research, New Delhi

Dated: 28- June - 2023

(Completion of Dissertation from respective organization)

The certificate is awarded to
Name **Dr. Azmin Sheikh**
in recognition of having successfully completed her
Dissertation in the department of

Title: **Clinical Services**

and has successfully completed her Project on
A survey of Indian Population on Smartwatch uses in Remote Health Monitoring
Date: **6th January 2023**
Organization: **Doctor Alliance**
She comes across as a committed, sincere & diligent person who has
a strong drive & zeal for learning.
We wish him/her all the best for future endeavors

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By: **Sanju K Nagendra**
PeopleOps Manager

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This is to certify that **Dr. Azmin Sheikh** student of PGDM (Hospital & Health Management) from International Institute of Health Management Research, New Delhi has undergone internship training at **Doctor Alliance** from **6th January 2023** to **30th April 2023**.

The Candidate has successfully carried out the study designated to him during internship training and her approach to the study has been sincere, scientific, and analytical.

The Internship is in fulfilment of the course requirements.

I wish him all success in all his/her future endeavours.

Dr. Sumesh Kumar
Associate Dean, Academic and Student Affairs
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Mentor

IIHMR, New Delhi

Certificate of Approval

The following dissertation titled **"A Survey of Indian Population on Smartwatch Uses in Remote Health Monitoring"** is hereby approved as a certified study in management carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite for the award of **PGDM (Hospital & Health Management)** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

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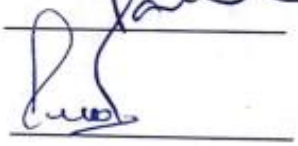
Dr Pumi Yadav	
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Title of the Dissertation/Summer Assignment	A survey on Indian Population on Smartwatch uses in Remote Health Monitoring.		
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This is to certify that Dr. Azmin Nishad Husain Sheikh, a graduate student of the PGDM (Hospital & Health Management) has worked under our guidance and supervision. He/ She is submitting this dissertation titled **"A survey of Indian Population on Smartwatch uses in Remote Health Monitoring"** at "Doctor Alliance" in partial fulfillment of the requirements for the award of the PGDM (Hospital & Health Management).

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

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This is to certify that the dissertation titled **A survey of Indian Population on Smartwatch uses in Remote Health Monitoring** and submitted by **Dr Azmin Nishad Sheikh** Enrollment No. **PG/21/023** under the supervision of **Dr. Rupsa Banerjee** for award of PGDM (Hospital & Health Management) of the Institute carried out during the period from **6th January 2023** to **30th April 2023**. embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

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(Dr. Azmin Sheikh)

FEEDBACK FORM

Name of the Student: Dr. Azmin Nishad Sheikh

Name of the Organisation in Which Dissertation Has Been Completed: Doctor Alliance

Area of Dissertation: Clinical services

Attendance: 100%

Objectives achieved: Yes

Deliverables: Data collection, analysis and project report

Strengths: Motivated, quality work

Suggestions for Improvement: Timeliness

Suggestions for Institute (course curriculum, industry interaction, placement, alumni):

Signature of the Officer-in-Charge/ Organisation Mentor (Dissertation)

Date: 23 June 2023

Place: New Delhi

FEEDBACK FORM

Name of the Student: Dr. Azmin Nishad Sheikh

Name of the Organisation in Which Dissertation Has Been Completed: Doctor Alliance

Area of Dissertation: Clinical services

Attendance: 100%

Objectives achieved: Yes

Deliverables: Research, Data collection, analysis and Project Report

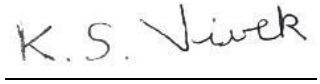
Strengths: Committed and Focused, Strong clinical understanding, Hardworking, strong desire to do well, able to put heart and soul into getting the tasks done.

Suggestions for Improvement: Lack of strategic thinking. Combined with not focussing on the big picture (as the saying goes not seeing the forest for the trees), this at times leads to inefficiency towards achieving the goals, or in some cases the goals not being met. Learn to think strategically and you will be unstoppable.

Suggestions for Institute (course curriculum, industry interaction, placement, alumni):

1) The healthcare world is depending more and more on innovative software platforms. Covering EHRs in detail and going over major software platforms would make your students more ready for the business world.

2) Project Management - There would have to be deeper emphasis on complex project management, and how to use PM tools (be it asana, monday, or any equivalent tool focusing on GANNT charts, dependencies etc)



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Date: 27/06/2023

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I would like to express my sincere gratitude to **Mr. Vivek Kushal** who have contributed to the successful completion of this study titled " **A survey of Indian Population on Smartwatch uses in Remote Health Monitoring**." Without his support, guidance, and assistance, this research would not have been possible.

I would like to acknowledge my mentor and teacher **Dr. Rupsa Banerjee** for enriching this project with her advice and suggestions, who generously shared her valuable insights and experiences. Her active support and cooperation were instrumental in providing me with the necessary data and information to analyse and draw meaningful conclusions.

I would like to acknowledge the research team and support staff for their dedicated efforts in designing and conducting this study. Their expertise, professionalism, and meticulous attention to detail have been indispensable in ensuring the accuracy and validity of the findings. I am grateful to the institutional review research committee that provided oversight and guidance throughout the study. I would also like to express our gratitude to our colleagues, mentors, and advisors for their invaluable input, feedback, and encouragement. Their expertise and guidance significantly enriched the research process and contributed to the overall quality of this study.

I am also happy to express my heartfelt thanks to all my friends and family members and to all those who have contributed directly or indirectly to this study, I offer my heartfelt thanks. Your contributions have played a vital role in the successful completion of this research, and I am truly grateful for your support and collaboration.

Table of Contents

ABBREVIATIONS

GPS	Global Positioning System
ECG	Electrocardiogram
SOS	Save Our Ship
SpO2	Oxygen saturation
COVID-19	Corona Virus Disease of 2019
ML	Machine Learning
QFD	Quality Function Deployment
PCOD	Polycystic Ovarian Disease
BP	Blood Pressure
PD	Parkinsons Disease
UAE	United Arab Emirates
TAM	Technology Acceptance Model
SW	Smart watch

LIST OF TABLES

LIST OF FIGURES

DISSERTATION REPORT

CHAPTER 1: ABSTRACT

Background:

One of the most recent advancements in the world of information technology assessment is the smart watch, commonly referred to as a small computer. New smart watches and fitness trackers are released to the public each year. Wearables for the wrist now have sensors, which collect useful data. Examples of these sensors are heart rate, accelerometer, and pedometer. Smart watches are getting more and more popular since they let users communicate and access web information while they're on the go. In addition to providing the user with temporal and spatial data, smart watches can display a map on their screens. It's a contemporary gadget that was released a few years ago. Market wearables capture vital signals that were previously used to identify the beginning of infectious disease. A smart watch is a piece of contemporary technology that combines smart phone features with ongoing data monitoring to promote fitness, including step tracking, heart rate monitoring, energy usage, and levels of physical activity. Additionally, it offers users feedback to support them in managing their health.

Aim:

To assess the use of smart watches by the population using it in monitoring health status.

Objectives:

1. To assess the prevalence of smart watch use in Indian Population.
2.To assess the socio-demographic factors associated with smart watch use.
3.To identify the conditions/ reasons for which the population is utilizing smartwatches.

Material and Methods:

The participants were given a self-made google questionnaire with 2 different sections for the smart watch users and non-users about the use of smart watches from various brands by people of all ages.

Results:

The study's findings suggest that because smart watches give users access to information about their surroundings and bodily problems, they are becoming increasingly widespread and valuable for individuals in their daily lives. 353 responses were collected and after analysis the prevalence of smart watch use in Indian Population from this survey was 46% of the participants has smartwatch and 54% of the participants does not have a smartwatch. The non smart watch users were using other apps and devices to track their health and maximum of the participants showed desire to use smartwatch in future for various purposes.

Conclusion: The percentage of smartwatch users was less than then the non-smartwatch users by 8%. Male users of smartwatches were found to use them 10.3% more frequently than female users, while the working population, particularly those in the 20–40 age range, made up the majority of smartwatch users. Cardiovascular illnesses and hypertension were shown to be the most prevalent conditions among participants who used smartwatches, followed by diabetes and obesity. The desire to use a smartwatch in the future was also observed in non-users of smartwatches.

Keywords: Smart watches, users, non-users, health issues, satisfaction, awareness, devices, health apps, self-constructed Questionnaire

CHAPTER 2: INTRODUCTION

Smartwatches have become an effective tool for remote health monitoring in recent years, allowing users to monitor their vital signs and general health. India's healthcare system might be completely transformed by this technology, especially in rural and underdeveloped areas where there is little access to medical care. The advantages and difficulties of adopting smartwatches for remote health monitoring in India will be discussed in this article, along with several standout models that are currently on the market.

In India, smartwatches have many benefits for remote health monitoring. In the beginning, they give people instant access to personal health information, such as heart rate, blood pressure, sleep patterns, and activity levels. Users are given the tools they need to take control of their health and make wise decisions as a result. Smartwatches can also give notifications when they notice unusual patterns, enabling prompt action and lowering the likelihood of complications.

Additionally, GPS-enabled smartwatches can track a user's position, which is useful for people with chronic illnesses or in emergencies. With the ability to track patients' movements and send help when needed, this functionality is especially important in remote locations with limited access to medical services.

While smartwatches have a lot of potential for remote health monitoring in India, there are still a number of issues that need to be resolved. First and foremost, dependable internet connectivity is required, especially in rural locations where network coverage may be constrained. For efficient data transfer, efforts should be made to upgrade network infrastructure and provide seamless connectivity.

Making sure the health data acquired by smartwatches is accurate and reliable is a substantial additional difficulty. Even if improvements in sensor technology have increased accuracy, low-cost devices may still have variations and inaccuracies. To guarantee the accuracy and consistency of data, standards and regulations for health monitoring equipment must be established.

Security and data privacy are also very important factors. To preserve users' privacy, it is crucial to have strong data protection procedures in place when using smartwatches because they capture critical health information. The handling and storage of health data gathered by smartwatches should be governed by stringent rules and laws.

There are a number of smartwatches on the market that include features ideal for remote health monitoring in India. One notable example is the Apple Watch, which has a variety of health tracking capabilities like electrocardiogram (ECG) readings, heart rate monitoring, and fall detection. Additionally, it features an integrated SOS capability that can link users to emergency services. The exorbitant cost of Apple Watches, though, might make them less widely available to Indians in general.

The Fitbit Sense is another choice; it's a multipurpose smartwatch with extensive health tracking features. It has functions including heart rate tracking, ECG readings, stress reduction techniques, and sleep tracking. Additionally, the Fitbit Sense also provides a SpO2 sensor for blood oxygen level monitoring, which can be particularly useful in COVID-19.

Brands like Xiaomi and Realme provide smartwatches with health tracking functions at comparatively cheaper pricing if you're looking for more economical options. These watches are used by a wider range of people since they offer fundamental features like heart rate monitoring,

sleep tracking, and step counting. They may not have some of the more sophisticated capabilities available in higher-end versions, but they are still useful instruments for remote health monitoring.

By giving people access to real-time health data and enabling proactive health management, smartwatches have the potential to revolutionise remote health monitoring in India. To enable widespread use and effectiveness, however, issues including internet connectivity, data veracity, and privacy concerns must be resolved. With a variety of smartwatches, including inexpensive models, this technology is now more widely available. Smartwatches have the potential to significantly improve healthcare outcomes and address the issues presented by distant and underprivileged areas in India with sustained development and sensible regulation.

Moreover, numerous applications for mobile health (mHealth) and remote health monitoring have been made possible by recent advancements in wristwatch technology. The smartwatch is a cutting-edge device that combines smartphone functions with ongoing health-promoting data monitoring, including step tracking, heart rate monitoring, energy consumption, and levels of physical activity. Users can receive input from them that enables them to keep track of their health, carry out just-in-time treatments like using medication depending on symptoms, and have direct contact with carers and medical professionals. But constraints specific to smartwatches, such price, wearability, and battery life, prevent widespread adoption of the device in healthcare and telemedicine.[1]

Smart watches have the potential to support health in everyday activities by allowing for self-monitoring of personal activity, obtaining feedback based on activity measures, enabling in-person surveys to identify behavioural trends, and facilitating two-way communication with family members and health care professionals. Smart watches, however, are a more recent innovation.[2] Thus, the following survey will provide information how smartwatch is used in healthcare applications and will help/enable us to witness a new trend how useful smartwatches are in examining health status leading to a healthy lifestyle. This study will provide the information what various measures people take if there are abnormal variations in health biometrics and what challenges they face while using smartwatches. This study will benefit us to know how technology aids in health management; improving quality of life and various challenges faced, thus fuelling new research in these areas.

Aim of this study is to assess the use of smart watches by the population using it in monitoring health status.

The Objectives

1.To assess the prevalence of smart watch use in Indian Population.

2.To assess the socio-demographic factors associated with smart watch use.

3.To identify the conditions/ reasons for which the population is utilizing smartwatches.

CHAPTER 3: LITERATURE REVIEW:

Smartwatches have become common wearable gadgets with a variety of features, including health monitoring. This review intends to investigate the body of knowledge about the application of smartwatches in healthcare settings. It highlights the impact of smartwatches on several facets of health and wellbeing while examining their advantages, difficulties, and possible uses.

The study by King CE et al discovered that only 27 studies directly relevant to health care were included in the 1119 papers on the use of smartwatches. These studies also only have a few number of applications, such as activity monitoring, chronic disease self-management, nursing or home-based care, and healthcare education. All studies had a very small number of research subjects assessed because they were all regarded as feasibility or usability studies. It is indicated that much additional research on much larger populations is required because there were no randomised clinical trial studies found. This will evaluate the effectiveness of utilising smartwatches in healthcare interventions and could ultimately result in the technology's widespread acceptance in this industry.[1]

In the study by Singh et al (2021) All senior citizens (those over 60) residing in Delhi and the national capital region made up the study's target group. The possibility of using smartwatches to keep tabs on participants' general health was known to all of the participants.[3]

In the review article by Lu et al (2016) provides insightful information on the prospective uses of smartwatches in healthcare environments. The evaluation serves as a starting point for additional study and the creation of wristwatch apps for patient monitoring, chronic illness management, and health promotion. The data can be used by researchers and healthcare practitioners to examine new possibilities and assess the efficacy of smartwatch treatments in the healthcare industry.[4]

The research done by Al-Emran et al. (2021) adds to the body of knowledge on the use of smartwatches in higher education. The research offers important insights into the elements influencing the acceptance and uptake of smartwatches in educational contexts by investigating students' attitudes and security concerns. The results have significance for educational institutions looking to include smartwatches into their learning settings, emphasising the necessity of addressing security concerns and coordinating with students' beliefs to foster effective adoption. Future studies in this field may deepen our understanding of the use of smartwatches in higher education and provide useful guidance for implementation techniques.[5]

Al-Maroof et al.'s study from 2021 adds to the body of knowledge on users' attitudes on smartwatches for medical use. The study offers important insights into the elements impacting the acceptance and uptake of smartwatches in healthcare contexts by investigating users' views, attitudes, and barriers. The research has ramifications for medical professionals and technology companies hoping to encourage the widespread use of smartwatches for medical purposes, highlighting the significance of addressing user concerns, guaranteeing data security, and offering user-centered design. Future studies in this area will help us better understand user acceptance and will help us create tactics that will encourage the use of smartwatches for medical purposes.[6]

The research done by Varghese et al. (2021) adds to the body of knowledge regarding the diagnostic and validation potential of smartwatches in movement disorders. The research sheds important light

on wristwatch sensors' function in unbiased movement evaluation by assessing their accuracy and dependability. The research shows the potential of smartwatches as diagnostic instruments that allow for remote and continuous monitoring, enhancing care and providing personalised treatment for those with movement disorders. By addressing problems, improving sensor performance, and confirming the clinical usefulness of smartwatches in the treatment of movement disorders, future research can develop the area even further.[7]

The research done by Almarzouqi et al. (2022) adds to the body of knowledge on the factors that influence people's decisions to use medical smartwatches. The study offers important insights into the variables influencing people's behavioural intentions towards these gadgets by using a dual-stage analysis approach. The findings underscore the need to address user concerns and promote the advantages of medical smartwatches, and they have consequences for healthcare practitioners and technology developers. Future studies can improve our comprehension of the adoption process and provide more information.[8]

The Lee et al. (2017) study emphasises the use of QFD approach, particularly the HOQ, in enhancing the product design of smartwatches. The research helps to create high-quality, user-centric smartwatches by discovering client requirements, translating them into design features, and prioritising these features. The research has significance for product developers and designers, highlighting how crucial it is to match design elements with consumer wants and continuously enhance the product based on user feedback. The use of QFD approach can improve the overall look and market viability of smartwatches.[9]

The research done by Panchbudhe et al. (2021) sheds light on how people interact with smartwatches from various manufacturers. The research captures user perceptions, satisfaction levels, and overall experiences using a questionnaire-based technique, highlighting the crucial elements that lead to user happiness and recommendations. The results have significance for makers of smartwatches, highlighting the value of taking into account customer preferences, enhancing design aesthetics, and increasing user interface intuitiveness to improve user experiences and foster brand loyalty. Future studies can look into further aspects of user happiness and factors that affect how users interact with smartwatches.[10]

The usability and accuracy of a smartwatch for measuring physical activity in the older population are evaluated in the study by Martinato et al. (2021). The research sheds light on the possible advantages and difficulties of utilising smartwatches in this situation by investigating the viability and acceptability of smartwatch-based physical activity monitoring. The findings imply that smartwatches can be useful instruments for monitoring and encouraging regular physical activity, which has implications for increasing physical activity in older persons. Future studies might go deeper into the precise characteristics and capabilities that enhance user experience and encourage older persons to engage in persistent physical exercise.[11]

CHAPTER 4: METHODOLOGY

Study Design: Cross sectional descriptive study.

Study setting: Online survey of a sample of Indian population.

Study participants:

Inclusion criteria:

1.People of any age group either using or not using smartwatches.

2.Patients with underlying conditions using smart watches to monitor their health.

3.Combination of smartwatches and smartphones to deliver the intervention.

Exclusion criteria:

1.People not consenting to participate in the survey.

Sampling and Sample Size

Sampling:

• Snowball sampling was considered. As the online questionnaire will be forwarded to known participants and then they will be asked to forward it to other people.

Sample size:

• Sample size is calculated based on a study by Singh et al [3] where p=69%, using the formula zα2*p*q/d2 with 95% level of significance and 5% absolute error, sample size is calculated to be 345.

Study Period:

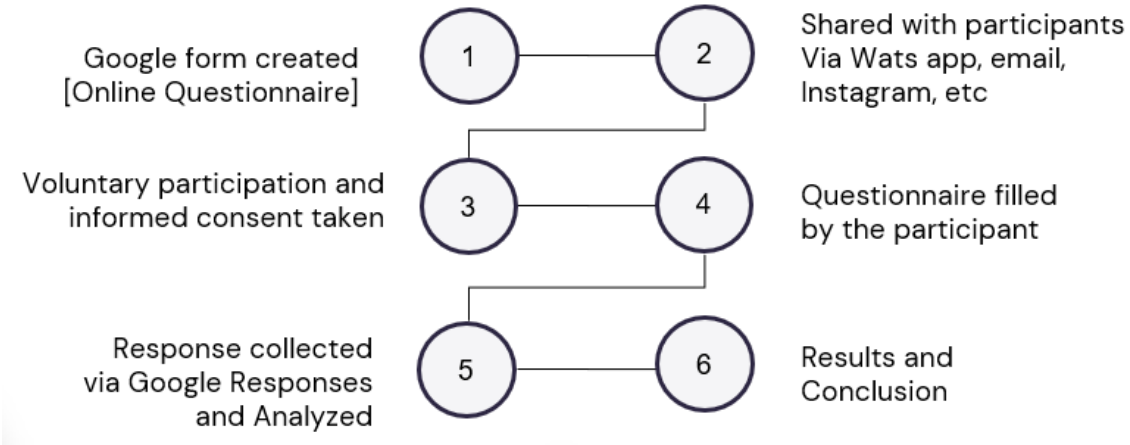
3.5 months including data analysis and report preparation [1st March to 20th June]

Method of Data Collection:

- A self-made Questionnaire using Google forms was created and circulated online amongst the participants.
- Google form generates a database which was imported to an excel sheet and using various excel formulas and graphs; analysis performed.

Figure 1: Mode of Data Collection

Data collection was carried out in the following steps:



CHAPTER 5: RESULTS

Section 1: Socio demographic factors

Table 1: Socio demographic factors

Category	Frequency	Percentage
1. Gender		
Male	180	51%
Female	171	48%
Prefer Not to say	2	1%
2. Age group		
21 – 40	147	41%
40- 60	74	21%
Below 20	66	19%
Above 60	66	19%
3. Occupation		
Working	132	38%
Student	124	35%
Non-working [homemaker, finding job]	61	17%
Retired	36	10%
4. Own a smartwatch		
Yes	163	46%
No	190	54%

The prevalence of smart watch use in Indian Population from this survey was 46% of the participants has smartwatch and 54% of the participants does not have a smartwatch.

The socio-demographic factors associated with smart watch use and non-users.Out Of 163 Participants ; Male 54.6% and Female 45.3% were using smartwatch and out of 190 participants ; 53.68% Male and 45.26% Female were non users

Maximum of the participants 47.23% belong to the age group of 21-40 years [77 participants] and the age group above 60 has the least i.e 12.26% [20 participants] were the users

and among the non users maximum participants belonged to age group 21-40 years [36%] and the age group below 20 had the least i.e.14.74%

Maximum of the participants 42.33% is the working population using smartwatches [69 participants] and the Retired population is the least i.e 6.74% [11 participants], Students 33.74% and Non working/ Homemaker/ Finding Job is 17.79% and amongst the non users; Students 36.32%, Working 33.16%, Non working/ Homemaker/ Finding Job 16% and Retired 13%

Section 2 : Participant is a smart watch user

Table 2: Medical condition/health issues

	N	%
Have no medical condition	73	44.79%
Hypertension and other Cardiac Disorders	38	23.31%
Diabetes	17	10.43%
PCOD	9	5.52%
Thyroid disorders	4	2.45%
Obesity	8	4.91%
Migraine	8	4.91%
Asthma	3	1.84%
Chronic Kidney Disease	2	1.23%
liver condition	1	0.61%
Total	163	

Out of 163 participants; 44.79% [73 participants] had no medical condition/ health issues and 55.21% had medical condition. Majority of the participants had Hypertension and other Cardiac Disorders 23.31% [38 participants] followed by Diabetes 10.43%, Asthma 1.84%, chronic kidney disease 1.23%, and Liver condition 0.61%

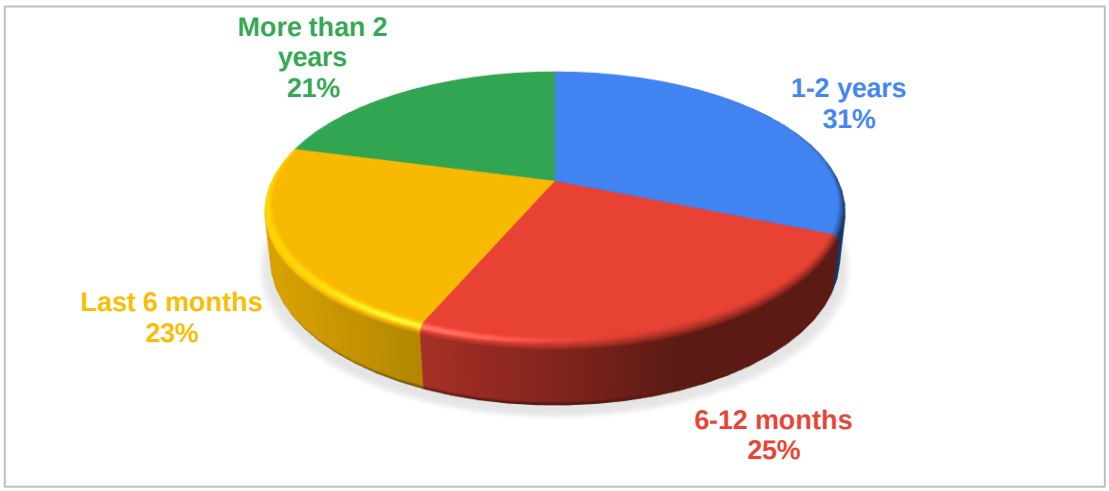
Table 3 : Use of other device to track your health status other than your smart watch

	N	%
Do not use any other device	121	74.23%
BP monitor	14	8.59%
My phone	12	7.36%
Glucometer	10	6.13%
Weighing Machine	6	3.68%
Total	163	

The vast majority of respondents (74.23%) say they just use their smartwatch to monitor their health. This shows that the smartwatch is the only device used by these respondents to track their health.

However, some of the responders do make use of other gadgets for certain health monitoring needs.8.59% of those surveyed track their blood pressure readings using a blood pressure monitor (BP monitor). Followed by 7.36% of respondents use their phone to track their health and 6.13% of those surveyed use a glucometer to check their blood sugar levels and 3.68% of those surveyed use a scale to keep track of their weight.

Figure 2: Duration of using smart watch



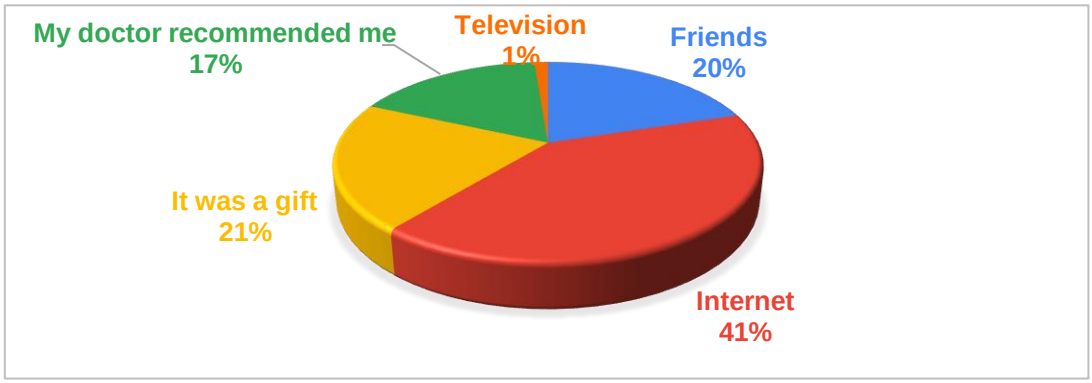
53% of the participants were using their smartwatches since less than a year and 21% of the respondents are using their watches for more than 2 years

Table 4: Purpose of buying the watch

	N	%
To track my health status	46	28.22%
Due to medical condition/ Doctor advised	34	20.86%
I like digital watches	30	18.40%
To get work updates/emails/messages/calls	27	16.56%
To look stylish	24	14.72%
Cannot deny free gifts	2	1.23%
Total	163	

The purpose of buying the smartwatch for Majority of participants 49.08% was either to track health status or advised by the doctor and 34.35% bought the watch because they like it

Figure 3 : Source of awareness about smart watches



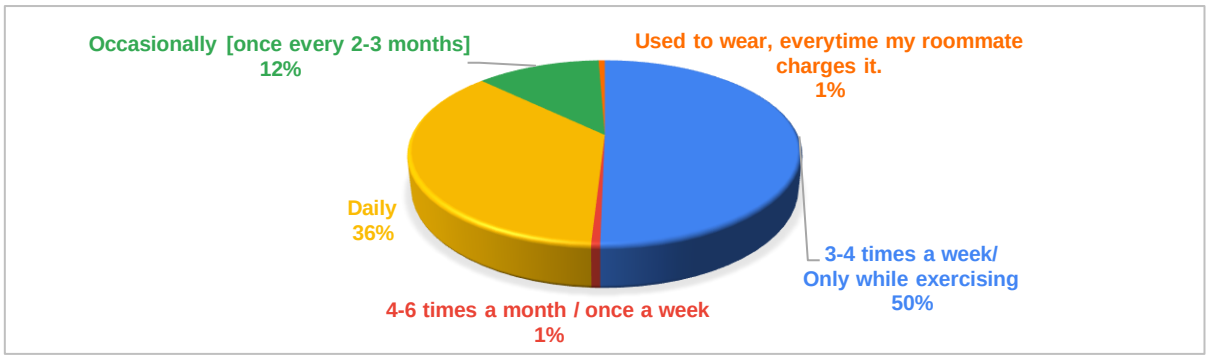
The participants learned about smartwatches through a variety of sources, although major source was internet (41%).
21% of the participants reported receiving a smartwatch as a present, 20% said they learned about the item via friends, 17% said their doctors had informed them about it, and 1% said they learned about it from television.

Table 5: Information preferred from the smart watch

	N	%
Medical information	78	47.85%
Exercise info	42	25.77%
Dietary information	22	13.50%
Email/communication history, Social media updates	21	12.88%
Total	163	

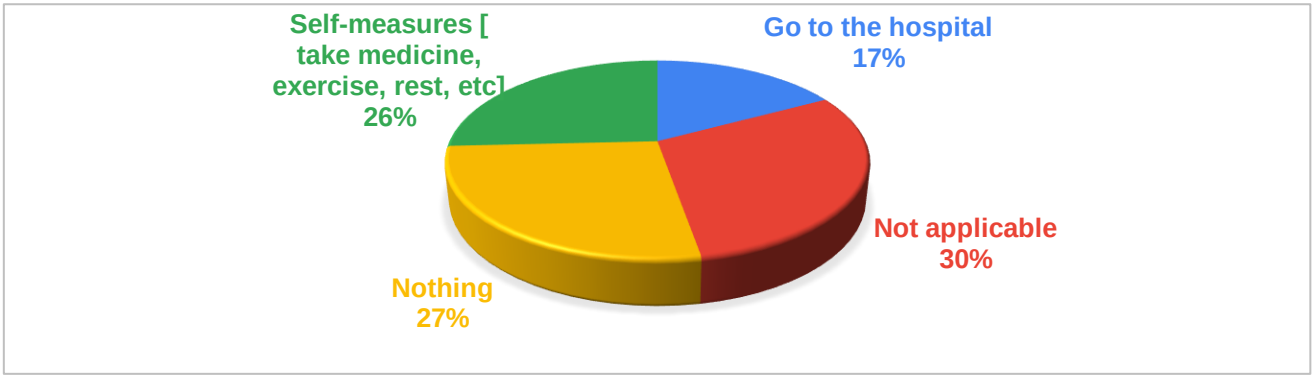
73.62% would prefer medical and exercise information from their device followed by dietary 13.50%and least 12.88% would prefer emails and other updates.

Figure 4: Usage Frequency of the wearable device



86% of the participants wear their device 4-7 times a week and 13% wear it occasionally

Figure 5: Measures taken by participants when an abnormal variation in the measured health information



When an abnormal variation is detected 27% participants do nothing, 26 % take self-measure and 17% go to the hospital.

Table 6: App used on watch/mobile to teach health status

	N	%
Do not use any app	141	86.50%
Google Fit	9	5.52%
Samsung health	5	3.07%
Fittr	4	2.45%
Apple health	2	1.23%
Youtube	2	1.23%
Total	163	

86.50% of the participants do not use any app to track their health.

Table 7: Challenges faced while using your smartwatch

	N	%
Quick Battery drainage	94	58%
Real time data is not accurate sometimes	43	26%
Does not notify when measured data is not in normal range	26	16%

Major challenge face by 58% participants while using the smartwatch was quick battery drainage and 42% reported that the real data is not accurate or does not notify on on abnormal event

Table 8: Smartwatches help manage health

	N	%
Yes	94	58%
No	25	15%
Not Sure	44	27%
Total	163	

Maximum of the participants agreed that smartwatches help them to manage their health and 15% disagreed to it.

Table 9: Situation where smartwatch helped to identify any health issue

	N	%
Not until now	132	80.98%
Yes, abnormal heart beat, Reminds me of elevated BP	28	17.18%
Yes once i forgot to take my blood pressure medicine and my BP got elevated. The smartwatch alerted me	3	1.84%
Total	163	

80.98% participants responded that their smartwatch did not help them identify any health issue until now and 19.2 agreed that the smartwatch alerts them about any abnormal variation which helps them manage health.

Table 10: Reasons of not being satisfied with smartwatch.

Much more accurate data can be provided with an alarming feature for higher ranges which is above normal
Not satisfied because it doesn't have many features which limits the usage of the smart watch
I wish for more options
More options for messages and calls
Easy user interface

99% of the participants were aware that smart watch can be used to monitor health and 1% reported that they are unaware about it

Among the smartwatch users 6 % would discontinue using their smartwatch in future and 94% would continue using it.

76% participants have recommended and 24% participants have not recommended smartwatch to anyone

91% of the participants were satisfied with their respective smartwatches, 6% were not sure and 3% were not satisfied with their smartwatch

Section 3: Participant is a non-User

Table 11: Reason of not using a smart watch

	N	%
I am Not so tech savvy	63	33.16%
Smartwatches are Overpriced	48	25.26%
Likes analogue watches / Not so fond of smartwatches	36	18.95%
Do not find smartwatch of any use	16	8.42%
Total	190	

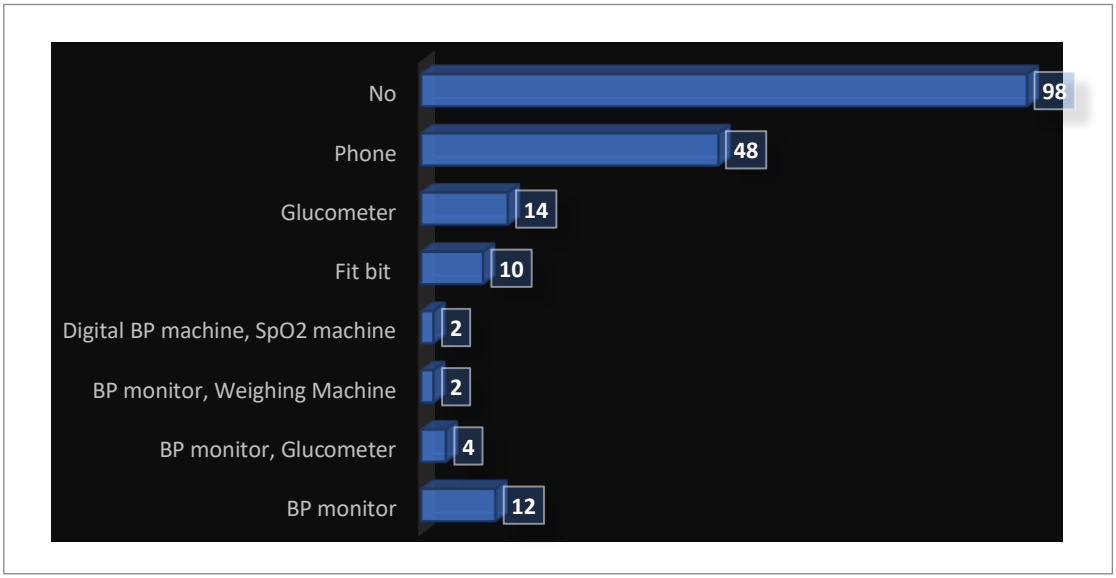
Majority 33.16% of the participants were not using the smartwatch because they are not fond of technology and 8.42% did not find smart watch of any use

Table 12: Medical condition/health issues

	N	%
Do not have any medical Codition	102	53.68%
Hypertension and Other cardiac disorders	37	19.47%
Diabetes	26	13.68%
Thyroid disorders	10	5.26%
PCOD	8	4.21%
Obesity	4	2.11%
Migraine	3	1.58%
Total	190	

Out of 190 participants; Majority 53.68% [102 participants] had no medical condition/ health issues and others had medical condition. Participants had Hypertension and other Cardiac Disorders 17.47% followed by Diabetes 3.68%, and less participants were seen with Obesity 4.91%, migraine 1.58%

Figure 6: Other device used by the participants to track health status



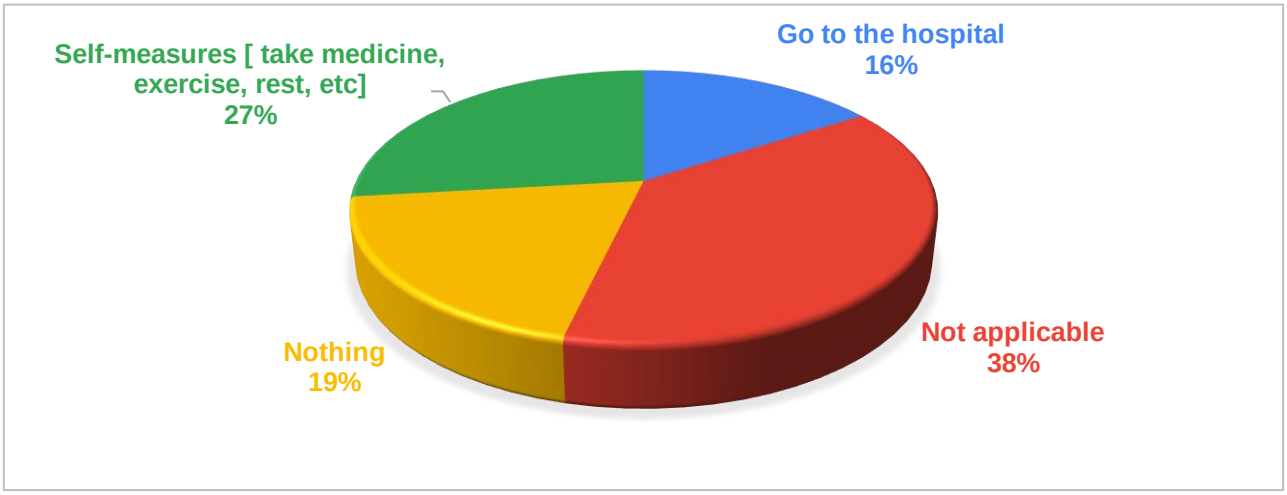
Majority[98] of the participants were not using any device and other were using devices such as phone, glucometer and BP monitor to monitor their health.

Table 13: Apps used on watch/mobile to teach health status

	N	%
Do not use any app	121	63.68%
Google Fit	28	14.74%
My fitness Pal	13	6.84%
mySugr	8	4.21%
Runkeeper	5	2.63%
Strava	5	2.63%
Samsung health	4	2.11%
Apple Health	2	1.05%
Instant heart Rate	2	1.05%
Health app IOS	2	1.05%
Total	190	

63.68% of the participants do not use any app to track their health.

Figure 7: Measures taken by participants when an abnormal variation in the measured health information



Among the non users majority of the participants, 88% were aware that smartwatches are used to track/ monitor health and 12 % respondents were not aware of it.

Table 14: Source of awareness about smart watches

	N	%
Internet	107	56.32%
Friends	37	19.47%
My doctor	25	13.16%
From This Survey	10	5.26%
It was a gift	9	4.74%
Television	2	1.05%
Total	190	

The participants learned about smartwatches through a variety of sources, although major source was internet (56.32%), 19.47% said they learned about the item via friends, 4.74% of the participants reported receiving a smartwatch as a present, 13.16% said their doctors had informed them about it, and 1.05% said they learned about it from television.

Table 15: Information preferred from the smart watch

	N	%
Medical information	63	33.16%
Exercise info	57	30.00%
Dietary information	39	20.53%
Email/communication history, Social media updates	31	16.32%
Total	190	

63.16% would prefer medical and exercise information from their device followed by dietary 20.53%and least 16.32% would prefer emails and other updates.

Table 16: Reasons by non-users for using a smartwatch in future

	N	%
To Track my Health Status	78	41.68%
*Because smart watch can track our health status and give us real time data of health which is beneficial.		
*Because it gives a clarity about your health and the measures you need to take to be in good physical condition		
*Yes it's easier to track my steps then		
*I believe it will help me track my health problems and status in a easier way		
Yes, Want to give it a try	53	27.89%
Want to use, Its cool, stylish, like it	35	18.42%
Find it of no use, Distracting/ analogue better	24	12%
Total	190	

Majority of the participants 41.68% would use the smartwatch to track their health and 12% would not use it in future because they find the device useless.

88% of interviewees expressed a willingness to use a smartwatch, while only 12% said they would not in the future

CHAPTER 6: DISCUSSION

In the study by Reeder et al, the majority of the research (14/17, 82%), used consumer-grade smart watches. Patients were used in studies that focused on monitoring activity, heart rate, speech therapy compliance, diabetes management, and the detection of seizures, tremors, scratching, eating, and medication-taking behaviour. In the bulk of patient-related studies (10/17, 58%), few exclusion criteria were applied while recruiting participants. Participants with such conditions were only included in trials with a particular emphasis on controlling diabetes, epilepsy, or Parkinson's disease.[2] In study by Lu TC(2016) the majority of studies (19, 79%). Two registered clinical trials that are in progress were found. The majority of the listed studies (6, 25%) centred on elderly health monitoring applications. One study on cardiac arrest and five on Parkinson's disease patients. [4] In study by Varghese et al (2021) Technology-based Parkinson's Disease (PD) examinations are made possible by smartwatches. To incorporate those devices in an assessment, their accuracy and dependability must be assessed. We propose original findings for machine learning (ML)-based illness classification and sensor validation. To assess tremor-like amplitudes and frequencies, a comparison setup was created using two distinct series of Apple smartwatches, a seismometer from Nanometrics, and a high-precision shaker. Clinical smartwatch measurements were obtained from a prospective research with 450 persons with Parkinson's disease (PD), participants with other disorders (DD), and those who were healthy.[7]

Whereas in our survey Smartwatches were used to track daily steps, Blood pressure, blood oxygen and pulse rate. Majority of the participants had Hypertension and other Cardiac Disorders 23.31% [38 participants] followed by Diabetes 10.43%, PCOD 5.52%, thyroid disorders 2.45%, Obesity 4.91%, migraine 4.91%, Asthma 1.84%, chronic kidney disease 1.23%, and Liver condition 0.61% among the smart watch users. No participant with Parkinson disease was reported by this survey nor any participant used the smartwatch for Tremor assessment or were using the sensor validation.

In the study by Singh et al had 534 respondents and all Senior citizens (those over 60) living in Delhi and the national capital region were the study's target demographic. All the participants were aware that smartwatches might be used in order to maintain track on their overall health.[3]

In our study of smartwatches, the awareness was not 100percent. Among the users 99% of the respondents and among the non-users 88% of the participants were aware that the smartwatches can be used to monitor health. The reason for unawareness was not being so fond of technology and no interest (36 participants) in smartwatches by the non-users.

In the study by Al- Maroof (2021) the factors influencing the adoption of Smartwatch are found using the Technology Acceptance Model (TAM). In medical facilities in the UAE, the questionnaire is given to a group of doctors, nurses, and office employees. The findings of the present study demonstrate that the key model constructs contribute to SW acceptability and satisfaction in several ways. Overall research indicates that SW is highly sought after in the medical industry and is utilised as a common channel between physicians and their patients. In a medical setting, where the primary motivation is to improve and facilitate the effective roles of doctors and patients. [6]

In our survey all age groups were included. Participants with medical condition used Smartwatches to monitor their health. Satisfaction was found out to be 91% among the users. Quick battery drainage, real time data not accurate, user interface difficult to use were few reasons of unsatisfaction among the 9% users. Our study did not particularly involve doctors, nurses or patients but also

students below age 20, homemakers and retired populaton. 17% participants said that their doctor recommended the watch to them and among the non-users, 13.16 participants source of awareness about the smartwatch was their doctors.

In study by Martino et al (2021) it included participants were 75 years old on average. With the exception of one observation, the Bland-Altman plot showed that all variations between measurements fell within the confidence intervals, illustrating the strong agreement between the step count measurements, hence measuring their physical activity.

In our study out of 163 participants using smartwatches 20 belonged to elderly population (14 male and 6 female) and they used the smartwatch for measuring their exercise information, medical information and dietary information as well.

In the study by Holko el al (2022) surveyed 1007 adult patients about wearable fitness trackers at six Federally Qualified Health Centres. Results show that 48% of people are interested in buying fitness trackers. Cost and a lack of knowledge were two obstacles, which showed that high-touch methods, education, and investment are needed for widespread adoption of digital health devices.

In our study 88% non-smartwatch user participants showed the interest in using it in future which was higher from the study of Holko el al(2022). The obstacles for not buying smartwatch were for 33.16% technology was an obstacle [being not so tech savvy], for 25.26% reason was smartwatches being overpriced and 8.42% did not find it of any use

In the study of Jal et al(2022) Nearly half of the research projects that were chosen employed Android wear (9, 45%). This could be because Android Wear is open-source, which makes it possible to use it in accordance with study criteria. Apple Watch was used in six publications (30%). Both systems recently released have blood oxygen sensors, electrical heart sensors, third-generation optical heart sensors, GPS, and barometric altimeters as functional components. Smart watch GPS and heart rate tracking accuracy is comparable to some good dedicated trackers. The Apple Watch's (7%) electrocardiogram (ECG) and blood oxygen (SPO2) monitoring capabilities from the most recent series are no longer of a high standard of care. [15]

In our survey of smartwatches no participant reported of using smartchwatch or other device to monitor ECG, moreover it was found that participants are using different gadgets to monitor their other health issues, Apple health was used by only 4 participant, BP monitor was used by 14 participants using smart watch, glucometer (10 participants) and weighing machine (6 participants) to monitor their health. Among the non users SPO2 machine was used by 2 participants, BP monito by 16, Glucometer by 14, fitbit (10 particpants) and 2 participants were using weighing machine.

Also, among the users other health applications such as Google fit, samsung health, Fittr, apple health used on the android/ smartphones were used by the participants to track their health, between the non-users With 14.74% of the respondents, Google Fit is the most widely used option. With 6.84% of the user base, MyFitnessPal is the second most popular app, and mySugr is third with 4.21%. The remaining options, which range in user percentage from 2.63% to 1.05%, are Runkeeper, Strava, Samsung Health, Apple Health, Instant Heart Rate, and Health app iOS.

CHAPTER 7: CONCLUSION

From the above data collected and the results which we got from the study it can be said that-

The percentage of smartwatch users was less than then the non-smartwatch users by 8%. Male users of smartwatches were found to use them 10.3% more frequently than female users, while the working population, particularly those in the 20–40 age range, made up the majority of smartwatch users. Cardiovascular illnesses and hypertension were shown to be the most prevalent conditions among participants who used smartwatches, followed by diabetes and obesity. The desire to use a smartwatch in the future was also observed in non-users of smartwatches.
The main source is the internet. 41% of users and 57% of non-users agreed with this statement. The users level of satisfaction was great, coming in at 91%. Additionally, 99% of smartwatch users and 88% of non-users were aware that smartwatches are used to monitor health.
Among the non-users other devices such as glucometer, Bp device, etc and health apps such as Google Fit, fitness pal, etc were used to track their health status.

Smartwatches offer constant health monitoring, individualised insights, and improved patient participation, they have the potential to completely change the way chronic illness management. Despite difficulties, continued technological and scientific progress shows promise for enhancing the use of smartwatches in the management of chronic diseases. Healthcare professionals and people with chronic conditions can collaborate to improve overall quality of life and health outcomes by utilising the capabilities of smartwatches.

CHAPTER 8: Data Collection Tool

Questionnaire

Informed consent

Information by interviewer
Hi! I am a student of IIHMR, a Institute of Health Management in Dwarka, New Delhi. I would like to ask you a few questions regarding smartwatch. This study examines smartwatches, its different applications, and how they might help people lead healthier lives while also monitoring their health. You are not required to take part in the survey. Typically, the questions you will be asked last between 10 and 15 minutes. Your responses will be kept completely private and only the survey team members will have access to them. Your identity and name won't be saved. You are under no obligation to complete surveys or engage in research if you choose not to. You are allowed to choose not to respond to any questions you are uncomfortable answering for whatever reason. You will not receive anything from taking part in this research project, either directly or indirectly. However, as technology develops, your feedback might enable us to learn more about the subject, which might also be useful to you later on. As a result, we respectfully ask that you take part in this study.
In case of any query, you may contact the institute at 01130418900 or IIHMR, Plot No. 3, Sector 18A, Dwarka Phase II, New Delhi 110075.

Informed consent by the participant
"I understand that my participation in the study is completely voluntary, and I may choose to withdraw from the study at any time if necessary. I also understand that the information provided by me will be kept confidential and will be used only for this research purpose.
The details of this study have been explained to me. I give my voluntary consent to participate in the above-mentioned research study."

Option 1 – Yes
Option 2 – No

1. Please indicate your Gender
   Male
   Female
   Other

2. Under which Age group you belong to
   Below 20
   21 – 40
   40- 60
   Above 60

3. What do you do?
   Student
   Working
   Non-working [homemaker, finding job]

Retired
Other (please specify)

4. Do you have a smartwatch?
   YES
   NO

If Participant select's No as an Option

5. Reason of not using a smart watch?
   I am Not so tech savvy
   Likes analogue watches / Not so fond of smartwatches
   Smartwatches are Overpriced
   Do not find smartwatch of any use
   Want to buy a specific Brand
   Other (Please specify)

6. Do you have any medical condition/health issues?
   Hypertension
   Diabetes
   Obesity
   Thyroid disorders
   Cardiac disorders
   Any other (please specify)
   Not applicable

7. Do you use any other device to track your health status? If yes please specify
   Yes
   No

8. Name of any specific app you use on your watch/mobile to teach health status?
   App name----
   Not applicable

9. Are you aware that smart watch can be used to monitor health?
   Yes
   No

10. From where you came to know about smart watches?
    My doctor recommended me
    Friends
    Internet
    Television
    It was a gift
    Other (please specify)

11. What information would you personally want your device to tell you? Please specify [multiple choice]
    Exercise info
    Medical info
    Dietary info
    Email/communication history
    Social media updates
    Other (please specify)
    Not Applicable

12. What measures do you take when you see an abnormal variation in the measured health information?
    Nothing
    Go to the hospital
    Self-measures [take medicine, exercise, rest, etc]
    Other -please specify
    Not applicable

13. Do you wish to use a smartwatch in future?
    Yes
    No

14. If yes/ no please specify why
    [open ended]

If Participant select's Yes an Option

5. Do you have any medical condition/health issues?
    Hypertension
    Diabetes
    Obesity
    Thyroid disorders
    Cardiac disorders
    Any other (please specify)
    Not applicable

6. Do you also use any other device to track your health status other than your smart watch? If yes please specify
    Yes
    No

7. Since how long you have been using your watch?

Last 6 months
6-12 months
1-2 years
More than 2 years

8. Are you aware that smart watch can be used to monitor health?
   Yes
   No

9. What was the purpose of buying the watch
   To look stylish
   I like digital watches
   To track your health status
   Due to medical condition/ Doctor Advised
   Other (please specify)

10. From where you came to know about smart watches?
    My doctor recommended me
    Friends
    Internet
    Television
    It was a gift
    Other (please specify)

11. How often do you use your wearable device
    Daily
    3-4 times a week
    4-6 times a month
    Occasionally [once every 2-3 months]
    Other (please specify)

12. What information would you personally want your wearable device to tell you? Please specify [multiple choice]
    Exercise info
    Medical info
    Dietary info
    Email/communication history
    Social media updates
    Other (please specify)
    Not Applicable

13. Name of any specific app you use on your watch/mobile to teach health status?
    App name----
    Not applicable

14. What measures do you take when you see an abnormal variation in the measured health information?

Nothing
Go to the hospital
Self-measures [take medicine, exercise, rest, etc]
Other -please specify

15. What are the challenges you face while using your smartwatch
    Quick Battery drainage
    Real time data is not accurate sometimes
    Does not notify when measured data is not in normal range
    Other - specify

16. Does your smartwatch help you manage your health?
    Yes
    No
    Not sure

17. Was there any situation where your smartwatch helped you to identify any health issue? (If yes please describe)
    Yes (Description)
    No

18. Are you satisfied with your smartwatch?
    Yes
    No- specify

19. If dissatisfied with your smartwatch, are you going Discontinue/ stop using it in future? If no please specify
    Yes
    No

20. Have you recommended smart watch to anyone else?
    Yes
    No

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