

**Czech University of Life Sciences Prague Faculty of
Economics and Management System Engineering and
Informatics**



**Smart Healthcare
and
Assisted Living**

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Economics and Management

DIPLOMA THESIS ASSIGNMENT

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Systems Engineering and Informatics
Informatics

Thesis title

Smart healthcare and assisted living

Objectives of thesis

The goal is to perform a survey to make clearer views in the control of ICT that keeps record with accuracy and relevance and analyse different objectives by managing the factors of modern technology with smart applications, and define different viewpoints of modern medical science interventions and the impact on human beings.

Methodology

In the first part of thesis, there will be a theoretical review, for example on robotized strategies can have patient monitoring devices and personal digital assistants in smart living. In the second and practical part of thesis, there will be a study which can have various evidences by making primary researches by conducting interviews, surveys, focus group discussion and sample collections over the past experiments. Likely, this study can further elaborate the goals of smart medical systems for accomplishing better assistance in our daily life. Quantitative results will be performed over the primary data analysis methods to accept the collections from samples and viewpoints of the respondents. Be focused on basic challenges faced by the smart healthcare providers and also the opportunities while applying the improvements, and robotized strategies can have patient monitoring devices and personal digital assistants in smart living.

The proposed extent of the thesis

80 – 120 pages

Keywords

the quality of care; surgical plans; clinical decision support systems; E-health (electronic processes and communication process in healthcare practices) and M-health (mobile health)

Recommended information sources

Gambhir, S.S., Ge, T.J., Vermesh, O. and Spitler, R., 2018. Toward achieving precision health. Science translational medicine, Journal of medical systems, 43(3), pp.1-10.

Marques, G., Ferreira, C.R. and Pitarma, R., 2019. Indoor air quality assessment using a CO₂ monitoring system based on internet of things.

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Declaration

I hereby declare that I have worked on this diploma thesis titled " **Smart Healthcare and Assisted Living** " by myself, and I have just used the sources mentioned at the end of the thesis. As the author of the diploma thesis, I declare that the thesis does not infringe any person's copyrights.

In Prague on

Rajesh Kumar

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1. Introduction

In today's era, certain advancements are taking place in the field of scientific theories and technologies along with the use of conventional medicine with biotechnology as a fundamental part of technological advancement. Gradual digitization and technical advancement are taking place. The emergence of the smart healthcare process has taken place with the introduction of technologies in the field of medicine. It can be said that smart healthcare is not only simple progress in the field of technology but also a multi-change extent. There have been certain medical changes in the models such as care transformed from centralizing disease to centralizing patients, constructional changes in technologies such as the change took place from clinical computerization to local medical computerization.

Certain changes took place in the medical administration such as administration shifting from general to individual (Ali *et al.*, 2020). The last change took place in the sector of treatment and prevention of diseases such as the center of attention transformed from the treatment of disease to prevention and healthcare. The changes were made to meet the individual needs of the patients with the help of improvement in the healthcare process, enhancing the health and medical care services and constituting the enhancement in modern medicine.

1.1 Concept explaining smart health care:

The concept of smart healthcare might be considered to have evolved from the concept of a smart planet. The smart planet can be defined as the infrastructure based on technology that includes processing information through cloud computing and supercomputers, sensors that perceive information, and transformation of information with the help of information of things (IoT) (Khan *et al.*, 2020). The role of a smart planet is to coordinate with the community systems and merge them so that they can realize the refined and dynamic administration of the society of humans. Smart healthcare can be considered as a system that provides health services that includes IoT, linking people, wearable gadgets, and the use of mobile internet to achieve and get access to information, institutions, and materials related to healthcare, and then the active response and management of medical habitat that needs smart manners.

It has been observed that smart healthcare can provide the connection between every party related to the field of healthcare by ensuring the fulfillment of every necessity of the individuals (Tuli *et al.*, 2020). It also helps in making informed decisions as well as smooth the logical assignment of the processes involved in the smart healthcare process. The concept of smart healthcare might be considered to have evolved from the concept of a smart world. The smart planet can be defined as the infrastructure based on technology that includes processing information through cloud computing and supercomputers, sensors that perceive information, and transformation of information with the help of information of things (IoT) (Khan *et al.*, 2020). The role of a smart planet is to coordinate with the community systems and merge them so that they can realize the refined and dynamic administration of the society of humans. Smart healthcare can be defined as a system that provides health services that contains IoT, connecting people, wearable devices, and the use of mobile internet to obtain and access information, institutions, and materials related to healthcare, as well as the active response and management of medical habitats that require smart behavior. It has been observed that smart healthcare can provide the connection between every party related to the field of healthcare by ensuring the fulfillment of every necessity of the individuals (Tuli *et al.*, 2020). It also helps in making informed decisions as well as smooth the logical assignment of the processes involved in the smart healthcare process.

1.2 Technologies helping in smart healthcare process:

It can be justified that smart healthcare processes involve the association of patients and doctors, institutions of research, and hospitals. It can be considered as an animated whole that has numerous dimensions that include monitoring and prevention of disease, treatment and diagnosis, managing hospitals, medical research, and decision making in the health sector. Big data, mobile internet IoT, microelectronics, cloud computing, 5G, and artificial intelligence, in addition to biotechnology, have become the cornerstone of intelligent healthcare.

All of these technologies are required for the fine details of intelligent healthcare. It can be said that from the view of patients, they can use the devices they are habituated with to keep noticing their health all the time, can get assistance virtually if needed, and can avail remote services in remote homes (Kumar *et al.*, 2020). It

will be helpful for the doctors as well because they can manage the medical details of the patients including the Picture Archiving and Communication Systems (PACS), Electronic Medical Records, Laboratory Information Management System, etc. Using mixed theory and surgical robots, more precise surgery can be done. For managing the individual materials and the chain of supply and using the unified platforms of administration for collecting information radio frequency identification technology (RFID) can be put into consideration.

1.3 Application of smart healthcare technology:

The goals for delivering smart healthcare can be broken down into three categories: The diagnosis of the disease has become smarter with the application of surgical robots, artificial intelligence, and mixed realities. The use of artificial intelligence for building the decision support of clinics has gained results in diagnosing lung cancer, hepatitis, and skin cancer.

With the beginning of the 21st century, it can be noticed that several chronic diseases have reached the zenith of the spectrum of human health. Chronic diseases have long disease duration, are incurable as well as costly (Yang *et al.*, 2020). It can be said that the new model of health administration under intelligent healthcare pays most care to the self-management capacity of patients.

It has been observed that the new disease threat forecast model that carries data with the help of smart apps and devices also uploads them to the cloud with the help of the network and examine data results that are based on the algorithmic program to feedback the result that has been predicted in real-time with the use of composed messages.

1.4 Rationale:

The thesis is having various rationale by directing recent and basic scopes of collecting data. It does not collect any personal information of any patient or have any kind of illegal access to any records of hospitals. The thesis is constructed keeping the Data Protection Act 2018, in mind that does not allow and displacement of personal information or data of any patients. It can be said that in today's world the intervention supports the physical and mental health of patients by taking a few

steps against disgrace. The Copyright, Patents and Design Act 1988 can take immediate action if an unauthorized copy of any other research work has been identified. The thesis defines individual views on the relevant topic and takes other works as references. The survey has been done on an adequate number of participants which is approx. 100 by circulating questionnaires online, on every social media platform to reach the maximum audience.

The primary focus is based on the use of smart technologies in the field of medicine and their application of that. The thesis also focuses on several pieces of literature helping in putting forward the concern of using smart technologies for medical purposes.

2 Objectives and Methodology of the thesis

Intelligent technology can be defined as a health service structure that uses technologies such as IoT, connecting people, mobile internet for information access, wearable devices, and institutions that are related to healthcare and finally responds to and manages the needs of medical habitats smartly. The thesis helps in focusing on the use of smart technologies in the medical field and keeping accurate and relevant records of the same. There are certain objects of the thesis such as,

To help the users learn to manage themselves during emergencies. Proper emphasis is provided so that the user can have an excellent experience.

To connect health with digital treatment and care solutions that can be operated without any help with additional facilities such as detection of emergencies, alarm capabilities, and continuous monitoring of health.

The primary challenges that are faced by the providers during the implication of smart health technologies and also the opportunities in the application of the technologies. Certain methods will be followed in the research work.

2.1 Research philosophy:

The thesis will follow positivism for pursuing the research. Positivism defines the factual representation of knowledge in any research work. The research will include

factual information gathered through observation. The role of the researcher in the research will be limited to collecting data interpreting it in an unbiased way. The study will be in the quantifiable observation that will provide statistical analysis as well as human experiences. The research will follow all the five principles of positivism such as there will be no logic of examination throughout science, the research's purpose will be determined through explanation and prediction, the search will be observed through human senses, the common senses of human will not be allowed to prejudice the findings of the research (Positivism - Research Methodology, 2021). Science in the research will be free from value and should not be judged by the use of logic.

The observer will conduct the work independently in the following research. The research will be irrelevant to human interest. The explanations in the research will demonstrate casualty. The method of deduction and hypothesis will be used to progress the investigation. The concepts offered in the study will be operationalized, allowing them to be measured. In the research, the unit of analysis will be reduced to the simplest words possible. The results of the study will be generalized using statistical probability. Sampling that will be used in the research will be done on a massive amount that will be randomly selected.

The study will focus on the evolution, source, and nature of knowledge. In the research, positivism will be based on experience as a reliable source of information. The positivist in the research will presume that several types of the process can be recognized as a particular variation in the relation and action between the individual researchers. The research findings from the studies will be descriptive and will lack the perception of several issues that are deep-rooted. The researcher will be an analyzer of the researcher's goals. The researcher will work independently, and the research will be performed subjectively.

2.2 Methodological approach:

Both primary and secondary methodologies will be used to perform the research. The research will provide information of both self-conducted as well as information that has been conducted by others. The research will give the answers to specific questions along with that it will also go through the previously conducted research

(McCrocklin, 2021). Both of the methods will be responsible for answering specific questions that will come up during the conduction of the research. The answers to a few questions will be available in journals and other research works but there will be questions that will require more resources to answer.

The research will consist of data from the previous research materials that had been published in reports of research and documents that are similar. The documents will be available at websites, public libraries or data can be obtained from already filled surveys. The method will be cost-efficient as the data will be collected more from the internet. The data will be free of cost and will cost very less to download the already available data on the internet. Data will also be gathered from public libraries as they contain information and manuscripts of principle research that had been conducted earlier (Xavier, 2020). The study will take a broad view on the topic.

The research will be conducted in the following ways such as the topic will be identified then resources providing sufficient data will be lined down. Already existing data from the previous studies on a similar topic will be collected and will be compared and combined with several other data. The data will be analyzed by searching all the answers to the questions that will come up with the research.

On the other hand, the research will also follow a primary collection of data from a survey that will be conducted on approx. 100 people through an online survey. For data collection, the research will be undertaken on a firsthand basis. The research will be based on raw data. The data that will be collected suits the need of the research and will be customized. Data will be collected based on absolute need (Xavier, 2020). The researcher will be completely immersed in data collection. Online surveys will be used to collect data. The survey process would be time-consuming and might need one to six days.

Research Strategy:

The research strategy, in this case, is a mixed one as it uses both primary and secondary research strategy as it is a mixed method. The research will follow a case study as a secondary research strategy and a survey as the primary strategy. The survey research will follow two critical factors of the survey that are time and tools.

In research, there are various survey methodologies that are employed. The survey will be conducted online for this research. One of the most popular survey methods is the online method. The cost that will be involved in processing the survey will be minimal and the responses that will be gathered from the survey will be extremely accurate.

Cross-sectional survey research will be followed. The researcher will conduct a cross-sectional survey to collect perceptions from a target audience of hundred people in one or six days (Ekuni *et al.*, 2020). The survey method will be implemented in various sectors such as SME business, retail, healthcare, education, etc. The research will use an analytical cross-sectional research method. Researchers will be able to collect data in a relatively short period of time using this strategy. Certain approaches for implementing survey questions will be used.

Such methods will be penning down the questions that will be related to surveys. Understanding the outcome will be very effective in conducting the survey. The target audiences will be finalized. The question that will be irrelevant to the survey will be filtered out as per the survey requirement. The survey will become instrumental if the people participating in the survey ask for the sample questions.

The distribution of the survey questions will be conducted through emails, online and social media platforms. It will be the most important part of the survey. The survey will be chalked out keeping in mind the region and the target audience (Adam, 2020). The feedback from the survey will be analyzed on a real-time basis and the identification of patterns will lead to a much-required breakthrough for the conduction of medicine through biotechnologies. There will be several benefits of the survey research such as the online method of the survey that will be followed in the research method will be low cost than that of paper surveys. The responses of the participants will be kept safe and private.

Another strategy that will be followed in the research will be the case study method. A detailed examination of the specific subject will be performed. The case study method will contain qualitative as well as quantitative methods. The case study method will compare, understand, describe and evaluate the various aspects of the problems that will be faced during the conduction of the research. The case study

method will help the researcher to obtain solid, provisional, deep knowledge about the subject of medicine through biotechnologies (Guo, 2020). The case study method will allow the researcher to explore the meaning, implications, and key characteristics of the case.

The case study will be proved appropriate for the research work as it will keep the focus of the researcher manageable in the project especially due to the lack of time and resources for performing research on a larger scale.

Certain steps will be taken in performing the case study. The researcher will select the topic of smart healthcare technologies through various smart healthcare sources and will develop certain questions along with some statements that will come in the path of the research. The case study will have the potential to provide unexpected and new perceptions of the subject. The research will complicate or challenge the existing theories and the assumptions that already exist. The research will propose some practical courses that will act for resolving the problem (Guo, 2020). The research will bring new perspectives of the upcoming research. The research will not require any representative or random sample from any case study it will look deep into the cases and will come out with relevant comings.

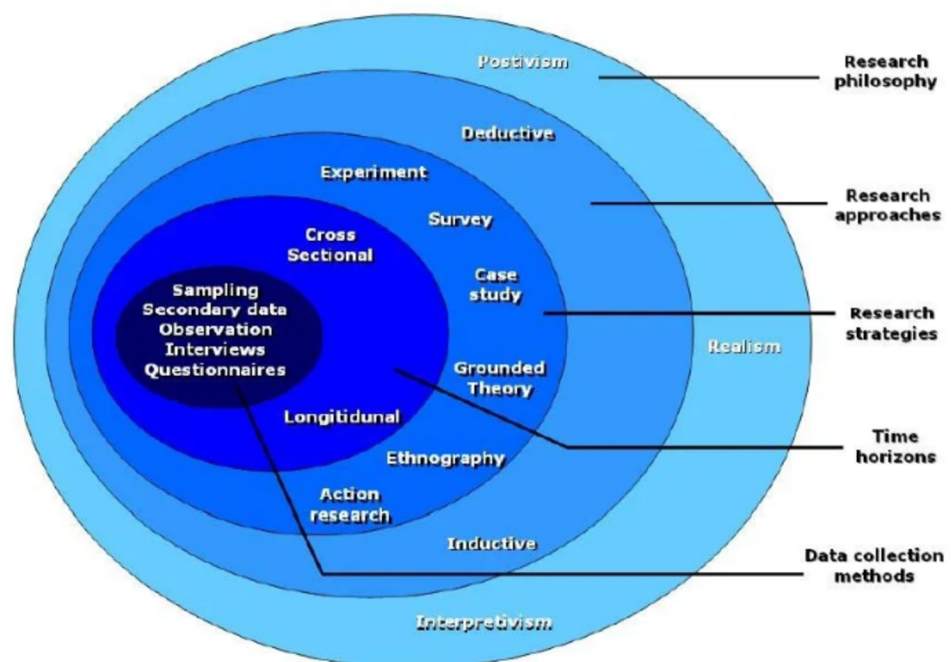


Figure1: The research onion

(Source: Analysis of Saunders Research Onion - Thesismind, 2021)

A theoretical framework will be created in the research method by keeping the focus of the researcher more on the solid details than the general theories. The research will have some connection with the theories that are in the field. The case study will not be any remote description but is non-segregated into the knowledge that is already existing about the topic.

The research will exemplify theories by presenting the cases that are under investigation (Kuzu, 2020). The research will expand the theories that will unveil new ideas and concepts that are needed to be absorbed. The research will also challenge theories that will expose some particular cases that do not fit with the assumptions that have already been established.

A literature review will be done of several sources that will be related to the topic and the development of the theoretical outlines. It will notice the key theories and concepts to guide the interpretation and the analysis. Several other methods will be used as well for collecting data on the subject (Kuzu, 2020). The case study will focus on the qualitative data using several other methods such as observation and analysis of the secondary as well as the primary sources. The research will also perform a qualitative method of collecting data.

Ethical approach of the research:

The ethical approach in research is based on the principles like discussing the cognitive properties in a forward manner. The consciousness will be there in numerous roles. Informed and rules regarding consents will be followed. The respect will be given to the respondents for privacy and confidentiality. There will be three primary ethics that will be put into concern of the ethics in the research that will be performed. First and foremost, the confidentiality of the people participating in the survey will be maintained. Any information that will be taken from the participants will be kept securely and very privately so that it does not get into any kind of misuse.

Secondly, the answer of the participants that will be taken in the survey will be having proper consent from the participants. After, the survey question form will be given to the participants. Thirdly, the information that will be collected from the participants and the answers to the survey will only be used in further study of the topic or any research related to the topic of medicine through biotechnologies. Any other usage will be observed as an offense and steps will be taken regarding the following.

3 Literature review

As the technology becomes upgraded day by day, in the healthcare industry it gives a strong impact. It could be possible because a large number of innovative digital devices are introduced day by day. The changes in medical technologies have some effective ways to describe, some of them are-

Some medical machines help both the patients and the hospital authority to make the medical flow simpler. By using 3D printing in medicine, we can see our internal multi organs in a digital view and it helps the health professionals (Doctors) to find out the issues of the patients in a short time. The latest technologies of 3D printing are also used in many surgeries to know in a better way how the patient's bodies are responding to the surgery. Medical data plays a huge role in analyzing and significant the problems or solutions for the patients. Using new technologies can convert the large data in a short-term way for understanding the doctors as well as the patients. Remote monitoring is another innovation to help those patients who are facing problems to visit the hospitals every week. By using this technology patients can easily consult with their doctors from home comfortably. The innovations of various mobile apps become trending nowadays. So, the various apps are also innovative for the medical science department. As a result of it, people can count their blood pressure, calories rate, heartbeat rate, etc. by using those apps easily.

How the latest technologies affect the healthcare industry and its trends:

Advance telemedicine is another innovation of modern technology which became more popular during the pandemic of the COVID-19 case. After these days the hospitals that had not any plans regarding the advanced telemedicine part also

planned to create their telemedicine services for their customers. Telemedicine service is to reach their patients virtually and to consult and increase access to primary care as long-term facilities like providing dialysis centers, mental health services, etc. All the points which are described here have a good impact on healthcare but also have some disadvantages. Here though the advanced telemedicine techniques gave many solutions for a particular disease but for the people it is difficult to understand which medicine is suitable or perfect for them then (Siyal *et al.*, 2019). Telemedicine is the innovation of the technology which is used in the healthcare department. The basic thing of telemedicine is to provide the patients with their prescribed medicine through online mobile or web portals. This new technology is used in this part of healthcare to make the healthcare process easier for the patients. This is difficult to habituate to this new technology at first these decades but after some time it will be easier for all of us to handle the techniques of telemedicine. Recently, in the healthcare departments telemedicine are used to avoid the gathering of people due to Covid-19 situations. The most common fact of using telemedicine as a healthcare solution is to save the time to visit the doctor's chambers to take the names of prescribed medicines. By using telemedicine one can easily know the information regarding the medicines given to individual patients. Telemedicine helps people know more about the condition of their health by clicking a single button on a telemedicine-based software. As a disadvantage of using telemedicine, we can mention that to use telemedicine should have to access their smart devices properly. The cost of the smart device is too high for the people who be to under poverty. The software or the web portals sometimes failed to give the right calculation regarding the organs, so it can affect healthcare a drawback.

5G enabled gadgets are used to introduce new technologies to the next generation of health care services. These devices make the medical care process easier to understand among people. As AI, iOS, Big data are used to fulfill the needs of modern technologies we also need a proper internet speed to handle the technologies. 5G supported devices are not only used for the help of the doctors, it is also used to convert a long process in a short time and give the results more quickly that will help the patients to cure their disease in a quick way. As the disadvantages of 5g enabled devices we can mention that the cost of the internet pack is difficult to effort for some patients. The technologies which are used to upgrade the healthcare department

are supported by the 5G technologies. Using the technologies, the up gradation of 5g enable devices are becoming more popular due to increasing the uses of the internet. To use the 5G technologies in the department of healthcare the technology should be maintained for the proper up gradation. At the end of the discussion of this part there can be concluded some of the advantages and disadvantages of using the 5G model in the healthcare part. The advantages of using the 5G in healthcare mostly create positive impacts to both of the doctors and patients. Using the 5G technology the latest designed machines can be invented day by day to reach the futuristic state of healthcare properties. To set up the 5G technology there is a necessity to establish the 5G supported system, which can create a huge problem for our society. Using the internet of 5G speed it will bring the whole world into our hand in a few minutes. The knowledge can be boost up easily by using it. There are many disadvantages that can be found for the use of 5G in our healthcare system. The dependency upon the technology will increase by using the 5g technology in this department. Another drawback of this point is there can be the risk of losing the data at a certain time and can create a huge problem. The old generation of us cannot comfortably use 5G enabled devices. It is difficult for them to understand how to use digital devices at the particular time when it is needed (Yadav, and Mamilla, 2021).

Healthcare's digital assistant is another example of modern technologies used in medical science. The technologies of Google Home, Alexa have changed so now people can interact with these smart digital assistant devices. In this year Epic and Cerner have created their largest electronic health records and try to add visual assistants in the software. Using those digital assistant devices people can change their language in their own mother language to understand the health care tips properly and to maintain the tips. Though the digital assistants can guide the patients in their user's healthcare routine, but it has some of the drop backs to be pointed out. Like the cost of the digital assistants are very high so that the people under the poverty rate cannot effort these kinds of digital equipment. Digital assistants are using the latest technologies to compete with the other devices for the healthcare departments. Digital assistant devices offer the facility for their users to interact with those devices. To upgrade healthcare technology as per requirement should spread a positive impact to our society. To describe this point briefly here we have to point out the advantages and disadvantages of using the digital assistant devices. To access

digital assistant devices, one must be able to access the internet. This facility can help those people to know more about how to access the internet portals. The providers of the digital assistants should develop their open facilities to attract more people to engage with this part of the healthcare department. Another advantage of using digital assistants in healthcare is to make the easy way for the patients to maintain their regular healthcare routine. These devices are more expensive to purchase for the people sometimes. As the upgraded technology is used here to balance the software with the interaction of the users the faults can be found in the technology are referred as the drawback of this point. As we can say that the misuse of technology like hacking is called as another backdrop of using the smart assistant devices like Google assistant, Alexa etc. Assistant devices are made of the storage systems. So, if the recovery process cannot be done properly then the risk of the data loss is creating an issue as the use of the digital assistants (Bhatt, Dey and Ashour,2017).

Smarter Pacemaker are devices which use the upgrade version of AI technology. Artificial pacemakers, which have been around for almost a century, are still a vital piece of medical technology. The smarter pacemaker differs from the previous artificial pacemaker within several ways. Using the upgraded version of Bluetooth technology, this device can be linked with the smart phones of the patients. This process which is used in this technology makes the healthcare process more understandable for both of the doctors and their patients. Smarter pacemaker is the device which innovated recently for healthcare. The pacemaker is linked with the other smart devices like smart phones directly. Bluetooth technologies are also upgrading their own properties day by day, so this device also requires the upgrade day by day. This pacemaker works to examine the heartbeat rate of the patient's heart. Using the latest technology in the device helps the patients and doctors to take care of the patients suffering with heart problems. Pacemaker is used as the artificial products for calculating the heartbeat rate. So smart pacemakers make that work easier for the upcoming generation. There are some advantages and disadvantages we can find by using the smart digital pacemaker. One of the advantages is it is easier to use for both the doctors and the patients. Secondly as an advantage we can say that by using the smart pacemaker that it consumes a little time to generate the result. By using the smart pacemaker there is a regularity to knowing about the

heartbeat rate of the heart as the advantage of using a smart pacemaker. Besides some pros, there are some cons we can establish at this point. Sometimes smart devices are not able to provide the proper or right data which can be mentioned as the drawback of the smart pacemaker. Secondly, another disadvantage of this point is that those devices are very costly to buy for people. As it uses high technology there are some risks of technical errors found as the disadvantage of using a smart pacemaker (Dimitrov, 2019).

Healthcare devices for a wearable purpose also make some different sense from the old healthcare process. The innovations of smartwatches can help their owner to calculate the footsteps if a person wears the watch during his jogging time. Some diabetes patients of them wore the glucose monitor to count their rate for their health. The drawback of this point is the meter that calculates the count rate is not proper or perfect sometimes. So, it can create many problems for the patients to understand the rate of the wearable devices (Kruse *et al.*, 2017). Those devices which are used for healthcare purposes are based on highly upgraded technologies. Nowadays smart devices can be used as wearable components. The features of those gadgets which are used in healthcare are able to measure the rates of various organs in human beings. Motion trackers are the most essential parts of any upgraded device. Smart devices are popular for two reasons. Firstly, the smart devices have the technology to interact with their users, so it will act as a motivation for them while they are using the smart devices during their daily workout times. Secondly, they use sensor technology in their devices that can act while they touch the skin of the user. The devices are easy to use by the users. There are some drawbacks we can mention to the use of these wearable devices. These devices are very costly to effort by all the people who belong to the under-poverty rate. These devices are launched in the market with a year of warranty to their users which decreases the value of the device's productivity. Many of the smart devices applied the technology to measure the critical monitoring parts of the human bodies. The cutting-edge based technology devices are made of Bluetooth systems. So, using another smart device one can easily handle the other device if it was connected to the patient's body. So as an overview of this point we can say that wearable devices with upgraded technology helps a IoT to enhance the growth of the healthcare system (Davenport and Kalakota, 2019).

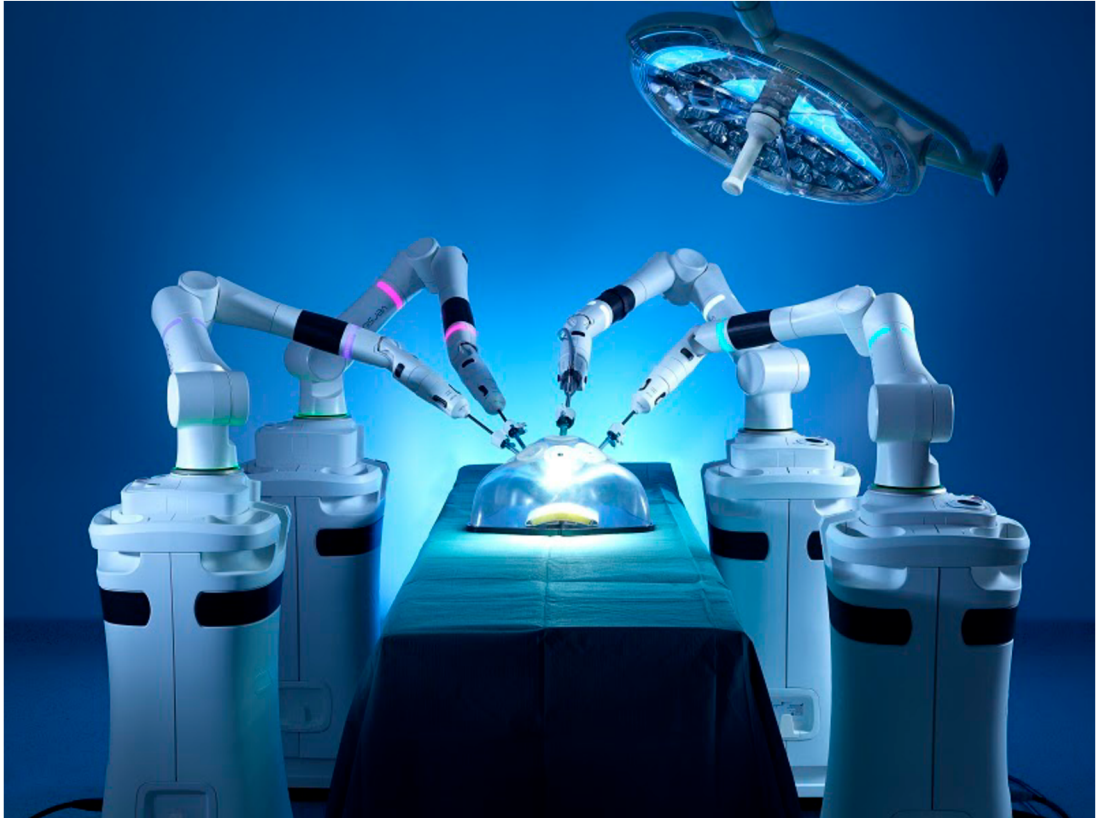


Figure 2: Robotic surgery

(Source: Kent, 2021)

Robotic surgery is another master key of the latest medical science. Robots are the products of new technologies. The use of robotic machine in medical science in surgeries is rising exponentially. Da Vinci's robotic surgical system already covered 200000 operations by using 5G internet enabled services. The advantage of robotic surgery is it is performed in a prescribed way by the doctors. It takes more time while the doctors did their operations consuming a long time like more than two or three hours. While doctors use robotic surgery in a way that they can control the robot by sitting in another place at the same time. So, it will be so handy to the doctors and as well as the patients. Robotic surgery has also its own drawback to create the problem against the surgery in medical science. Like if for a fraction of a moment the surgery went wrong, then the robot cannot solve that problem at that point of time in that situation. As the doctors were involved in that purpose of the surgery at that time this process also takes the same time to describe the prescription to the technical robots. There are many plus points we can get by using the smart and

upgraded technologies but besides these points we can also get stuck at a point of time with the dependency on the technologies. Robotic machines are the invented gadgets to support the medical science or the healthcare industry. The countries which belong to a proper economically developed system only can effort the robots in the healthcare industry. There are some advantages to implement robotic surgery in the healthcare sector. Use of robotic surgery makes hospitalization a short-term process. It is taking very little time to process a surgery. By using robotic surgery, it is easy to reduce the scariness of a patient. By using the robotic surgery risk of the infection becomes observed at a low rate. The recovery rate of the patient becomes fast by using this method in healthcare departments. This technology helps to reduce the rate of pain and blood loss of the patients during the operations. Though robotic surgery is costly for the people, it can reduce the time of the patients and doctors which is used to visit the hospital. There are some basic benefits we can get by using robotic surgery such as the doctors can get better visualizations regarding the operations details. As the doctors can get the clear visualization about the operations, it will help them to enhance their efficiency in their work (Khezr *et al.*, 2018).

At the end of this discussion, this part describes the applications of the technologies to the healthcare industry. Technology is the only way to develop the healthcare industry to balance this industry with the other departments. The Healthcare department is one of the sensitive departments for the growth of our growing society. To enhance the development of our society, it is so much needed for application of the technologies to the healthcare systems. The gadgets which are used in the healthcare centers are used highly upgraded and newly launched technology. By using the technology in the healthcare industry, it will be very easy for the people to handle or consult with their doctors at home by using smart gadgets like the smart phones, computers, tab etc. The technology helps the doctors as well then can treat patients by using the smart gadgets like smart pacemaker, smart inhaler, and smart heart rate counting machines etc. the technology also assists those people who are in their old ages. As an example of this they can consult with their visited doctors comfortably at home using the smart phones by pressing a single button. Those gadgets are sometimes caused as a distraction to the children in their personal growth. The technology depends on smart gadgets taking the whole time of a person so that they cannot focus on their work properly (Hussien *et al.*, 2019).

3.1 Advantages of Technologies in healthcare:

Greater way to take care of the patients-

Technologies become upgraded in the terms of leading the whole world in a smarter way to change the lifestyle of peoples and maintain the proper balances with the advanced world. Implementation of modern technologies is referred to as the advantages of using technologies in the medical science or the healthcare services because by using these can be the greater to take care of the patients in a smarter way. This part of the technology helps the doctors to reach their non-local patients as the other way the same can be helpful to their patients. As it is the way to reach the specialized doctors at the visual digital portal the patients get individual visit sessions from their selected doctors at home.

Improve Public Health:

Applications of technologies are the better way to think about the improvement of public health. A standard IT health system can provide the information to think about the world. The improvement of public health is grown day by day using the help of the upgraded technologies.

Digitalization in Health records:

The most crucial and the essential facts of using the modern technology is the process which is followed by the medical or healthcare organizations to transform in a digital way. In the above point digitalization in the health record means the details of the treatment and the other related details are combined in a single record which takes a small storage space in the using digital device like the smart phones, the computers etc. in the old medical health care techniques there is used pen paper-based file which can be destroyed after some time easily. The records can be lost by the patients for the further procedure and the patients stuck in many problems. By using the latest technologies in the part of taking records helps the health organization or the patients to save for further use. It will help both the doctors and patients to access the same records at the same time by pressing a single button using digital portals.

Big data and the Cloud data:

The term big data is referred to as the substitute word term of combination of the digital-age and often intertwined with the electronic health records. Cloud data is processed by analyzing the elements like reducing healthcare waste, reducing healthcare costs, improving the efficiency and the care of the healthcare center etc. To provide the services over the internet the cloud used both the hardware and software while compiling or gathering the data. The basic advantage of using big data and cloud data is from anywhere in the world if the patient and the doctor can access the records or data if they have the permissions. To access the cloud is a very simple way, by using the suitable application from their smart phones or computers or any other internet accessible devices (Kumar and Singh, 2018).

Better and safer data Storage:

Using the cloud technologies, the risk of losing the medical data records became lower than the previous workflow. To establish the thesis, point here is some examples described below- like in the previous days the records regarding the healthcare organizations and patients are kept in a written form. So, if someone wants to view a particular record then it would create trouble for those healthcare members who must find that data and it also took a long time. After using the latest technologies in this type of case it consumed less amount of time by using some keywords and the process of finding data. Cloud storage protects the risk against the loss of sensitive data and also gives the recovery service.

Help via mechanism:

In this point here can be described some devices which are used for treatment. As the technology becomes developed day by day mechanical systems are also developing their features to work with the technology. Mechanical science is helping in the medical science to make the procedure of treatment faster as the solution to any kind of disease. The utilization of smart devices such as smart pacemaker, smart inhaler, artificial organs etc. helps the medical science to get the result in a smarter digital way to understand their problems. As the disease can define in a smart way, to find its solution becomes easy by consuming a short time process.

Positive impact of technology in healthcare:

Technology brings many positive impacts to healthcare services. It helps to know the people about how to balance the lifestyle by accepting the digitalization processes in the healthcare department. Using internets or online portals of the patients can get their health records easily at home. Though the terms 'telemedicine' become more popular due to this pandemic, it creates long lasting good effects on medical science. Overall, there are many positive impacts we can get by using technology in medical science.

After analyzing the various advantages of technologies in medical science or healthcare organizations it will help to clear the concept of describing more details about the disadvantages of this topic. Some of the disadvantages of technologies in medical science is described below-

3.2 Disadvantages of Technology in healthcare:

Highly expensive:

The technologies which are used to develop the process of medical and healthcare organizations are costly to effort for the people under the poverty level. As the implementations of the new technologies could not be available in the market at a low expense so it creates a huge problem for people to access the technologies. So as a result of it we can say that implementations of technologies will enhance the medical property but also affect the economic stability of a country.

Over Dependence in technologies:

As much as we adopt the latest technologies it will create many other points against the power of medical science. As an instance of it we could say that medical technology has an over dependence on latest technology. It will create problems when the devices which are used in medicine have detected the technical errors. It is quite natural for the technical devices to face an error at any time. This problem is especially vital in the accident and emergency department of any hospital authorities. As an example of this disadvantage like if there is a patient is admitted in the urgency of his and wants an amount of blood to save his life immediately. The other

member of him went to the A&E department to know about the blood analysis information. At that point of time the department suffered from the technical error and failed to inform the patient's member about the blood analysis information. It will create a huge problem for both the hospital authority and the patient. So, this point is called a backdrop of using technologies in healthcare.

Increase the risk of Internet hackers:

As the use of technologies increases day by day in any sector of our lifestyle, the risks of hacking the information also increase day by day. Sometimes a patient's medical histories along with the health records are kept by the doctor or hospital authorities for further confidential purposes which are ethical and legal. So, if the information will be leaked by the hackers on the internet, it will obviously create a security issue for both the hospital authority and the patient. So, this point can be mentioned as the disadvantage of using the latest technology in medical and other factors for our lifestyle.

Negative impact of technology in health care system:

As for the negative impact of technology used in healthcare, the most dangerous point is lack of the security in privacy of the healthcare center or for the patients. Besides it the unstable social relation between the patient and the doctors can be found as the negative impact of using the technology. To access the upgraded technology people, must increase the usage of smart devices. So as another result of it the body ache, lack of sleeping etc. types of diseases are found. As a negative impact of technology, the people will be more attracted to the smart devices, so the personal growth is decreased sometimes. Sometimes the smart devices fail to distribute the accurate information, so it can create a negative impact on the people. The growth of the children's development is also hampered due to increased technology.

Technology and its progress are a part of every human's life. Applications of technology can create good impacts as well as bad impacts to change the lifestyle of humans in various parts (Ahram *et al.*, 2017).

The technology is very important for the healthcare system as the functioning of the healthcare system is updating itself with the latest technology and there are different systems that are important for the healthcare facility. Different countries use different healthcare systems and the technologies are important for the life support process in the industry of healthcare. 60% of healthcare organizations have initiated introducing IoTs into their facilities and China is the foremost country that commenced the technology in the healthcare industry. 47% of the healthcare companies are expecting that they will be using the latest technologies within the next few years and the process is important for the companies. It is estimated that within a few years 40% of the IoT industries will be used for the healthcare system. Almost half of the people who are using the healthcare facility want to contact their physician through the digital mediums and to do that the people need to take the support of the latest technologies such as smart devices, IoT and other internet-based processes (Arsene, 2021).

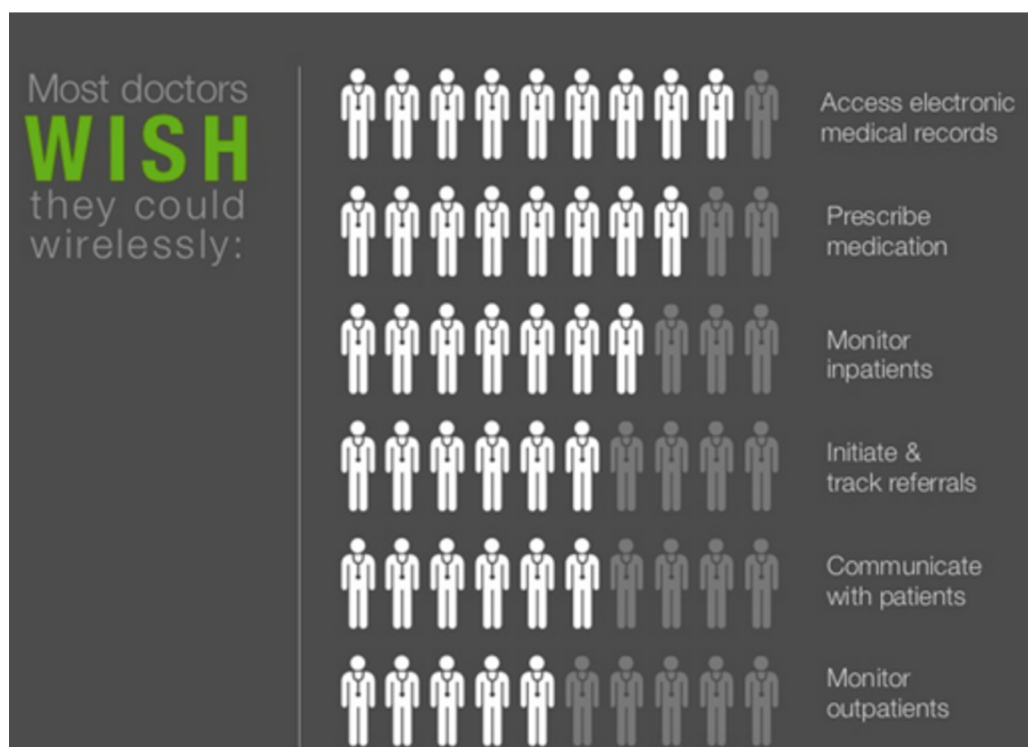


Figure 3: IT in healthcare

(Source: 45 Mind Blowing Digital Health Statistics and Trends, 2021)

The doctors are aligning to the latest models of healthcare and the process is important for the healthcare industry as they are trying to keep up with the latest models that the industry is adopting and therefore along with the patients, the physicians are attempting to use the technology more and more in the healthcare sector.

The diseases are changing courses and it has become tough for the healthcare providers to maintain the procedure of care with the old models and therefore the people are preferring the use of the latest technologies in the case of healthcare including the medicine, surgery and other such divisions. In those scenario, the people need to understand the applications of the technology. The connected healthcare system is important for the people and the quality of the healthcare will increase with this connected healthcare system and the possibility of a positive outcome will increase as well. According to Arsene (2021), the connected healthcare system will change the course of the healthcare system. The advantages and the disadvantages have been discussed above and from that we can understand that the technology is important for healthcare and the industry will be totally based upon the technology within a few years. The quality of the healthcare system is important and to maintain that, the application of the technology is needed by the healthcare system. As the technology is upgrading, the healthcare system, being a necessary system, is adopting the applications of the technology in it. The policy of the healthcare companies is to maintain the quality of the medication system so that more people can get under the schemes of the digitally enhanced healthcare. The proposal of health needs the quality under it so that the people can use the latest technology for the identification of their disease and the solution of them.

It can be justified that the patients from the younger generations expect comfort and personalization that needs the use of multichannel retail communication operation along with accepting the mobile applications and social media. The workforce of smart healthcare requires staff specialized acquiring additional skills. To make the work more well organized for the staff, it is necessary to use the support of robotic and digital assistance. The concepts of technology and health depend on the infrastructure and the use of ICT for research, monitoring, and patient treatment of public health and disorders (Smart Healthcare and New Technologies 2021). Public

health could also be assisted by digital mobile services. The smart healthcare network will provide a connection dedicated to healthcare and health using modern technologies like Pol and WIFI.



Figure 4: The smart health care

(Source: Internet of things in healthcare: applications, benefits, and challenges, 2021)

The smart healthcare system related to the cloud is responsible for the coordination of hospital and healthcare services. Smart healthcare made it possible for the doctor to connect the patient and transmit the information and data. Collaborating with smart clinics enables the diagnosis of terrible ill patients. It can be said the local governments have set some projects of digitalization in motion for covering the gap with the rest of the European country. There are several initiatives taken and projects that have been launched keeping the focus primarily in digital innovation.

There are several health care devices among them some are wearable such as the blood pressure measuring wristwatches. It is supplied with a sensor under the strap that helps in measuring blood pressure.

4 Research and Analysis

4.1 Primary Research

4.1.1 Table 1. Summary of the demographic information for the survey respondents in percentage.

| | | |
|----------------------------|-------------------------------------|-----|
| Age | 18 to 29 | 65% |
| | 30 to 40 | 29% |
| | 41 to 50 | 4% |
| | 51 to 60 | 2% |
| Gender | Male | 40% |
| | Female | 57% |
| | Prefer not to say/Other | 3% |
| Education | High school | 39% |
| | Bachelors | 4% |
| | Masters | 12% |
| | Doctorate (PhD) | 42% |
| | Prefer not to say/Other | 3% |
| Employment status | Employed (full-time) | 43% |
| | Employed (part-time) | 8% |
| | Student | 39% |
| | Self-employed/Freelance | 8% |
| | Unemployed | 2% |
| Field of Occupation | Engineering, Information Technology | 20% |
| | Business and Management science | 30% |
| | Social science, Education, Law | 8% |
| | Medical Science | 12% |
| | Natural science | 7% |
| | Public Health | 2% |
| | Other | 21% |
| Income status | Less than 250 € | 25% |
| | 250 to 500 € | 15% |
| | 500 to 1000 € | 21% |
| | 1000 to 2000 € | 26% |
| | 2000 to 3500 € | 7% |
| | More than 3500 € | 6% |

4.1.2 Demographic questions

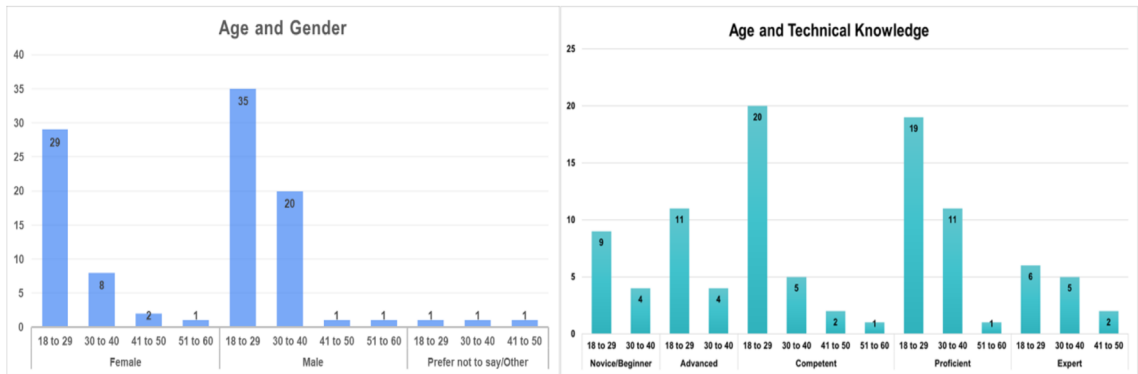


Figure 1: Information about age, gender and technical skills

Majority of the survey respondents were young from the age of 18 to 29. about 65% of the total respondents. The second largest group was between the age of 30 and 39, meanwhile 40% were males, 57% females and 3% did not disclose their gender. About 39% of the responders have done high school education, while 54% completed their university education. The largest group of people was about 42% who graduated from a doctorate degree.

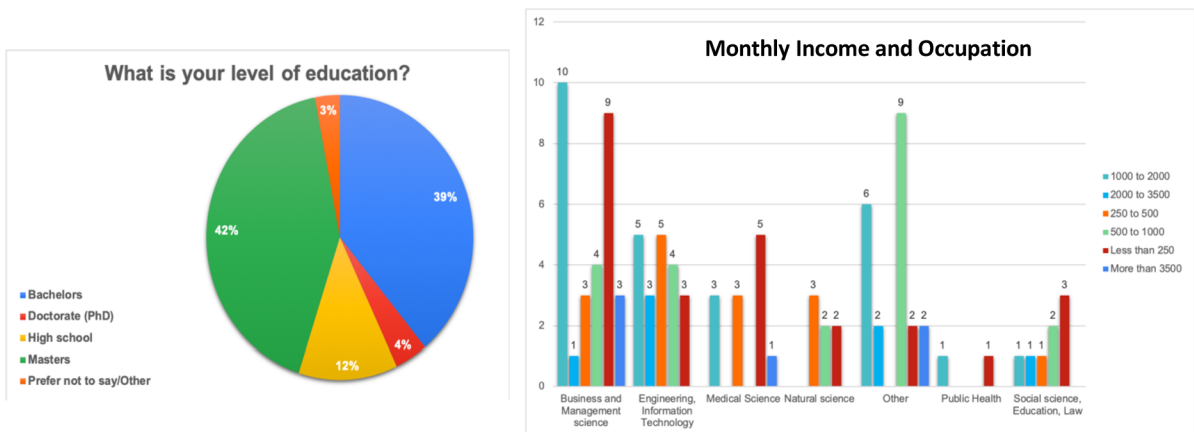


Figure 2: Information describing education level and relating income and occupation.

So, mostly, survey respondents were well educated. 43% of the people responded as being full-time employees, 8% were freelancers/self-employed, while 8% were working part-time. About 39% people were students. 30% of the people were educated in business/management sciences, 20% in IT and engineering, 14% in medical sciences and public health, 8% in social sciences and 7% studied natural

sciences. 40% of the respondents had a monthly income of less than 500 euros, 47% had an income between 500 to 2000 euros, while 13% had an income of more than 2000 euros. Full-time employees had more income than the rest of the groups. Most of the respondents were competent and proficient in terms of their technical skills and knowledge. The most tech-savvy population was found to be in between the age of 18 to 39.

4.1.3 Subjective questions

Device and System.

With the outbreak of the COVID-19 pandemic, social isolation and quarantine have become commonplace around the world. Regular medical visits and interactions between individuals and healthcare professionals are reduced using a smart health monitoring system. Professionals have used technology to make patients' lives easier in order to diagnose and treat them early. The Internet of Things (IoTs) is being used to construct a smart health

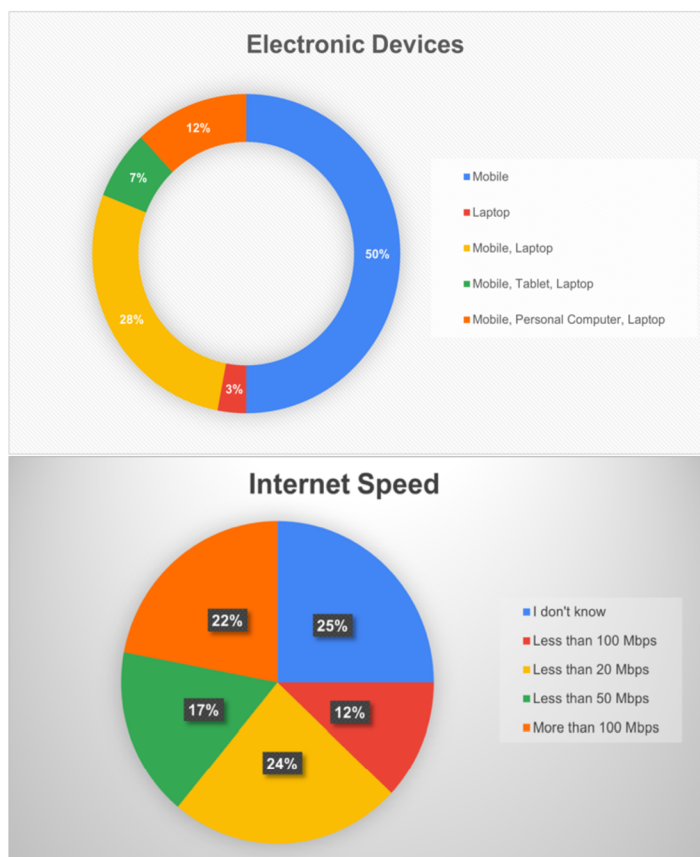


Figure 3: uses of different electronic devices and their internet speed.

monitoring system that can track a person's blood pressure, heart rate, oxygen level, and temperature. The system can monitor the variables at regular intervals because to the availability of high-speed internet. Furthermore, the cloud platform enables for data storage, allowing for the recovery of prior measurements in the near future. Fraud detection and prevention would be aided by this technology.

As we can see from the both pie chart that mostly responds used mobile phones and a few of them used only a laptop which is 50% and 3% respectively. The people who used both laptops and mobiles were 28%. If we talk about Personal computer users, then only 12% were there and tablet users were 7%. Overall, it is apparent that mobile users are in huge number and it is followed by laptop users.

Taking all of this data in mind, internet speed is a crucial matter which enables all smart healthcare devices or applications to be connected on a single platform. So, it is observed that 25% were not aware about their network speed. People who were using less than 20 Mbps is the second bigger number that is 24%. And it is chased by 22% of respondents who were using more than 100Mbps. 17% were those who had less than 50 Mbps and only 12% were under 100Mbps.

From the above data, it is seen that the speed of the internet is a critical factor in ensuring that the doctors and the other professionals have timely access to relevant information. For mobile health applications to be used across the medical care range, high-speed Internet access is required, with the highest data rate requires 10 Mbps for two-way visual multimedia streaming. On the other hand, a minimum of 10 Mbps bandwidth is recommended for nursing homes to support moderate internet use, allow EHR (electronic health record) and high-quality visual consultations to be used simultaneously, as well as non-real-time image downloads and remote monitoring.

A small rural clinic or private practice with fewer than five physicians requires at least 10 Mbps, whereas a facility with five to twenty-five physicians requires at least 25 Mbps. However, a facility with as many employees as a hospital will need a minimum of 100 Mbps.

As mobile devices have grown more ubiquitous in health-care settings, the creation of medical software applications (apps) for these platforms has exploded. Information and time management, access to and maintenance of health records, communication and consultation, reference and information gathering, patient management and monitoring, and clinical decision-making, and medical education and training are just a few of the things that apps may help HCPs (Healthcare Professionals).

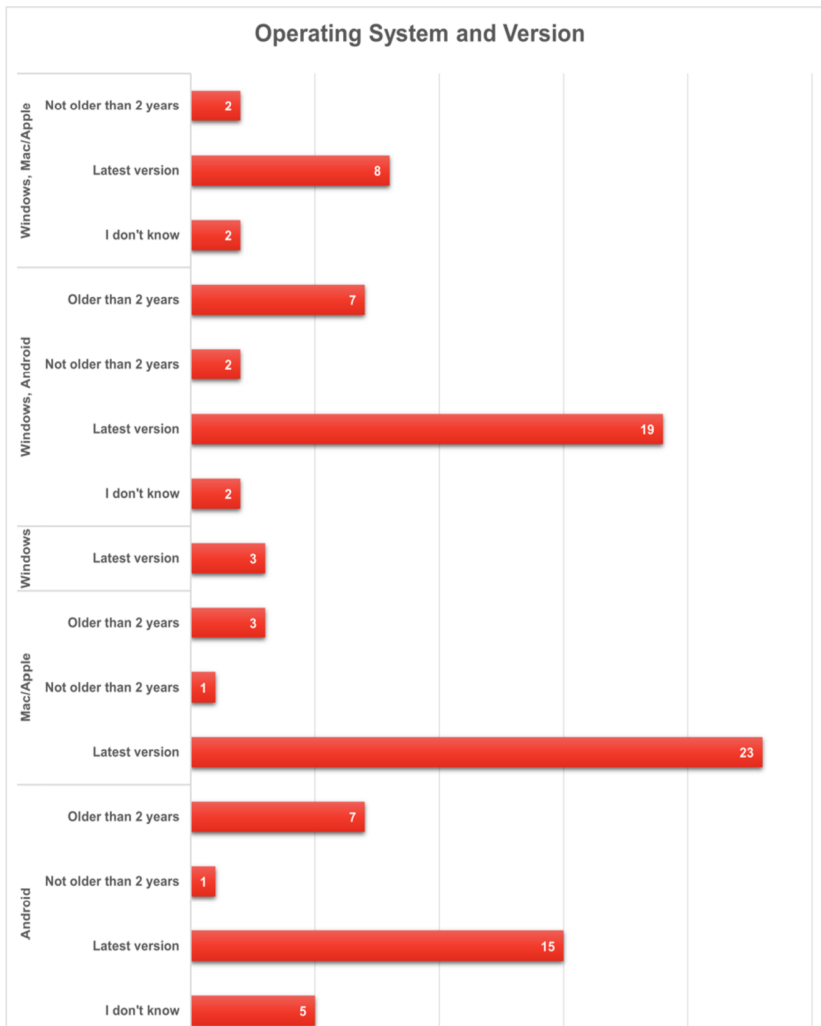


Figure 4: relation with different types of system's operating system and their version.

From the bar chart, it could be understood that majority of users were using latest version of their system whether they were android, windows or mac/apple users. By observing the above data, it can be seen that there is a mixed or correlated kind of result. Almost, everybody was using latest version. Android and Apple users were found almost

similar which is 19% and 23%. In a nutshell, there were a variety of other medical news applications available. Medical apps for Apple and Android mobile devices provide real-time information about disease epidemics in different parts of the world. This information was gathered from various sources, including online news, eyewitness accounts, and government reports.

Technology and Applications.

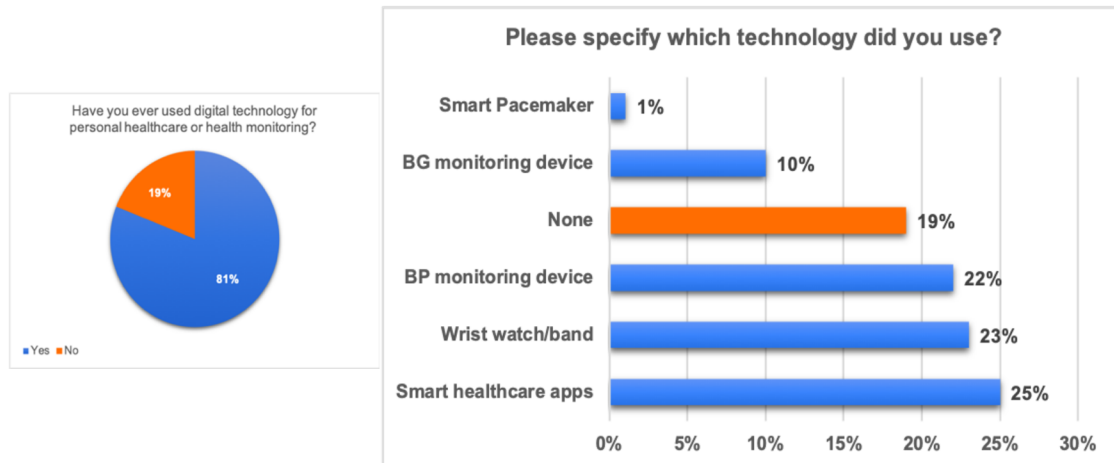


Figure 5: uses of health monitoring devices and their types.

The above-mentioned question is indicating the importance and requirement of technology among the public. The respondents were so open to answer, as it can be seen that majority of respondents were using smart health monitoring technology to measure their health graph which is 81% whereas only 19% respondents were not using any technology for their health monitoring.

On the right-hand side graph, it is depicting the types of smart healthcare devices they used. As people are so used to smart applications when asked about if they are using any technology and about their personal healthcare devices for health monitoring, they didn't hesitate to answer the questions.

Many of them are now ready to trust their lives in the hands of smart healthcare devices. Nearly, more than 80% respondents have used any of the smart technology which shows that 25% respondents were inclined toward the various “Smart healthcare apps” or smart healthcare applications which could be used with any of smart gadgets connected to mobile interface and further it followed by “Wrist watch/band” and “BP monitoring device” (Blood Pressure monitoring device) which are 23% and 22% respectively.

It seems lower that only 10% preferred “BG monitoring device” (Blood Glucose monitoring device). A quite reliable data can be observed that just 1 percent of

individuals are there who have used Smart Pacemaker. As it is discussed above only 19% of people were there who did not use the smart healthcare devices.

In nutshell, as data is evaluated and investigated in accordance with the audiences' responses it could be said that Smart healthcare application/apps, Wrist watch/band and BP monitoring devices are quite common in public's choice as they find it a vital part of their daily lifestyle which it further could be helpful and beneficial for their health. Besides this, it is understandable that a negligible number of individuals used smart pacemaker because it is a sensitive case which could only be used to some exceptional affairs.

Diagnosis.

In the initial days, the only way to diagnose rare diseases was to conduct a thorough physical and analytical examination on the premises of the hospital. A smartwatch can now assist us in detecting any irregularities in our health. Consider an elderly patient's rapid heartbeat. In the case of an epidemic disease like Ebola, technology plays a critical role in limiting the transmission of this fatal disease by alerting people and encouraging them to take the necessary precautions. Patients should only take medication with the supervision of a doctor. Recent technology advancements, on the other hand, have brought preliminary tests to the patient's doorway. Several clinical procedures, such as blood testing, diabetes monitoring, and blood pressure monitoring, can be performed in real time at a distant site. Wearable IoTs sensors, fog computing, cloud computing and mobile computing, along with the fast development of latest telecommunication services, provide real-time monitoring of users, diagnosis, communication with doctors, prescription of medicines, and delivery to doorsteps.

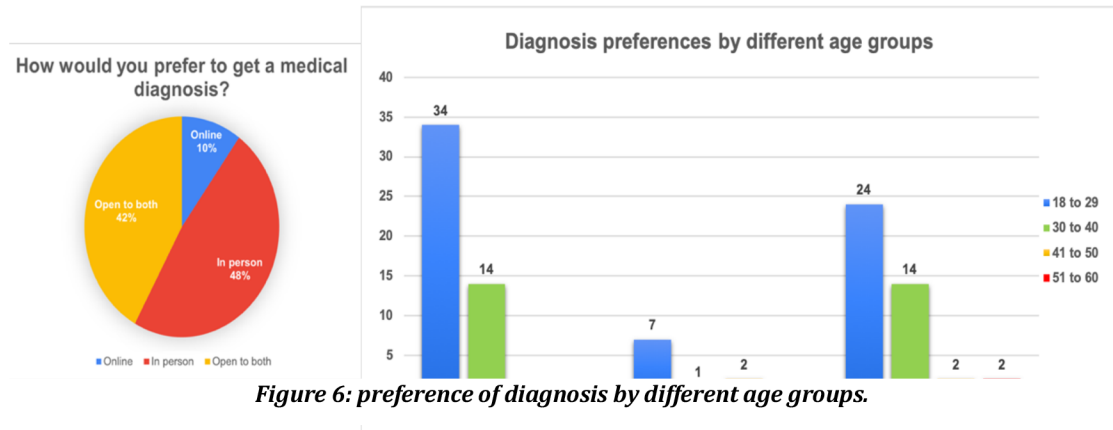


Figure 6: preference of diagnosis by different age groups.

In most situations, responders and smart technologies co-related with each other and they were satisfied with diagnosis though smart healthcare technology which can be seen from Pie chart that near about 52% were either Open to both or Online for diagnosis of their health which is 42% and 10% respectively. However, 48% respondents would prefer their traditional way of diagnosis. When it comes to the relation with various ages and their choices, it explains more detail information about diagnosis preferences. In bar chart, if we talk about “In person diagnosis” then only two age groups showed their interest towards this conventional way of diagnosis which is 34% and 14% who are between 18-29 and 30-40 respectively. On other hand, more were inclined to Online and Both kind of diagnosis. In Online diagnosis only 18 to 50 years old people performed whereas all age groups preferred Both types of diagnosis. A noticeable point can be seen here very old generation, who are between 51-60 years, were open to both and they are also accepting new technology. In contrast, it is observed that as the young generating growing old, they are being open to new technologies; to prove it from the graph, it depicts that 18-40 years old were in favor of traditional way (In person). Further, it went up to 18- 50 years old and finally in all ages of groups were in the side of Both methods. The above information depicts the apparent picture of acceptability of both traditional and smart diagnosis among the audience.

Treatment.

Robots will become more autonomous as technology advances, eventually executing certain activities fully on their own. As a consequence, doctors, nurses, and other healthcare personnel may focus on treating patients with more empathy.

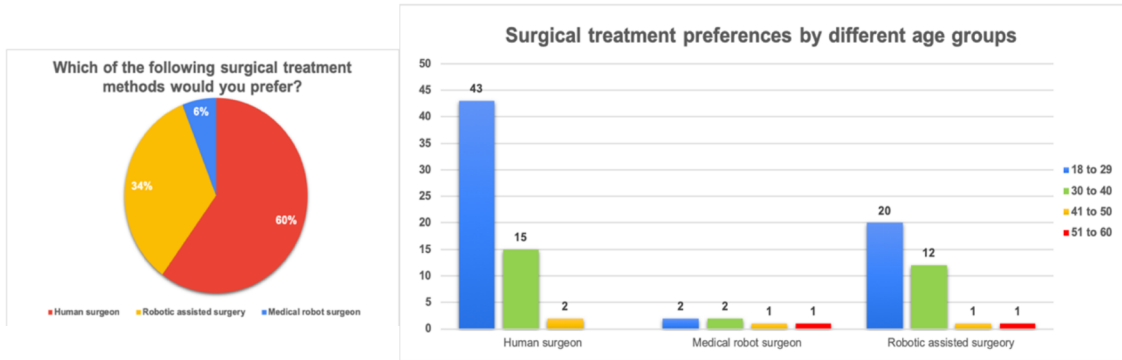


Figure 7: preferences regarding surgical treatment by different age group.

The above-mentioned question is indicating the importance and trust of technology among the public when it comes to surgical treatment. As people are so used to smart applications that when asked if they would have medical robot surgeon or human surgeon or both, they didn't hesitate answering questions. As it can be seen from the Pie chart that a few numbers of respondents are agreed to have medical robot surgeon when they would be needing in the future which is 6%. majority of the whole audience trusted conventional way of surgical treatment by a Human surgeon near about 60%. Nearly, 34% respondents were willing to have that treatment by a robotic machine but trusting their lives in the hands of a Human professionals; in other words, people preferred Robotic assisted surgery which is 28% higher than the Medical robot surgeon. Explaining it further in bar chart, it is inspected that age is an important factor where as they grow old their preferences regarding technology increasing, same as diagnosis preferences chart. It can be seen that 18 – 50 years (altogether 3 age groups) preferred Human surgeon, further all age groups would like to have Medical robot surgeon though the percentage is very low. Same as medical robot surgeon, all age groups performed here, but they picked to Robotic assisted surgeon which higher than Medical robot surgeon. Apart from that, elderly persons have shown their interests toward new technology rather than just a traditional way of treatment and majority of young generation (near about 43%) were more inclined to Human surgery if it would be needed and they were not wishing to have treatment

from such devices and were skeptical about it. The data is evaluated and investigated in accordance with the audiences' and respondents' responses in order to complete the dissertation's requirements.

COVID Applications.

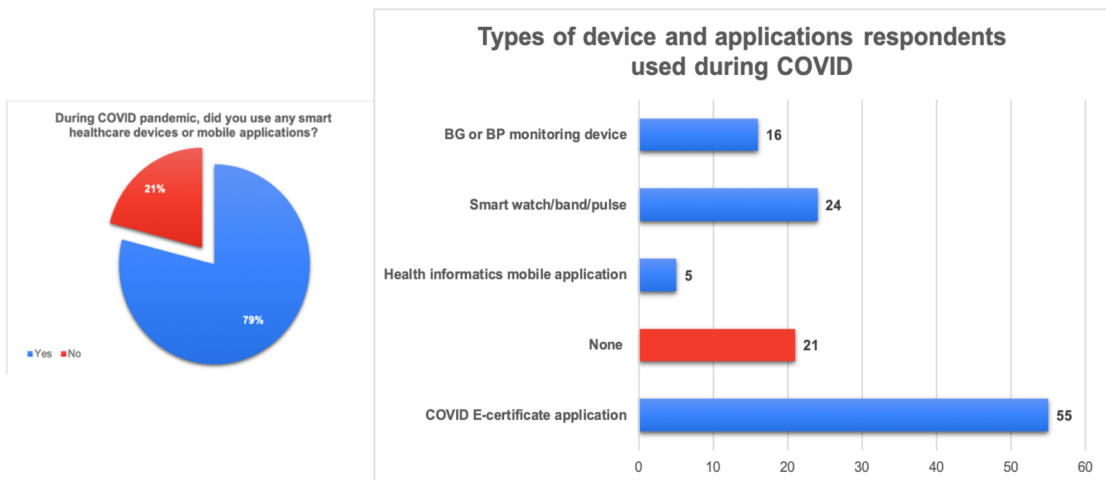


Figure 8: uses of smart devices and applications during COVID.

The above charts represent how useful smart healthcare technology were during COVID time. There were many obstacles during this time unless these applications were not there such as COVID certificate, e-receipt. There is one Czech republic's app called "**Tečka**". In accordance with EU rules, The Digital COVID Certificate, or Tečka, in the Czech Republic uses EU technical requirements to verify COVID-19 health status. (vaccination, recovery, test results) and other is **CovPass** which was mostly used. Consequently, it supports in maintaining social distancing. On the other hand, **e-receipt** is a substitute of it with its more functionality such as keep more records of bills, receipts of medical prescriptions and so on. In Pie chart, a good number of respondents can be seen who have used smart healthcare applications which were useful during pandemic, it was 79% whereas 21% did not use any application. Elaborating it further in bar chart, 55 percent respondents used COVID E-certificate apps such as Tečka, CovPass etc. it is followed by 24% and 16% who used Smart watch/band/pulse devices and Blood glucose/Blood pressure monitoring devices respectively. Rest of 5% preferred Health informatics mobile applications.

Consequently, it supports and eases most of daily tasks that's why it is mostly liked by respondents where it could be seen clearly that during this time nobody was allowed to trespass the rules of pandemic, nobody was authorized to break the rules

of safety and security and mostly health professional were not available there to treat the patients in their clinics so in this case smart health application proven to be more helpful in those situations; such as BP/BG monitoring device assisted both doctors and patients by maintaining distance. So, it can be said that these applications are highly acceptable among the common public.

Improvement in Healthcare system.

The latest technology is much helpful for the present healthcare system and it is carrying various importance with its application to every sector as well as healthcare systems.

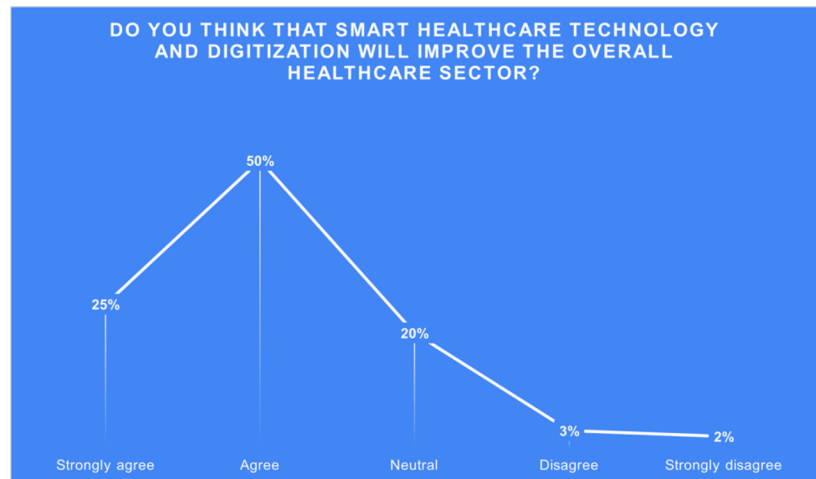


Figure 10: different opinions on improvement in overall healthcare system using smart healthcare devices.

The question has

100 responses of people and each response is different from each other and a small analysis can be done from the total percentage about the answering method of people. It can be seen here that 50% of people agree about the thing where 2% of people strongly disagree about this. There is a 3% response which indicates moderately disagree people and 25% of people highly agree with the topic. On the contrary, there were also 20 % of people who are neutral to answer this question. It also indicates that they are unaware about the topic or the spreading manner of technology in every place and work systems.

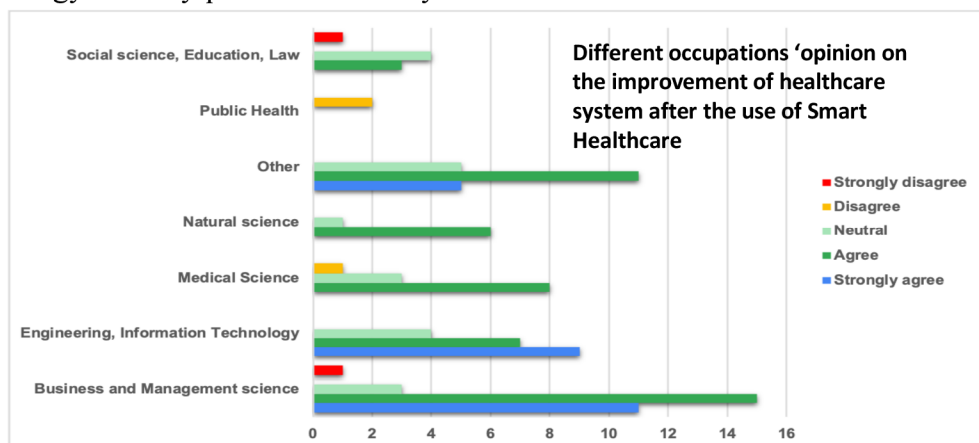


Figure 9: different occupations 'opinion on the improvement of healthcare system after the use of Smart Healthcare

Further it can be elaborated by adjoining it with occupations. Having the perception of different people who belong to various department would let us help to know how these smart healthcare technologies are putting an impression on their minds and how much are they accepting these works. As it can be seen that a very few responses are observed who are strongly disagreed regarding this asked question which is 1% only in professions such as “social sciences, education, law” and “business and management science”. However, a very strongly agreed individual can be seen in occupation “business and management science, engineering, information technology, other” which altogether is 25%. All profession like business and management science, IT, Medical science, Natural science and others are highly accepting the idea of improvement in healthcare system in the times to come whereas an astonishing point can be seen in Public health occupation which is only pointing towards disagreement which is nevertheless 2%. Apart from the Public Health, rest of the professions are neutral to a certain number which is 20%.

It is crucial to know the necessities of technology in the healthcare system. Its importance is spreading in various places of work and several business processes also adopting the features of technology to make a growth in the organization. Healthcare system also needs to become advanced by adopting the technologies for various uses to cure people from their diseases and health issues. A moderate range of the people are still unaware about the advantages and disadvantages of technologies and its adoption in the healthcare system. The method of using the technology in various places of treatment are needed to be understood by the people otherwise it will be a gap of knowledge in any individual of this present world.

Security and Safety.

(Source: As done by the researcher)

The above image depicts the Safety and Security concerns using smart healthcare technology

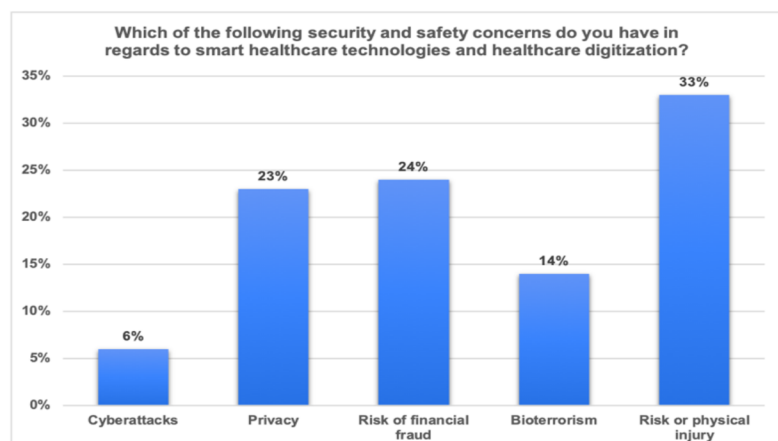


Figure 11: public's opinion on safety and security with use of smart technologies.

and digitization which in our daily lives, smart healthcare technology plays a vital role. E-health/ M-health or Telemedicine applications are types of smart medical services that allows patients to be diagnosed and treated from a distance. The vital signs of patients are monitored using smart health gadgets (e.g., glucose, heart rate, and blood pressure). It can enhance healthy behaviors, timely treatments, reduce hospital visits/re-admissions, and rescuing lives by allowing users and healthcare professionals to access to self-monitoring and data. Despite its many advantages, respondents showed their concerns regarding privacy and information leakage risks during data exchange and so on, in which the user might or might not lose control of their personal data without even realizing it, particularly when a third party is involved. Moreover, when combined with additional data, the re-identification of individuals and sensitive information can be predicted. So, keeping in mind such concerns, public has taken an interest in this matter which is Cyberattack, Privacy, Risk of financial fraud, Bioterrorism and Risk or Physical injury.

As the bar chart explains different opinions in which Cyberattack is the least concerned matter where minimum number of audiences were worried about it which is 6% although most of our respondents comes from IT background. A slight increment is observed of 8% (overall 14%) in the relation to Bioterrorism. A similarity is noticed between Privacy and Risk of financial fraud with a negligible disparity which is 23% and 24% consecutively. Maximum number of responders had the fear of Risk or physical injury with 33% of vote. Thus, this whole calculation showed that besides the technology advancement, there are some points which need to be fixed which don't let the public to accept smart healthcare technology fully with reliability and faithfulness. Such as hackers and invaders could create a chaos for the whole system, could steal their very sensitive information which further lead them to misuse the information, blackmail to the users and could be a threat to their lives. Moreover, risk of physical injury is major concern when it particularly comes to a surgery from a distance. some mismatches were there among the results when it is come to privacy matters but looking at other charts it can be judged that smart healthcare technology are mostly acceptable.

Concern about Cost.

Almost everyone is aware that there are alarmingly high proportion of people without health insurance and there is persistent rise in health-care prices. These

expenditures are currently rising day by day due to the use of smart medical technology. From the survey it was observed that majority of the people were concerned about the cost in the healthcare

system. Overall, 29% of people were moderately concerned, 29% were extremely concerned and 26% of people were somewhat concerned. Apart from this there were some people who had very less (5%) or no interest (11%) in the cost of the healthcare technologies.

The occupations graph shows the link between the cost consideration and healthcare technologies. As it can be clearly observed in the graph that people which has a background in the field of business and management areas had undeniable consideration of upcoming or existing healthcare technologies whereas the individuals which belong to the areas such as social science, education,

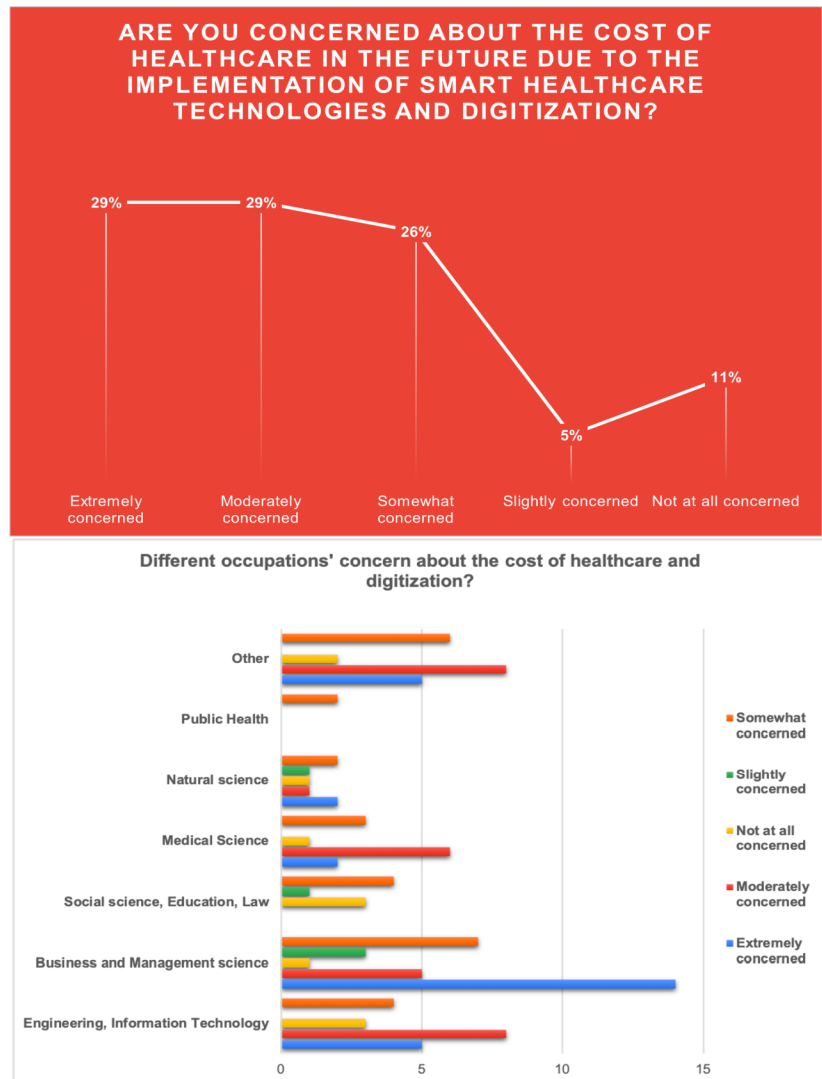


Figure 12: Public's opinion regarding cost concerns by relating with different occupations.

law, engineering, and information technology (IT) had no concern about the cost of the new technologies.

However, people in certain areas such as others, medical, engineering, and information technology has moderate consideration to the new technologies. Overall, it could be observed that most of the audience consider cost as a major factor in the field of healthcare.

Medical Websites.

Online medical services are fast growing over the world as a result of the COVID-19 pandemic. It might be difficult to realize you have a health concern that necessitates medical care and treatment. Seeing a doctor online for any periodic consultations appears to be a fantastic choice now, rather than going to the doctor and discussing your problems in order to receive treatment. Booking a medical consultation online has numerous advantages.

Prompt medical attention, a second opinion, access to specialists, comfort and convenience, no need to save all medical reports, cost-effective and time-saving, and so on are some of the advantages. From the pie chart, it can be observed that most people (85%) have used any of medical website for the medical information or medical advice whereas 14% were not interested in it and did not use those websites.

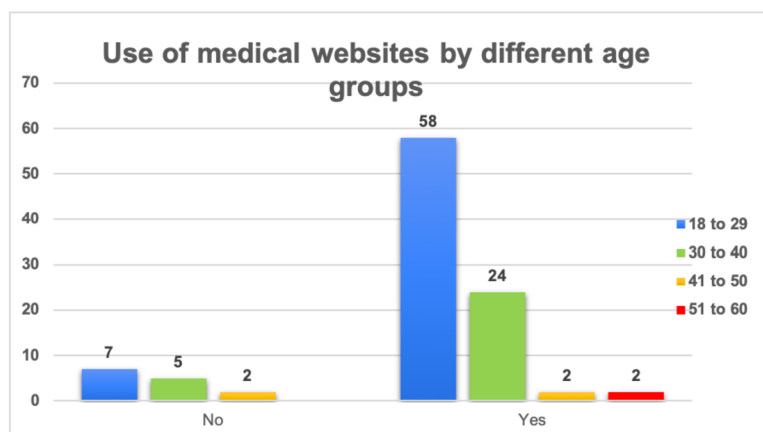
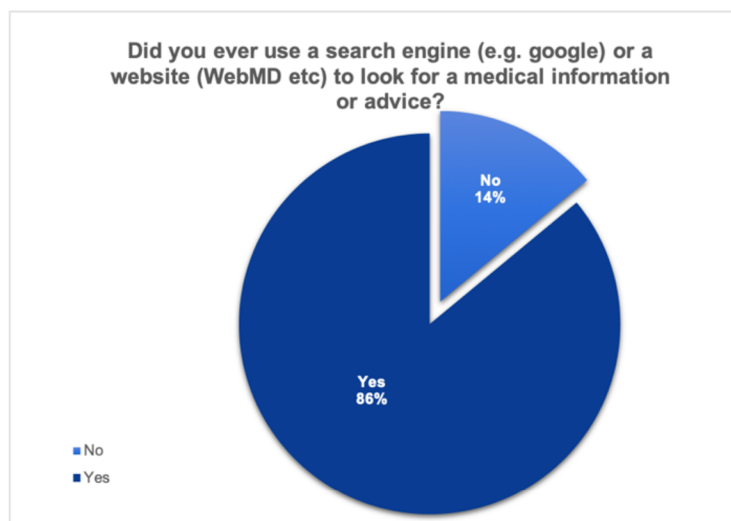


Figure 13: public's opinions on the use of medical websites relating to their age groups.

Further elaborating, the bar chart is depicting the image that young people (between the age of 18 to 29) used these websites for any of their health problem information or advice which is 58% where 30-40 aged people were 24%. From data it can be extract that elderly persons from 51 to 60 years old had more interest regarding new technologies because they only chose “Yes” for these websites which can be seen clearly from the bar chart. An astonishing point can be seen here that the age group from 41-50 were very less and similar to both “Yes” and” No” sections which is 2%. The Internet is a valuable source of health information for many people. The quality of information that people come across on the internet can have a big impact on them. We show the kind of questions individuals ask online, as well as the benefits and drawbacks of different information sources for finding solutions to those inquiries. This helps to meet people's online health information needs.

4.2 Secondary research

“Enabling Technologies for the Internet of Health Things”

As stated by Rodrigues *et al*, 2018; the upcoming future is accepting the most promising technology that is the Internet of Things or IoTs. The evolution of this technology will provide a wide and great benefit to the well-being and healthcare system. There are various kinds of recent products and publications available in the present market from industry for this topic. The journal paper indicates the various reviews on the technologies that are based on the IoT for ambient assisted living and healthcare. The indication of the journal paper about the reviews is called the Internet of Health Things or IoHT. This review paper identifies the advantages due to technologies for the future period and it also refers to the obstacles that could arise at the time of application of the technology. The overcome solutions from the challenges and their approach to the future trend is also provided in the reviewed paper. It is noticeable that further studies for this topic is much important and it helps to improve various things. The various things that can be improved by the further studies are techniques that are currently adopted, technologies of IoHT and current novel concepts to get a solution and be overcome from the identified issues or challenges. The presented results in this reviewed paper are served as a source of information for technology specialists, researchers, general population, and healthcare providers to make improvements for the Internet of Health things or IoHT. The healthcare system has a need for new infrastructure of networks that

provide better options to them and also for patients. The current need and requirement of the proposal and planning is to consider and increase the number of connected devices to the network. The industry and academy proposed a new kind of vision of the internet to consider the next generation of internet. The Internet of Things, or IoTs, is the proposed vision. IoT offers an intelligence for the objects and considers some capabilities or capacities to generate, gather and store information or data from different sensors. These data or information is collected to perform autonomously the various actions that are based on coordinate functions, actuators and information sharing that considers the connectivity of devices. The support of IoT can be defined with a remote-control vehicles/ambulance and the device such as a vehicles/ambulance is controlled by the remote as well as it is connecting machine to machine communications to support the IoT. These dungeons are also able to support the IoT for the purpose of development of technology in various factors and matters. These M2M technologies can be applied and adopted in the various kinds of industry domains such as industry automation, healthcare system, smart home, smart grid, among others and transportation. Among all industries, healthcare is growing fast in adopting the IoT services to get various solutions against the challenges and issues they are facing for their process of treatment and adoption of IoT. It is considered as a key driver of the industry and cloud computing is collaborating very fast with IoT to develop various processes and provide better services to patients and bring an application of health that could be called as the Internet of Health Things or IoHT. a projected score within 2020 is developed by various agencies such as Gartner expects 25 billion, Cisco expects 50 billion and Harvard Business Review expects 28 billion devices connected with the server or network.

“Internet of Things for Smart Healthcare: Technologies, Challenges, and Opportunities”

As stated by Baker, Xiang and Atkinson, 2017; healthcare is mostly an essential part of care due to illness in life. Although it is unfortunate that the rising chronic illness and the over population increases a significant strain on the modern system of healthcare. It can be seen that the needs and requirements due to beds and minimum resources for a better treatment are so high. It is required also to bring a solution that could help the healthcare system to provide more effective services to the serious and at-risk patients. The Internet of Things or IoT is identified as a wide potential

solution for the healthcare system that helps to lessen the risks and pressure in the system of healthcare. The research is being done on some patients by monitoring them with some conditions for them. There are also specific further researchers available that aims to serve aiding rehabilitation through progress monitoring of a patient consistently. In this review paper it also can be identified that healthcare in emergency situations is also related to the possibilities of related work, but they are not totally researched as widely as other matters or topics. The research has been done here for the evaluation of selected challenges that have occurred while adoption, their applications in various processes of healthcare and other places or sectors and their remaining problems are needed to be clarified by the researchers at the time of evaluation of these factors or matters.

Every topic of the research is tested individually and also considered for the data mining, data analysis, and storage of data. These things are integrated with various kinds of matters into a system. The various kinds of sensory types are compared with some places where focus needs to be placed on the communication method or communication process. It is hard enough to draw an image of this process in this paper and the sensor management and big data management will support communication by considering the little regards for the network. The paper identifies various key components of end-to-end matters and a unique contribution has been made to the researches about the Internet of Things system of healthcare. The study also provides a model that proposes the application of all IoTs based healthcare systems. It is an important process for the healthcare systems of all over the world because there is still no use for remote control monitoring for a patient. The paper is providing a broad comprehensive survey that falls into the model with various proposals to adopt technologies in various places of work or healthcare systems. The main focus has been set on sensors that could provide better response in future processes of the healthcare system with much kind of implementation in the process. The sensors are used to monitor various kinds of parameters of health, cloud technologies and standards of short-range communication and long-term communication. The paper distinguishes the various factors of the major survey that contributes and considers the essential components of healthcare that are IoT based systems and it is totally separate from each other as a system.

“The impact of the hybrid internet of things/cloud computing platform on healthcare systems: opportunities, challenges, and open problems”

Cloud computing presents optical computing, networking resources and storage over the internet to the individual and organization in a dynamic process. At present time it can be said that the resources are easier to manage, physical ones, cheaper and contain more elasticity than the set of locals. The services of Cloud are stored in the data centers and station thousands of various computers (Darwish et al., 2017). It could be justified that the evolution of Cloud Computing can be related to the current popularity of data. Thus, it can be said that Cloud Computing provides obligatory storage, networking, application, and computation supporting massive application of data.

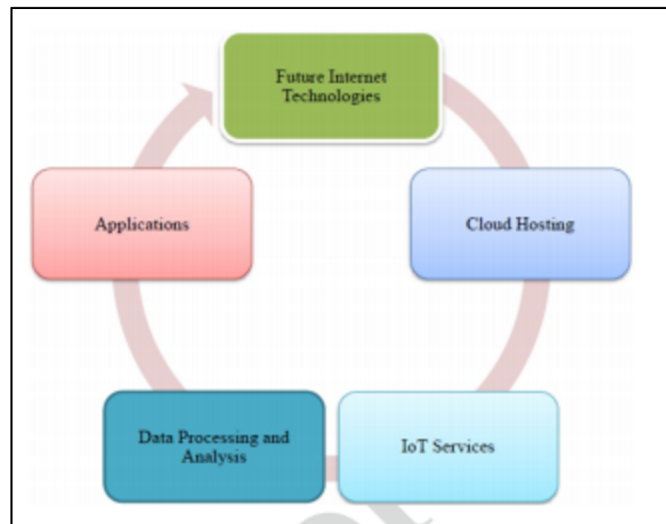


Figure: Upcoming technologies of internet

(Source: Darwish et al., 2017)

It can be said that the healthcare industry always faces challenges with the development of various diseases throughout the time. The wide application of IoT can be observed by interconnecting available resources related to medicine and also providing reliable, effective and smart healthcare services to several patients suffering from chronic diseases. There have been several progresses in monitoring healthcare.

It is possible to say that cloud computing is a new technology that is structured to produce a huge number of resources and services via a platform of networks such as the Web. It provides various advantages to its users such as virtual storage, virtual servers, and virtual hardware. It can be said with the help of cloud computing it will

get easier to satisfy the request of patients without any human interference. The application received from the patient's side can be easily accessed through several platforms like tablets, smart phones and laptops. Patients do not have access to cloud resources like software or hardware.

In addition to its benefits, cloud computing has a number of drawbacks. For instance, it can be said that the ethics of the services provided by Cloud can get compromised because of the shared infrastructure and system. In the healthcare sector, providers of cloud process the individual data of patients from various sources. The risk of enclosing individual data to the law enforcement is massive in the system of Cloud Computing. The dynamics and complexities of off shoring chains demands the use of sub-framer, the services that are provided by the providers of cloud may come in a package of several services from various providers (Darwish et al., 2017). The provider of cloud services does not provide the client with sufficient tools and methods for data management. The clients of the cloud services do not have proper information regarding the cloud operating process thus creating risk to both patient and the client.

From a survey it can be noted that the project of IoT has been a massive growing technology that attracted huge attraction globally. IoTs possibly be divided into three sections such as: orientation of systematic paradigm, the internet and things. There have been several successful applications of IoT in various fields such as healthcare.

"The Quality of hospital healthcare, patient satisfaction, and loyalty"

The global competition in the healthcare industry gave birth to patient's curiosity and concern in respect to the supply of services provided by healthcare. With the development in the population of senior citizens and the focus on health, greatly improved the needs and promoted a transformation to healthy lifestyle among the normal population. The growing worldwide cut-throat services spread influence on the urban business, prominently in the healthcare services. The associations related to healthcare have begun to put stress upon the superior quality of the healthcare services due to increased competition among hospitals including customers to select hospitals offering best services.

It can be noticed over the previous three decades, the quality of service and the outcome it provides serves as one of the infrequent topics in the literature of marketing, receiving widespread attention in the field of academic research (Fatima,

Alam Malik and Shabbir, 2017). It can be justified that the demand for better and improved service quality in the field of healthcare leading to structure pressure towards the service providers have become an onerous assignment to the investigators, government policy makers, therapeutic specialist and hospital administrator. It will help fulfill the patient's needs by building loyalty and satisfaction.

Unique service of hospitals allows empowerment to the administrative body of hospitals for distinguishing the services from other hospitals as well as increasing a favorable position to the practical services regarding the competition along with an up gradation in service proficiency. It can be said that the quality of hospital services is the discrepancy between the assumption and perception of customers regarding the services of the hospital. In the services of healthcare, patients perform as the necessary capital of the hospital.

Several studies suggest that in the setting of healthcare it is necessary to focus on the satisfaction of patients as it determines the level of services the hospital is providing (Fatima, Alam Malik and Shabbir, 2017). Satisfaction in patients can also be evaluated by inspecting several differences between expected and received quality of services from the hospital. Positivity in a patient's remark of services will portray the quality of healthcare service in a very appreciative manner.

Hospital service contentment can give rise to customer loyalty towards the hospital. Positive reviews from patients can give rise to trust within the patients that eventually creates positive responses towards the hospital (Fatima, Alam Malik and Shabbir, 2017). The services provided by hospitals and the loyalty of the patients are interconnected with each other. It can be said that prescribing to others and readiness in returning to the hospital can be defined as the behavioral intentions. The loyalty within clients is differentiated as the purpose of the customer satisfaction.

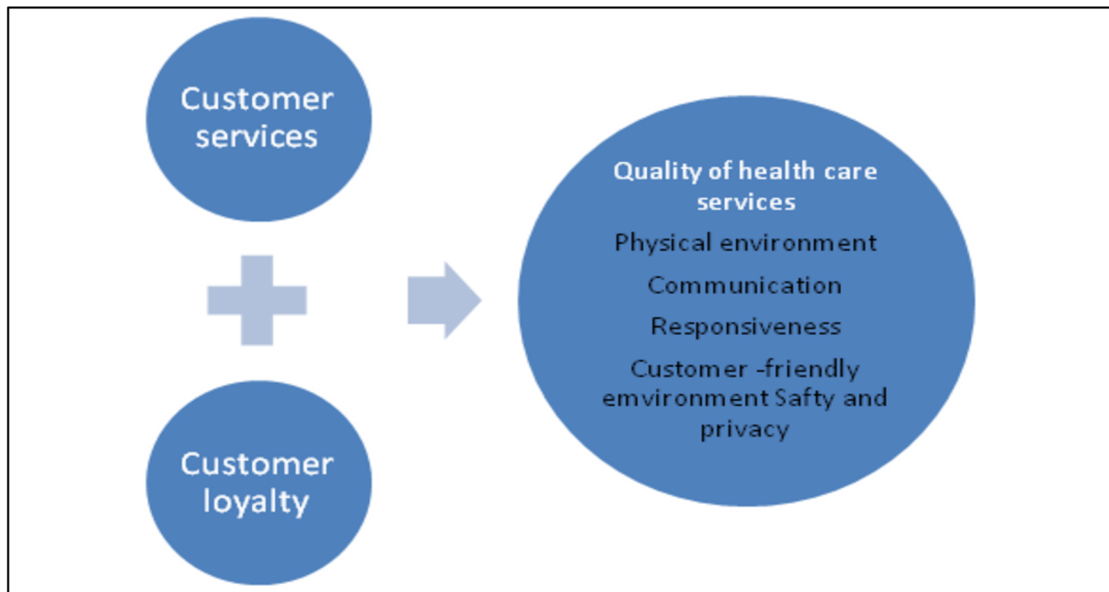


Figure: Relation between customer service and loyalty

(Source: Created by author)

From several studies it can be said that the satisfaction of patients has the impact on the rate of consistency of the patient with demands and the doctor council. It can be said that the evaluation of patient's satisfaction has transformed into a crucial portion of the associations related to healthcare. Satisfaction of a patient works as a source between behavioral intention and the quality of services. It has also come into consideration that the satisfaction of the purchaser performs as one of the most important reasons for the development of customer loyalty.

5 Discussion of result and recommendations

5.1 Discussion of the data

From the study it can be observed that several research methods have been applied. Data for the research has been collected from surveys as well as referencing to several journals. Survey has been performed on an online basis and a section of society was selected. The survey has been conducted by taking proper consent from the participants. They were aware of the research process and the privacy of the participants has been kept into certain consideration. The questionnaire has been sent through email, online and social medias and the research study has been performed based on the replies that have been achieved from the participants.

It can be noticed that maximum participants of the research belonged from the certain age group of 18- 29 years that counts to 65% and it is followed by the age

group of 30- 40 years that is 29%. The minimum participants were from the age group of 41-50 and 51-60 years counting to 4% and 2% respectively. From the data it can be clearly observed that young adults are more active in participation rather than the people in their 40s or 50s. On the other hand, from the secondary study it can be put into consideration that in the near or upcoming future the adaptation of the most promising technology will take place that is the Internet of Things or IoT. The evolution of this technology will provide a wide and great benefit to the well-being and healthcare system.

Several reviews on the technologies have been put into light in the research discussion. It can be noticed from the study that various things can be improved by the further studies and techniques that are currently adopted, technologies of IoHT and current novel concepts to get a solution and be overcome from the identified issues or challenges. Again, the study defined the support of IoT with a remote-control vehicles/ambulance and the device such as a vehicles/ambulance is controlled by the remote as well as it is connecting machine to machine communications to support the IoT. It can be justified that the dungeons are also able to support the IoT for the purpose of development of technology in various factors and matters. These M2M technologies can be applied and adopted in the various kinds of industry such as healthcare systems, smart grid, transportation, industry automation, and among others.

From the primary study it can be put into consideration that the participation of male candidates is 40%, female candidates we more that ranges to 57% and remaining 3% were those who don't want to disclose themselves (Prefer not to say/Other) and noticed that there were 8% of people. It was not possible to engage the total population for data collection, but the smaller number of participants also helped in obtaining a clear picture of the various things related to the technologies related with healthcare industries. On the other hand, a study of the internet of things in the healthcare industry revealed some interesting findings, it can be observed that the rise of chronic illness and the over population increases a significant strain on the modern system of healthcare. The needs and requirements due to beds and minimum resources for a better treatment are so high.

The Internet of Things or IoT is identified as a wide potential solution for the healthcare system that helps to lessen the risks and pressure in the system of

healthcare. The research is being done on some patients by monitoring them with some conditions for them. From the study it can be justified that the research focus at healthcare in emergency situations is also related to the possibilities of related work, but they are not totally researched as widely as other matters or topics. The aim of the paper is to identify the different key components of end-to-end matters and a unique contribution has been made to the researches about the Internet of Things system of healthcare. The primary focus of the study has been set on sensors that could provide better response in future operations of the healthcare system with much kind of implementation in the process. It can be observed that various factors of the major survey are contributing and considering the essential components of healthcare that are IoTs based systems and it is totally separate from each other as a system.

From the primary research, demographic questions have been answered. It can be put into consideration that the people are aware of the latest technologies and its application in the healthcare industry. It can be noticed, the majority of respondents used mobile phones, with only a few using a laptop (50 percent and 3 percent, respectively). Individuals who used both laptops and mobile phones accounted for 28% of the total. Personal computer users accounted for only 12% of the total, while tablet users accounted for 7%. Overall, it is clear that mobile users outnumber laptop users by a significant margin. With all of this information in mind, internet speed is a critical factor in connecting all smart healthcare devices or applications on a single platform. As a result, it was discovered that 25% of respondents were unaware of their network speed. People who used less than 20 Mbps made up the second largest group, accounting for 24% of the total. And it's being pursued by 22% of respondents who use more than 100Mbps. Only 17% of people had less than 50 Mbps, and only 12% had less than 100 Mbps.

From the study it can be observed that these responses have much positive awareness of the different device and their speed of technologies in every sector as well as the healthcare system. If healthcare systems have been affected by the technologies, then the doctors and medical initials should have not recommended the usage.

On the other side, Secondary research focuses on the application of cloud computing. Cloud computing presents optical computing, networking resources and storage from the internet to the discrete along with organization in an active process. The services provided by Cloud are stored in the data centers and station thousands of various

computers. Cloud Computing provides obligatory storage, networking, application and computation supporting massive application of data.

It was clear that the majority of users, whether they were Android, Windows, or Mac/Apple users, were using the most recent version of their operating system. It can be seen from the preceding data that there is a mixed or correlated type of result. Everyone was using the most recent version. Users of Android and Apple were found to be same, with 19% and 23% respectively. In a nutshell, there were several more medical news apps to choose from. Medical apps for Apple and Android mobile devices provide real-time information on disease outbreaks around the world. This information was gathered from various sources, including online news, eyewitness accounts, and government reports.

The study focuses on the wide application of IoT that can be observed by interconnecting available resources related to medicine and also providing effective, smart and reliable services of healthcare to several patients suffering from chronic illness. There have been several progresses in monitoring healthcare. Cloud computing is a current technology which has been structured to produce a massive number of services and resources with the help of a network platform for example, the Web. The study also focuses on the various advantages to its users such as virtual servers, virtual hardware and visual storage.

It can be said that the ethics of cloud service compromise the shared infrastructure and system. It can be observed that the providers of cloud process the individual data of patients from various sources. The dynamics and complexities of off shoring chains demands the use of sub-framer, the services that are provided by the providers of cloud may come in a package of several services from various providers. The study also focuses on the lack of tools and methods provided to the clients by the cloud servers. The study also reflects the massive growth of Cloud technology attracting people globally. The study also segregates IoT into three different parts such as, things, orientation of systematic paradigm and the internet. It can also be mentioned that the IoT is used in several parts of the healthcare industries.

From the primary research it can be observed that the current technologies surviving the healthcare system is very helpful and also carries multiple applications and devices to various sectors along with the healthcare.

Only 1% of people have used a Smart Pacemaker, according to reputable statistics. Only 19% of those present did not use the smart healthcare gadgets, as previously said.

In a nutshell, because data is evaluated and investigated based on audience responses, it can be concluded that smart healthcare applications/apps, wrist watches/bands, and blood pressure monitoring devices are popular among the general public because they consider them to be an important part of their daily lives that may also be beneficial to their health. Aside from that, it's acceptable that only a small percentage of people used smart pacemakers because it's a delicate case that should only be used in extraordinary circumstances.

In most cases, respondents and smart technologies were intertwined, and they were satisfied with diagnosis through smart healthcare technology, as evidenced by the Diagnosis Pie chart, which shows that 52 percent of respondents were either open to both or online for health diagnosis, with 42 percent and 10 percent respectively. However, 48% of respondents said they favored the traditional method of diagnosis. Whereas if talk about surgical treatment, a small percentage of respondents (6%) consented to have a medical robot surgeon if they were to require one in the future. 60% of the audience believed in the traditional method of surgical therapy by a human surgeon. 34% of respondents were willing to have that treatment done by a robotic machine, but they preferred to put their lives in the hands of human specialists; in other words, individuals preferred Robotic assisted surgery, which is 28% more than the Medical robot surgeon.

Thus, it can be said that it is important for technologies to spread in several areas of the workplace and several business organizations as it promotes growth. It is necessary for the healthcare industry to implement technologies for curing several health issues and diseases. It can be observed that most of the people are still not aware of the disadvantages and advantages of technologies and its use in the healthcare industries. It is necessary for people to understand the technological usage in several places of treatment as unawareness can be proved to be a gap of knowledge in people.

In terms of COVID pandemic technology, 55 percent of respondents utilized COVID E-certificate apps like Tecka, CovPass, and so on, while 24 percent and 16 percent used Smart watch/band/pulse devices and Blood glucose/Blood pressure monitoring gadgets, respectively. The remaining 5% selected health informatics mobile apps.

It can be justified that the technologies help patients by calculating sugar level, pulse and the blood pressure of the patients. All the mentioned things in the human body are checked with machines that are totally based on technologies. As a result, it supports and simplifies most daily tasks, which is why it is most popular among respondents. During this time, nobody was allowed to break the pandemic rules, nobody was authorized to break the rules of safety and security, and most health professionals were unavailable to treat patients in their clinics, so smart health applications proved to be more useful in those situations; for example, BP/BG monitoring. As a result, these applications are widely accepted among the general public.

On the other hand, the secondary research suggests that the global competition in the healthcare industry has encouraged concern and curiosity within patients with respect to the healthcare services that are provided to the patients. With the developing concentration of health among the population and increase of senior citizens it is necessary to promote and improve the needs for having a healthy life. The competition that is growing worldwide spreads a great influence on global business. From the study, it can be noticed that the quality of service and the outcome it provides serves as one of the rare topics in the marketing of literature, receiving massive attention in the field of academic research. It can be also noticed that the demand for better and improved service quality in the field of healthcare leading to structure pressure towards the service providers have become an onerous assignment to the government policy makers, hospital administrator, investigators and therapeutic specialist. The unique services that are provided by the hospitals allows empowerment to the body of management of hospitals for distinguishing the services from other hospitals by increasing a favorable position to the practical services regarding the competition along with an improvement in service skill.

It can be justified that the hospital quality services are the inconsistency between the assumption and perception of patients regarding the services provided the hospital. According to several studies the necessary patient satisfaction has been put with patient loyalty in a parallel line. The study also focused on the satisfaction in patients that can also be evaluated by considering several variations between anticipated and received standard of services from the hospital facilities. Positivity in a patient's remark of services will draw the standard of the services provided by healthcare in a

very obligatory manner. The satisfactions that can be received due to the services provided by the hospitals give rise to patient satisfaction as well as patient loyalty towards the hospital.

From the question, if the healthcare system will improve with the application of technology shows that It can be observed here that 50% of respondents agree on the topic, while only 2% strongly disagree. There is a 3% response rate, indicating significant disagreement, while 25% of people strongly agree with the topic. On the other hand, 20% of respondents are undecided about how to respond to this question. It also suggests that they are oblivious of the topic or the manner in which technology is expanding throughout all places and work systems.

It's critical to comprehend the importance of technology in the healthcare system. Its significance is growing in numerous workplaces, with several business procedures embracing technological characteristics to help the corporation expand. The healthcare system must also evolve by incorporating new technologies for a variety of purposes in order to cure individuals of their ailments and health problems. A sizable portion of the population is still unaware of the benefits and drawbacks of technology and its application in the healthcare system. The approach of applying technology in various regions of treatment must be understood by the people, or there will be a knowledge gap in any individual in today's world.

From the question of safety and security, it is observed that this entire analysis of safety and security revealed that, in addition to technological advancements, there are several issues that need to be addressed that prevent the public from fully accepting smart healthcare technology as reliable and trustworthy. Hackers and invaders, for example, might disrupt the entire system, take their highly sensitive information, and use it to blackmail people or pose a threat to their lives. Furthermore, while doing surgery from afar, the possibility of bodily injury is a serious worry. There were some inconsistencies in the results when it came to privacy concerns, but based on the other charts, smart healthcare technology is acceptable.

If it is talked about expensiveness of the technology, it is estimated that Overall, 29% were somewhat concerned, 29% were extremely concerned, and 26% were slightly concerned. Aside from that, some persons were just little interested (5%) or had no interest (11%) in the cost of healthcare technologies.

The occupations graph depicts the relationship between cost and healthcare technologies.

Individuals with a background in business and management had undeniable consideration of upcoming or existing healthcare technologies, whereas those with a background in social science, education, law, engineering, and information technology (IT) had no concern about the cost of new technologies, as shown in the graph. So, it can be seen that Business and management people are more aware about cost of these smart healthcare technologies as they belong to this fields but rest of the occupations including medical field respondents are not that much concern they are moderate about it.

Taking about the question of different ages visiting medical websites or google search engine for their health advice or any other issue? (such as WebMD etc.)

From the graph, it can be seen that the majority of people (85%) have used any medical website for medical information or advice, whilst 14% were uninterested and did not utilize those websites. Further, the bar chart depicts the idea that young people (aged 18 to 29) visited these websites for any health concern information or guidance, accounting for 58 percent of the total, while 30-40-year-old accounted for 24 percent. It can be deduced from the data that elderly people aged 51 to 60 years old were more interested in new technology, as they only selected "Yes" for these websites. An astonishing point can be seen from this question as well as previous questions of diagnosis and surgical treatment that elderly people between the age of 51-60 were curious about new smart healthcare devices and technology. And they have highly preferred the new technology rather than tradition which their trust regarding these smart healthcare systems.

So, it evaluated that the Internet is a valuable source of health information for many people. The quality of information that people come across on the internet can have a big impact on them. We demonstrate the kind of questions people ask online, as well as the advantages and disadvantages of various information sources for answering such queries. This contributes to meeting people's needs for internet health information.

5.2 Recommendations:

As per the study certain things should be put into consideration before recommending anything. It can be said that smart healthcare is a system that uses

several technologies such as mobile internet, wearable devices and IoT so that information gets dynamically accessed and also connects institutions, people and materials relating to the healthcare industry. Smart healthcare responds actively to the environment related to medicine in an intelligent manner.

It can be said the use of advanced telemedicine acts as a smart technology has become very popular during the Covid 19 pandemic. The role of telemedicine service is to reach to the patients virtually and can be used to consult and increase the access of primary care as long-term facilities like providing mental health services, dialysis center, and so on. Telemedicine can have a good impact on healthcare but also have some disadvantages. It can be said that the advanced telemedicine techniques gave many solutions for a particular disease but for the people it is difficult to understand which medicine is suitable or perfect for him at that point of time. Thus, it can be used in the healthcare industries for certain services.

- The use of 5G is used to introduce new technology to the upcoming generation medical healthcare services. It can be justified that 5G supported devices are not only used to help the doctors, it is also used to convert a long process in a short duration and give the results more quickly helping the patients to cure from their disease faster. A certain disadvantage of 5G support is the cost of an internet pack that can be difficult for some of the customers. It can be said that for maintaining the 5G services it is necessary to upgrade the services provided by healthcare centers on a regular basis. The advantages of using the 5G in healthcare create positive impacts to both the patients and doctors. For setting up 5G facilities in a healthcare center it is necessary to set up 5G technology that helps in diagnosing patients in an advanced manner. It can be also put into consideration that dependence on technology will be increased by maximum using the 5G services. Thus, it can be suggested that 5G, despite having few disadvantages can be used in the healthcare field for improvement of technology in the industry.
- Another example of advanced technology is healthcare's digital assistance. It can be said that the technologies allow patients to interact with it and get desired solutions. Such technologies are Alexa, Google home and so on. These devices enable people to change the language as per their wish so that

the elderly people having people with language understanding can use the devices for medical purposes. The facility that digital assistant devices provide for their users is to interact with the devices. To upgrade healthcare technology as per requirement should spread a positive impact to our society. There are several advantages and disadvantages of digital assistance that should be put into consideration. The major criteria of accessing digital assistance are the knowledge of using the internet portals. It can be said that the providers of digital assistants should develop some open facilities that will attract more people to engage with this part of the healthcare department. The upgraded technology has been used to connect with the users and bring some drawbacks as well. Such misuse can be referred to as hacking the system. Use of these dives by maintaining proper security can be proved beneficial for the healthcare industry.

- It can be justified that the upgraded version of Artificial intelligence is the smart pacemaker. Smart pacemaker uses the upgraded version of Bluetooth technology and can be linked with smart phones of the patients. The technology makes the healthcare process more understandable for both doctors and their patients. The work of the pacemaker is to check the heartbeat rate of the patient's heart. Using the latest technology in the device helps the doctors to take care of the patients suffering with heart problems. Pacemaker is used as the artificial products for calculating the heartbeat rate. So smart pacemakers make that work easier for the upcoming generation. There are several advantages and disadvantages as well. The smart pacemaker makes it easier to operate both for patients and doctors. A regular reading of the rate of the heartbeat can be monitored. It can be said that along with several advantages there are disadvantages such as smart pacemakers can sometimes provide wrong data to the doctors as well as patients. Another disadvantage is that the device is very costly, and it cannot be affordable for certain sections of patients. Thus, it can be said that if the healthcare industry started to fund the device for weaker sections as well as does not totally rely on the reading of the device then it will be proved as one of the best technologies used in the healthcare industry.
- The use of healthcare devices in a wearable purpose can be proved as one of the greatest innovations in the history of healthcare facilities. The device can

help the owners to understand the number of steps they had walked in a day to stay fit. The device helps to regulate a healthy habit within the patients as well as healthy individuals to maintain a proper lifestyle. Healthcare centers should suggest the use of this device to the patients this will be very beneficial. The features of the gadget used in healthcare are able to measure the rates of various organs in human beings. Motion trackers are the most important parts of any device that is upgraded. The device has the ability to interact with the user and can even motivate the user for taking more steps. It also contains a sensor technology that can act while they touch the skin of the user. The devices are easy to handle by the users. Although there are some drawbacks as well the devices are very costly and have a warranty of a year decreasing the value of the productivity of the device. There are several smart devices that use technology to measure the critical monitoring parts of the human bodies. The modern technology based on such devices is made of Bluetooth systems. Therefore, using the smart device one can easily handle the other device if it is connected to the patient's body.

- Another milestone to the use of technology in the field of healthcare is the use of robotic surgery. It can be said the use of robots in surgery can be easily noticed. It can be said that Da Vinci's robotic surgical system already covered operations of nearly 200000 by using 5G internet services. It can be said that the manual surgery performed by doctors is more time consuming than the robot. As it can be assumed that the robots perform surgery in my lesser time and in a more advanced method. Thus, it proved to be much helpful for doctors as well as the patients. There are certain drawbacks of robotic surgery as well. If the surgery went wrong, then the robot cannot solve that problem at that point of time or in that situation. It can be said that the countries that are economically advanced can only use the technologies as robotic technologies are very cost sufficient. Countries with low economies cannot afford the technology. Use of robotic surgery makes hospitalization a process supporting short term. By using robotic surgery, it is easy to take very little time for processing a surgery by reducing the scariness of a patient. The process of surgery reduces the rate of infection spread after every surgery and it becomes flexible to observe any patient. The technology promotes reduction of blood loss and pain during surgery as well as that the

doctors can get better visualization of the patient's condition after surgery. Thus, it can be said that although implementation of the technology is cost effective still implementation of the technology can help in advancement in surgical activities lowering post-surgical hazards.

- It can be said that the use of smart technologies in the healthcare industry can have a greater way for taking care of the patients. Advance technology helps the doctors to reach their patients as well as it has proved very helpful to their patients. The technologies can help in advancing public health as well. It can be said that the digitalization in public health record keeping can be useful for the healthcare center as well as patients. The use of big and cloud data storage can prove to be very helpful for the advancement of hospital technology. It can be said that for delivering information through the internet, cloud uses both software and hardware. The primary advantage of using cloud data and big data is it can be used from anywhere in the world so that patients and the doctor can access the records or data if they have the permissions. The application of cloud is very easy to use from any Smartphone or computers or any other devices having internet connection.

It can be justified that modern technology provides better and safer storage of data. The cloud technologies reduce the risk of losing the medical data records and also lower the previous workflow. The role of Cloud storage is to protect the risk against the loss of sensitive data and also provide the recovery service. It can be easy to say that mechanisms are advancing with the advancement in technologies. With the help of mechanical science, it is getting easier in medical science to make the procedure of treatment faster as the solution to any kind of disease. It can be said that technologies help people to understand the way to balance their lifestyle by accepting the process of digitization in the department of healthcare. To get a health record easily it is necessary for the patients to get connected with the internet. Keeping check on the disadvantages, it will be beneficial for the healthcare industry to look into the advantages and implement smart technologies in the healthcare process.

- It can be justified that the survey put a light on the thought of population regarding the smart healthcare process. It can be identified that people

participating in the survey are divided into two sections, one having the knowledge about smart healthcare technology and its usage and the other without any awareness of the smart technology or its usage. It is necessary for people to be aware of the latest technologies so that they can apply it by themselves rather than depending on someone else. It will be easier for doctors as well to keep a check on the patient's daily progress and also keep data for further use of treatment.

- Introduction of IoTs would provide great and wide benefit in the healthcare industry. It generates and gathers information through sensory devices and is very beneficial for the healthcare center, doctor and patient. IoTs serves to reduce pressure and risks in the healthcare system. Cloud computing presents networking resources, optical computing and storage over the internet to organizations and individuals in an energetic process. Cloud Computing provides networking, computation, obligatory storage and application. Cloud computing is structured to produce services and a massive number of resources through a wide platform of networks. The application that has been received from the patient's part can be easily accessible through tablets, laptops and smartphones. Thus, it is necessary for the healthcare centers to use Iot and cloud computing for better functioning.

6 Conclusion

In the conclusion, it can be stated that various technological advancements have occurred in the realm of healthcare.. Gradual technical advancement and digitalization gave rise to smart healthcare technologies in the field of medicine. It can be said that smart healthcare is not only simple progress in the field of technology but also the multi-change extent. Smart healthcare can be considered as the final change till date that took place in the field of smart healthcare for prevention or mitigating of several diseases. From the concept of a smart world, the idea of healthcare arose. Wearable gadgets, IoT, and the use of mobile internet to achieve and obtain information are all examples of smart healthcare, connecting people, materials related to healthcare, and finally activating the medical habits that require smart manners.

There are various technologies helping in the process of smart healthcare. Such technologies are big data, microelectronics, 5G, mobile internet IoT, cloud

computing, and artificial intelligence along with the use of biotechnology. The technologies are required for the implementation of smart healthcare. The smart technologies will be very helpful for the doctors as it will be easier for them to manage the medical details. The objectives of the research laid in the facts that it will help the users to lean and manage themselves during the emergency. It will allow users to connect to digital treatment and care solutions as well as features such as alarm capabilities, continuous health monitoring, and emergency detection.

The research follows positivism philosophy. The researches include factual knowledge that is obtained through observation. The role of the researcher in the research is limited to collecting data interpreting in an unbiased way. The research follows all the five principles of positivism such as the goal of the research will depend on explanation and prediction, the search will be observed through human senses, there will be no logic of examination throughout science, the goal of the research will depend on explanation and prediction, the common senses of human will not be allowed to prejudice the findings of the research.

The data collection approach for the study was also quantitative. In addition, the study included both primary and secondary data collection methods. A hundred people were chosen, and the primary data gathering procedure was carried out with their assistance. Participants were issued a questionnaire by email, web, and social media platforms. The responses have been collected within 1-6 days. Several questions were asked, and responses have been analyzed accordingly. For the collection of secondary data, several online journals were kept into consideration. Four journals were taken for continuation of the secondary method of data collection.

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