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BY

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GE Healthcare

OVERVIEW:

Over 100 yrs and more than 50,000 employee worldwide it is leading the medical domain with its latest technology and digital solution. It enables healthcare workforce to provide smart and faster decision using its latest devices, services, application and analytics. The key centre of the company ecosystem work for digitalization in healthcare, précised health , better an speedy patient outcome, developed health infrastructure through their research process.

ORGANOGRAM:

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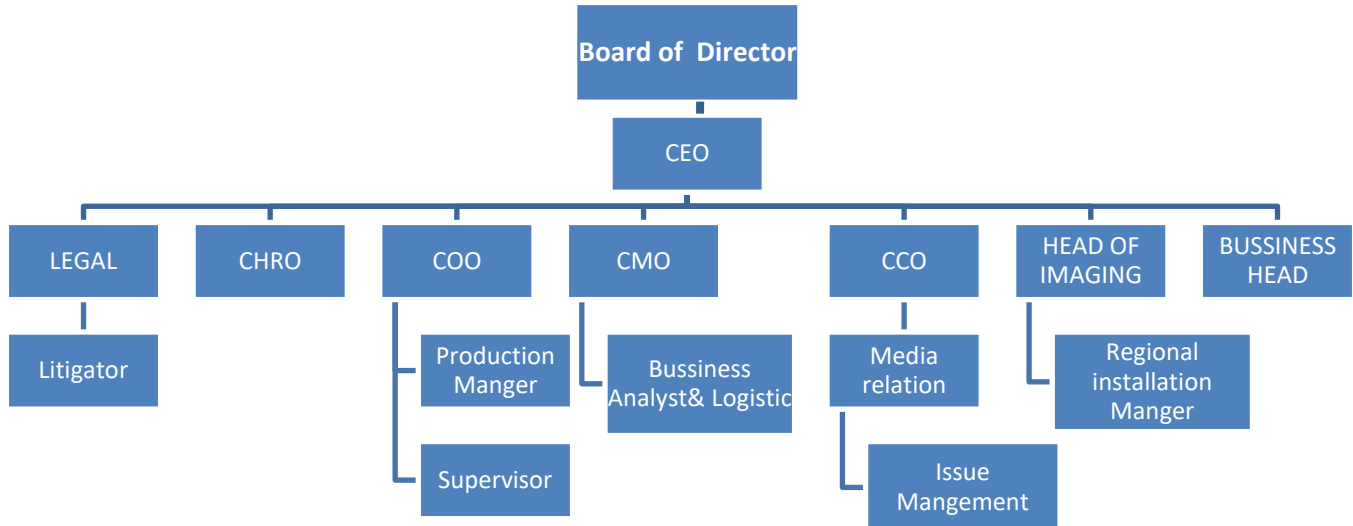
CEO-chief executive officer

    CHRO-chief human resource officer

    COO- chief operational officer

    CMO- chief management officer

    CCO: chief communication officer

LEADERSHIP:

Leadership is divided among top players to lead their fellow employees as follow:

1. Nalinikanth Gollagunta : he is the CEO & leads the main team for medical technology & make company a leader in the market through his strategic plan ,growth & partnership with others

2. Ashit Shah : he is currently business ultrasound head and he leads his team with key objective of high growth with desirable profit & master in running smoothly the bussiess operation

3. Maurat Setia : being a chief marketing officer he has master in field of innovation AI , digital technology in healthcare industry which helped GE to build a space in digital market and his main focus is giving better facilities to customer due to this reason he has been representing GE in world forums and also lead to its expansion around globe

4. Rohit Vishal Gupta: he holds a key position of chief human resource officer due to his keen experty in domain of employee relation & engagement , HR strategy and delivery it in new business environment

5. Srikanth Suryanarayanan: with around the globe experience he is currently leading as the head of imaging at GE healthcare and got 20 patents in his name with renowned publication and he develop latest technology to ease of the work of medical imaging and continuously motivate and work as keen employee of organization to achieve a great space in market

HR POLICY AND PRACTICES:

HR solution by GE healthcare goes beyond costing approach with strategy on market driven data and ensuring that leadership has key role in decision on financial resources for the future
 and by merger of their HR policy and practices with strategic plan

1. Pay practice as their centre of ecosystem due to shifting employee dynamics

2. Workforce management

3. Providing their employee health care services through pre scan , health and wellness activity, health plan and looking after injured employee

4. Base compensation program which help in retaining and recruiting new employees and helps to reduce turnover

5. The HR partners with effective leader to make recruitment and onboarding effective by establishing a metrics scale and score board to monitor effectiveness to improve and maintain progress which contribute by adding value to the team by providing right role to right person, deliver quality

6. HR partners up with finance team to analyze cause of add on pay practices and help by reducing organization dependence on pemium pay which develops a compensation structure to utilize a proper resource for needs

7. Provide environment free of harassment

8. Fair employment practice on merit

9. Follow privacy rights

10. It generates spirit of integrity among employees

11. Document employee concern through channels

12. Take corrective action against concern

13. Integrate employees integrity contribution and rewards them

14. Maintain accurate books and records of account and prohibit bribery in case employee challenges

15. Globally provide travel arrangement through GE travel centre for employee

16. Employees are strictly recommended not to share GE or any other company proprietary information to each other

17. Employee need to respect internal resources and property of organization

18. No activity at work or home should harm GE reputation

19. Don't not serve as independent consultant or exert outside GE

** These all key policy are given to employee in GE healthcare guide

COMMUNICATION CHANNELS:

For employees:

1. They integrate internal and external communication for telling about their brand and keeping their employee first policy

2. Send information where people are already seeking information like linkden, twitter and email page

3. Use chief executive as primary spoke person and employees as secondary spoke person for new employees and in induction programme

4. Transparent & integrated communications that showers brand storytelling is a great barometer for all corporate communicators for being open to every employee of organization

For clients and customers:

1. Traditional media
2. Healthcare ambassadors
3. Digital media
4. Social networks

5. Mobile apps

6. Interviews

7. Seminar

8. Publication

9. Events

10. Brochure

11. Interview

12. Campus enrichment programme

Challenges faced are:

1. need to make people realise impact of health

2. need more innovation in communication and training for employees

STRATERGY:

Company has adopted its stratergy on the basis of its 2 key analysis as follow:

Internal analysis :

1. Advanced training to employees and for customer needs

2. It merges technical & leadership training

3. With 70 lab in hands it build up & provide world class equipment to its clients

4. It motivate there employee by better remunerations economic slow down

5. Within key centre as research for new innovation

6. Continuously innovate solution to customer change needs

7. Has build it horizon across the globe with wider customer base

8. Transparency is key to organisation development as every outsourcing is kept under lens

External Anyalsis:

Competitive Analysis

Even though organisation have lots of competitor like FUJIFILM,SIEMENS but GE healthcare has work hard in every sphere to outstand it competitor

Industry Analysis

They have used Porters five forces model to determine which industry is more attractive and faces threats substances product

SWOT ANALYSIS:

Strength:

- Innovation,Research
- Organization Culture
- Superior Technology
- Awards,Recognization
- Global Market

Weakness:

- Fluctuation in revenue
- Environmental legal constrains

Oppournites:

- Growned population
- New product launche
- Emerging market

Threats:

- Outsource
- Newregulation
- Competitive enviornment

ROLES AND RESPILONSIBITY:

Various roles and their keen responsibility are linked under for the designated position holder and how they help to operate their organization work, while some of the major key chair holder responsibility are shared under their leadership above

1. Dr. Ajay Mishra(General Manager-Core Imaging): looks after the daily business operations that increases the revenue & he also looks after the financial data of the company.
   Develops and implements growth strategies of the company.

2. Vinod Chugh(Business Manager): develops and plans objectives to be achieved by the company to expand & implements those strategies which will attain the goals of the company.

3. Ateet Jayaswal (HR Manager): looks after the planning and coordination of the workforce under him & even into recruiting the right employees for the organization. Provides training and development to the work force.

4. Dr. Sunita Setia(Marketing ,Brand and Strategy): creates strategies for marketing , communication ,product management, digital marketing and brand management .

5. Nikhil Bhatia (General Manager-Marketing): looks for the marketing and profiling of the products and services provided by the company

6. Neha Singh(Senior Manager-Strategies and Operations): responsible for strategic planning f and sets objectives for sales , brand positioning and customer success.

7. Rakesh Swami (Senior Director-Corporate Affairs and Policies): responsibility is to provide strategic leadership and form policies which are effective and efficient & even advices various committees on policies and services of the company.

SERVICES AND PROGRAMMES:

PRODUCTS-

1. Advanced visualisation: cardiology imaging ,neurology ,oncology, vascular software
2. Anaesthesia delivery
3. Bone & metabolic health: lunar iDXA
4. Computed tomography
5. Diagnostic ECG: ambulatory& resting ECG, cardiology data management
6. EP recording
7. Gold seal refurbished system
8. Healthcare IT
9. Hemodynamic recording: my lab recording system, cath lab networking
10. Interoperability: DICOM,IHE
11. Life science
12. MRI
13. Mammography
14. Maternal infant product
15. Molecular imaging
16. Patient monitoring
17. Radiography
18. Fluoroscopy system
19. Surgical imaging

20. Ultrasound

21. Ventilator

SERVICES AND SUPPORT-

1. Digital solution

2. Healthcare technology management

3. Marketing library

4. Services enablers

5. Support documentation library

6. Service shop

PROGRAMME-

They launched start-up programme called Edison[x] comprises of applications focused on clinical, operational and financial outcomes; smart devices embedded with advanced intelligence to improve workflow, productivity and diagnostics; and the Edison platform. The platform enables GE Healthcare and its strategic partners to develop, deploy, manage, secure and distribute advanced applications, services and AI algorithms.

INNOVATION OR INVENTION:

Locally-

VP and GM Molecular Imaging & Computed Tomography, Gene L Saragnese.

Globally-

1. Electrical Impedance Tomography (EIT) for Lung Monitoring

2. Tube Watch

3. Ultrathin Strain and Temperature Sensors for Li-ion Batteries

4. Homeland Security Applications of Radiological Detection

5. Microfluidic Flow Cell for Cell Analysisigital Womb

6. Tumor Cell Heterogeneity & Immune Response

7. In Europe, MIT and GE create a brain trust to fuel ambitious healthcare research.

8. GE and Roche launch new digital solution that can help doctors design bespoke cancer treatments.

Why GE Healthcare?

Know days the healthcare is evolving and revolving around latest technological innovation which help the healthcare workforce to save time and increase sharing and analytics of data.

GE perspective to their programmes?

GE is providing new solution through its dedication which addresses current challenges with sum up of speed , ,image clarity ,connectivity and data availability.

Thus, to benefit the workforce and community they have dedicated this task by developing key software's which integrate themselves with national health programmes by GOI ,smart training and start-ups to provide quality to patient and is committed to it by designing such tools under their mission to save a life.

Various programmes related to communicable and non-communicable disease are as follow:

1. Training programmes for staff under Skill India Mission
    a. Doctors: echocardiography, Doppler CT guided biopsy , genomics, heart failure and gynaecological disorders etc
    b. Nurses: acid –base balance, arrhythmia and adequacy of anaesthesia testing etc
    c. Technologist: anaesthesia testing, CT imaging , stroke imaging etc

These all E-learning are done under flagship of GE healthcare institute for providing quality and services for patient by giving stannous training to the workforce

2. Start-up under Make in India Mission
    "SAMEER": associate work on research , development and shaping of a platform for indigenous MRI development in India to provide healthcare delivery to community in screening related to NCD and communicable disease with cost effective testing by developing it in own country.

3. Start-up to fight Covid -19 with GOI:

"Edison" company has collaborated with Microsoft and GOI to build up a platform using AI to focus on covid-19 patient where software will act as central hub from where staff can assess patient in ICU and on ventilator 24/7 without been actually present in contaminated wards.

4. Advanced visualization technology:

Being a healthcare delivery organization any disease whatever the type be screening is compulsory with accurate testing, scanning and accuracy thus GE has setup their mission to provide advanced solution to imaging sector in healthcare as its backbone for healthcare industry where it help to provide speedy and accurate result within a defined timeframe for any kind of disease to diagnose through advanced software eg. Hepatic Vcar, TAVI etc

Under advanced visualization programme , I am going to discuss about Hepatic VCAR below

HEPATIC VCAR: Software for segmentation of liver lesion
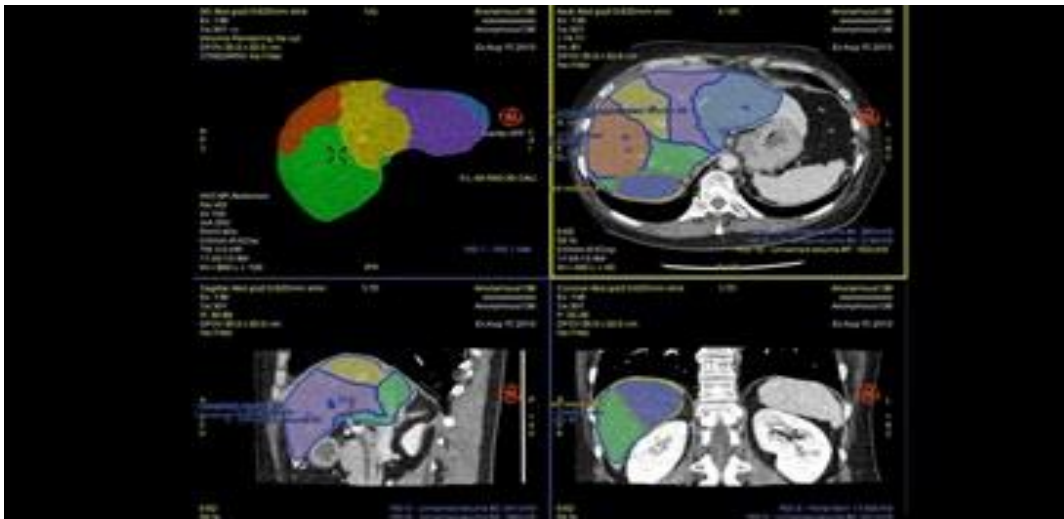
Role and responsibility of organization related to it:

Been the responsible organization they have put forward their step under the lens of National Viral Hepatitis Control Programme been a market leader in advanced visualization tool, that would help in diagnostic speed and confidence, thus organization has decided to contribute by early screening of patient and helping them to diagnose through this latest software technique where liver segmentation can be done to detect stages related to liver cancer, cirrhosis and hepatitis , been successfully implemented software in developed nations like France , USA it has contributed in bring down their mortality rate

In India the GOI is running this national programme because liver cancer is 5th largest cancer in our nation & 1.6%of our population every year falls under cirrhosis ,all though this programme is with good vision but certain gaps are their like less grass root level reach, less resource ,equipment and training , and if screened then stage left undiagnosed or if diagnosed it may be at the end of his life or may have cause morbidity

Thus , these challenges can be address by GE healthcare through Hepatic VCAR which provides platform for advanced training , screening, segmentation and visualisation of each section related to liver and can bring down mortality and morbidity rate

Objective:

It helps in automatic segmentation &assessment of liver and its related lesion which help in speedy and effective workflow in liver related disorder or tumor

Methodology:

GE healthcare for any kind of product they follow a common method of designing an innovation Process flow:

1. Select site of system that include guides, input of ground requirement
2. Select team for construction and designing
3. Preliminary plan
4. Final installation drawing
5. Construction drawing
6. Plan review and permits
7. Preconstruction meeting & finalize project
8. Construction

9.   System delivery

10. Installation

11. Training and first patient use

In India after seeing morbidity and mortality rate due to liver disease .GE healthcare is trying to collaborate it with GOI to implement it all over India

Overview:

Hepatic VCAR provides you with a complete reading solution for detecting liver lesions with flexibility and high performance unlike any other Liver analysis package ,can visualize and measure liver, liver segments and liver lesions and tumor. full integration with Spectral CT allows for use with GSI data. Helps you to build a clinical report

Key feature of Hepatic VCAR:

• Automated detection of Portal Venous phase driving liver segmentation

• Guided intelligent lesion segmentation &built-in lesions to prevent overlap detection and avoidance.

• Tumor burden calculations connect to segment, lobe or whole liver.

• Efficient waying of managing lesions and tumor for longitudinal exams.

•editing tools for quick and easy refinements

• Volume rendered visual depiction of the lesion and liver along with liver lobes, liver segments and portal vein for longitudinal comparison.

Use:

It is a post CT scan analysis software package designed to help radiologists and other clinicians in the detection, diagnosis, treatment planning, and monitoring of liver related disease

Approach :

AT COMPETITOR LEVEL:

GE healthcare approach related to this software is unique and agnostic ,in this case they view their competitor as their partner by collaborating with Microsoft they bind one thing that there is no overlap at technology level and by together can have a big impact on the related cause .

AT GOVERNMENT LEVEL:

1. In USA they have taken license approval from FDA and started spreading its foot prints in healthcare market & tie up with National Institute of Health

2. In European Union they have taken license approval and certification of safety and quality from European CE and competitive authority

3. In INDIA they are trying to get approval from government under CDSCO guidelines

AT COMMUNITY LEVEL:

They have tie up with NGO in Tamil Nadu and in various nation with respective civil society

Specific action taken:

AT COMPANY LEVEL:

They have taken unparallel combination of world interdisciplinary team to access the need of this software and design it in such a way that it could be easily handled and deliver for mankind

AT CLIENT LEVEL:

Thus they have taken following action to spread it :

1. Early approval and tie ups with organization
2. Training and user guide for every technician pre and post use with analysis
3. Centre hub to monitor timely update and quality requirement of software

All these action have help to get this software at ground level and help in reducing liver related diseases

Implementation :

For this software they have a unique strategy to implement it:

AT COMPANY LEVEL:

1. Training : advanced training to wokforce and data based problem analysis related software input& output and how to deal it
2. Mentoring & leadership provide to workforce for proper execution
3. The focused approach include three techniques:

a. Show me the money- to crush all workplace defects and improve productivityand quality of software

b. Everybody plays-they get their supplier under strict quality lens like six sigma so that they can ensure it effectiveness for patient use as they provide its spare parts

c. Specific technique – where they have ranked their programme and merge it with their organization goals, in our case they have ranked it in top priority for prevented liver disease under advanced visualization category due to whichits in high demand across globe

AT MARKETING LEVEL:

They have use user guide , detail case study on use of this software among patients ,videos of how segmentation and analysis is done on their web portal, blogs , seminar , collabartion with hospital are the ways of making this product deliverable from one end to another

AT GOVERNMENT AND COMMUNITY LEVEL:

They have taken detail licensing and certification from respective authorities for marketing and implementing for public health in USA and European Union, in case o India it is on early level , wheras in community reach it has stated in southern parts of India with help of NGO

Outcomes :

Highlights of software:

1.automatically segment the liver.

2. tool to construct liver segments.

3. user guided segmentation algorithms for telling size of liver lesions.

4.Integration of it with Spectral CT thatallows for quantification of Iodine to help in lesion characterization when used with GSI datasets.

Accuracy& timing of this software:

a.For Liver segmentation

Processing time-16.7 sec

Accuracy- 81.4 %

b.Portal vein segmentation

Processing time-8.5 sec

Accuracy -87.5 %

The success rate of this software is 84% (ratio of successful cases to the number of all cases)is successful when following things are showed :

• all the primary branches are segmented

• a majority of the secondary branches are segmented

• a low number of non-portal vein branches are segmented.

Liver Volume Average RSD(relative standard deviation):

Manual Segmentation	Automated Segmentation
2.54 %	3.69 %

Lead to increase in 36% examination and reduce 4% waiting time in diagnostic centre

REGULATORY FRAMEWORK ON SOFTWARE AS A MEDICAL DEVICE BETWEEN USA, AUSTRALIA & INDIA: COMPARATIVE ANALYSIS

INTRODUCTION:

Following key terms like SaMD , medical device as a software are quite unclear terms that may designate any kind of software, system or a device used in medical care depending on it use .Though it plays an important role in field of eHealth , telemedicine , M-health there is significant evolution in it which provide a great challenge for the notified and monitoring bodies to regulate them globally.

So, there is a need of proper regulatory guidelines, but unfortunately the guidelines are lacking to regulate them, so it can't act as environmental scan for the companies to make a proper device which can't breach ethical guidelines.

PROBLEM:

On the basis of the literature reviewed through standard database like Pubmed, Proquest, Research Gate, Scopus, though being a new topic less literature is available but although i have examined key problems faced among these countries as a whole even though they are competing with each other and lots have to be done in case of developing nation , following problems are faced off:

1. Classification rules & definition which are not adaptable according to SaMD products in among developing nation
2. No regulatory mechanism for post market survillence among developing nation
3. Lack of clarity in regulatory requirements related to Quality Management System

INTERVENTION:

Do regulation need up- gradation ?

In current scenario large quantity of SaMD products are entering into the market which lead to high risk for consumer and patient like AI, ML as current guidelines do not deal with software that provide content related to diagnosis and treatment

Though AI & MI been a software that helps in learning are mention in class1 in Australia , class 2 in USA whereas in case India there is no category even though if categories they are mention in low risk which doesn't face high scrutiny

Imported products for personal use are not registered with notified bodies that led them to escape the scrutiny

So, it is a need of an hour to upgrade the regulatory frame work according to the current need so that the main priority for every organization and products manufacturers remains quality, safety and their management

A tabular interpretation is presented below containing detail background on existing guidance document among 3 nations:

DISSIMILARITY:

Point of difference	USA	INDIA	AUSTRALIA
Classification	Class I,II,III	Class A,B,C,D only for medical device Not for SaMD	Class I,IIa,IIb,III
Notified bodies	FDA	CDSCO, no body defined for SaMD as of know	ARTG
Defination	**software intended to be used for one or more medical purposes that perform these purposes without being part of a hardware medical device**	As an immediate matter, devices that were not previously considered as 'medical devices' but will now come within the scope of 'medical devices', have the option to be registered with the Central Drugs Standard Control Organisation (CDSCO) and avail exemption from other requirements under the rules for some time going forward. Acc to 1st april 2020	Anyinstrument,apparatus or appliance is intended by the by the person fordiagnosis,prevention , treatment of disease

		new defination	
Regulatory pathway	510(k), pre market approval	No pathway defined	Multiple pathways to apply for individual device
QMS requirement	21CFR PART 820	ISO 13485	AS/NZS ISO 9001:2016
Timelines of approval	18-30 months	6-12 month	12 months
Clinical evaluation	① Valid Clinical Association ② Analytical Validation ③ Clinical Validation	No defined evaluation for SaMD	1.Scientific validity 2. analytic validity 3. clinical performance
Market approval steps	1.Classisfy device 2. implement QMS 3. submission of clinical trial 4. submission of market approval 5. FDA quality system 6. establishment of registration	No market approval steps for SaMD	1. Properly determine the classification of the device. 2. Implement a Quality Management System. 3. Prepare technical file 4. Prepare a Clinical Evaluation Report . Design Dossier audited by a Notified Body. 5. Obtain your CE Marking and ISO 13485 from the Notified Body. 6. Prepare a

			declaration
Validity of license device	indefinite	Not defined for SaMD	Annual registration require

SIMILARITY:

1. Both India and Australia faces clear and well defined regulatory guidelines as per existing standard
2. No country follow global standard according to global harmony for trade
3. USA , INDIA and AUSTRALIA face a common issue of patient safety and quality management as licensing approval and monitoring is not so stringent
4. India and Australia both don't have a single regulatory pathway
5. India stands out of league as there is no clear approvals , classification , evaluation related to SaMD as compared to USA and Australia

OUTCOMES:

USA:

1. It need a stannous process for every class of device either low, moderate
  Or high risk
2. Indefinite approval should be revoke so that continous time frame monitoring can be done on manufactures and need of that software according to patient safety and quality

INDIA:

1. It is clearly outline in difference table and problem mention above that India though been a larger industry for SaMD, doesn't have clear and define classification for software's
2. CDSCO though been a monitoring body doesn't have power to look on companies that manufactures software as medical device as no legislature is defined
3. Their need to be a defined risk classification so that market approval and clinical evaluation steps can be stated
4. As per new amendment notified by government no clear interpretation about SaMD definition
5. Companies like Siemens and GE can ensure their software requirement according to public need with ensured quality and safety under a defined body

AUSTRALIA:

1. If defined regulation is done then every SaMD products would require an Australian sponsor before supply under TARG
2. Which would help to monitor that device under defined body
3. No bypass could be done by overseas manufacture and companies

If strict guidelines and regulation are made according to global standard then, overall benefit would be as follow:

1. Minimised safety and public health risk
2. Watch eye on cyber security and data privacy
3. Would help to align with international standard
4. Help to built confidence among consumer for devices

Assessment of Knowledge, Perception and Willingness of using Telemedicine among Healthcare Students

ABSTRACT:
Introduction:
Telemedicine is a developing technology in Indian health sector and the success of any new technology depends upon a number of factors such as knowledge, perception and willingness of users and professionals towards it.
Objective:
The main objective of this study was to assess the knowledge, perception and willingness of healthcare students in using telemedicine .
Material and Methods:
A cross- sectional survey was conducted among healthcare students from 10th May to 24h May 2020 in India. A Sample size of 422 participants, recruited online through google form, was taken using Non Probability Convenience sampling. The pre-tested study questionnaire was administered which had 4 parts ; demographic details, willingness, perception and knowledge level. The data analysis was done using SPSS version 25.
Result:
Out of the study population 39.8% were male and 60. 2% were female. 43.1% reported low knowledge for telemedicine and 51.3% were reported to have low knowledge about its application. However the perception of students towards the technology was 95.3% and they were willing to use telemedicine and integrate it with their practice in future.
Conclusion:
The study findings revealed that even though participant's knowledge and awareness was limited, the majority reported positive perception and willingness towards using the technology. Thus it is essential to build proper and effective communication channels and awareness among students, professionals and users for telemedicine to succeed in India.

INTRODUCTION:

As per American Telemedicine Association (ATA)," Telemedicine *is the natural evolution of healthcare in the digital world"* (Chellaiyan et al., 2019). It literally means "healing from distance" which is often used as an umbrella term that consists of health care delivery in addition to education, research, health surveillance, and promotion (*Recent Directions in Telemedicine: Review of Trends in Research and Practice*, n.d.).Telemedicine offers a new method of providing healthcare services across different geographical areas and is used to facilitate the accessibility of healthcare services to people who do not have access to such services in their residential areas (Ayatollahi et al., 2015). As per WHO, the doctor-population ratio should be 1:1000 while the current doctor population ratio in India is only 0.62:1000. There are 2,79,588 hospital beds in rural areas and 4,31,173 beds in urban areas with 70% of population of India still living in rural area (*NHP-2018.Pdf*, n.d.). In order to fulfill the gap, massive resources and manpower would be required.Therefore, In order to fulfil this deficit between demand and supply of healthcare facilities in real time, telemedicine can play a crucial role in India(Chellaiyan et al., 2019).

 Previous research has shown that insufficient knowledge, skills and training of users with factors like lack of technical expertise and initial cost of investment are some of the important barriers for the use of telemedicine (Ayatollahi et al., 2015). Proper knowledge of telemedicine technology, especially of healthcare students & professionals, is important for successful implementation of the technology. With increasing knowledge about the benefits and capabilities of telemedicine, the willingness and perception could also be enhanced. Simultaneously, if the use of new technology is supported by the people working and studying in the field, it will help in building more confidence among others for the use of this technology which will build a positive attitude (Chellaiyan et al., 2019).

A literature review identified that most of the study has been completed to show the understanding of telemedicine among healthcare students and staff. For example a study conducted by M. Bade and Moga on students from Romania – the Transilvania University of Brasov (Faculty of Medicine) to know their perception and knowledge on telemedicine showed that increase in knowledge will help to change the attitude towards telemedicine (Badea et al., n.d.).A study conducted on the postgraduate student in West Bengal by Dr. Indira Dey revealed that 75% of students agreed for telemedicine to be used as a future tool and 70% said that if knowledge is provided for telemedicine then it will lead to change in perception as well (Dey & Bhattacharya, 2016). Another study

by Zayabalaradjane Zayapragassarazan & Santosh Kumar in a teaching hospital revealed that it's a need of an hour to provide sufficient knowledge and training to faculty, physicians and medical students on it as awareness level was quite average (Zayapragassarazan & Kumar, 2016).

As per a study conducted on the effect of education on perception towards telemedicine by Ranelle M, Nissenit, it has been shown that education improves perception towards telehealth among healthcare professionals(*Knowledge and Attitude of Health Professionals toward Telemedicine in Resource-Limited Settings: A Cross-Sectional Study in North West Ethiopia*, n.d.). Since telemedicine is an emerging technology in the health sector of India, in order to facilitate its adoption, the Government of India has also released new guidelines on 25th March 2020. However before undertaking the widespread implementation of telemedicine, it is important to explore the viewpoint of the users and healthcare professionals like knowledge, perception, and willingness towards adoption of telemedicine which could determine the future scope and success in India. (MacNeill et al., 2014) (Izham et al., 2010) (Shahpori et al., 2011)**.**Thus the objective of this study is assess the knowledge, perception and willingness of healthcare students about telemedicine.

METHODOLOGY:

Study design and study population:

A descriptive cross-sectional survey was conducted among 422 students studying in various clinical and non-clinical fields related to healthcare from 10th May to 24th May 2020 in India . A Non Probability Convenience Sampling method was followed to identify and recruit participants for this study. Participants who consented and met the inclusion criteria were eligible. Anyone who refused to participate was excluded. A sample size of 384 was calculated using the Cochran formula . . After factoring in the non response rate of 10% and missing data a sample size of 422 was taken into account and were targeted . But as it was not possible to conduct a community-based sampling survey during the period of lockdown, we decided to gather the data online.

The tool used for data collection was a structured questionnaire administered online through various social networks. A link of Google form was circulated which included a brief introduction with the purpose of study and consent form. The participants were asked about their willingness to take part in the study. Research ethics with regard to informed consent, voluntary participation and confidentiality of data were followed.

Inclusion criteria:
1. Informed consent prior to filling the questionnaire.
2. Participant's age should be 18-35 years as per the study time frame.
3. Those who have completed the questionnaire

Exclusion criteria:
1. Students below the age of 18 years.
2. Incomplete forms
3. Non respondents

Study tool:

The study questionnaire was designed and modified on the basis of previously published research articles(*(PDF) Assessment of Physician's Knowledge, Perception and Willingness of Telemedicine in Riyadh Region, Saudi Arabia*, n.d.). The questionnaire was evaluated by the mentor under whom the study was performed and was adopted in English only.

The questionnaire consisted of mainly 4 sections: (1) demographic characteristics, (2) knowledge, (3) perception, and (4) Willingness to adopt telemedicine. The level of knowledge was measured using the Likert scale in which the following grading was done: 1= very low, 2= low, 3=average,4= high and 5= very high. Similarly, perception and willingness were measured by using binary scales where 1= agree and 2= disagree.

Statistical analysis:

Data analysis was done using the statistical package of social science (SPSS) software version 25. Data was first extracted into excel sheets and then fed into IBM SPSS. Descriptive statistics like frequency and percentage were used to express various parameters and for the comparison of categorical data, Chi-square test was used. *p* value <0.05 was considered statistically significant.

RESULT:

Out of total participants 39.8% were men and 60. 2% were women. The mean age of the study participants was 24.23 years with a range of 18-35 years. More than 50% of the respondents were studying clinical courses (MBBS, BDS, BAMS,BHMS, BUMS and Nursing etc) and rest 45% of respondents were from non-clinical courses (MPH, MHA, MBA in health and hospital management, and other allied healthcare courses). The majority 89.8% of the respondents were from urban areas and only 10.2% of respondents belonged to rural areas (Table 1).

Table1. Socio-Demographic Characteristics of the Study Participants (N=422)

Characteristics	n	%
Age in years (Mean±Standard Deviation)	24.23±3.326	
18-25 years	287	68
26-35 years	135	32
Gender		
Male	168	39.8
Female	254	60.2
Course		
Clinical	232	55
Non-Clinical	190	45
Location		
Rural	43	10.2
Urban	379	89.8

Our study findings reported that 43.1% of study participants had low knowledge about telemedicine (p <0.05). 51.4% had low knowledge about applications related to telemedicine (p < 0.05) and 15.6% had attended webinars, conferences, or have done presentations related to telemedicine (p <0.05). Only 14% reported to have a high familiarity with the use of telemedicine in countries other than India, however this finding is not statistically significant at p = 0.694. (Table 2)

Table2. Variables Related to Knowledge of Telemedicine by course

Questions	Levels	Clinical Courses [n(%)]	Non-Clinical Courses [n(%)]	Total (%)	p-Value
To what extent you are familiar about telemedicine	Low	120(51.7)	62(32.6)	43.1	<0.001
	Average	73(31.5)	85(44.7)	37.4	
	High	39(16.8)	43(22.6)	19.4	
	Total	232(100)	190(100)	100	
To what extent you are familiar with applications related to telemedicine	Low	138(59.5)	79(41.6)	51.4	0.001
	Average	63(27.2)	76(40)	32.9	
	High	31(13.4)	35(18.4)	15.6	
	Total	232(100)	190(100)	100	
How often do you have attended webinar, conferences or have done presentation	Low	164(70.7)	110(57.9)	64.9	0.010
	Average	39(16.8)	54(28.4)	22	
	High	29(12.5)	26(13.7)	13	

related to telemedicine	Total	232(100)	190(100)	100	
To what extent you are familiar with current guidelines of telemedicine	Low	147(63.4)	120(63.2)	63.3	0.722
	Average	48(20.7)	44(23.2)	21.8	
	High	37(15.9)	26(13.7)	14.9	
	Total	232(100)	190(100)	100	
To what extent you are familiar with use of telemedicine in other countries	Low	143(61.6)	110(57.9)	60	0.694
	Average	59(25.4)	51(26.8)	26.1	
	High	30(12.9)	29(15.3)	14	
	Total	232(100)	190(100)	100	

Note: p value <0.05 and *p value <0.001 are statistically significant

Further, 95.3% level of perception was observed for telemedicine among the study participants. 27.5% disagreed with the statement that telemedicine is already available in India (p <0.05). 93% of respondents reported that they think technology has a viable role in healthcare sector whereas 91.4% of the students agreed that telemedicine saves time and money and 87.4% agreed that it saves efforts too, however the findings were not statistically significant (p = 0.797). (Table3).

Table3. Variables Related to Perception of Telemedicine by course

Questions	Levels	Clinical Courses [n(%)]	Non-Clinical Courses [n(%)]	Total (%)	p-Value
Telemedicine is a viable approach for providing care to patient	Agree	207(89.2)	176(92.6)	90.8	0.229
	Disagree	25(10.8)	14(7.4)	9.2	
There is viable role of technology in health care	Agree	214(92.2)	182(95.8)	93.8	0.132
	Disagree	18(7.8)	8(4.2)	6.2	
Do telemedicine save time and money	Agree	212(91.4)	174(91.6)	91.5	0.942
	Disagree	20(8.6)	16(8.4)	8.5	
Do telemedicine save efforts	Agree	206(88.8)	166(87.4)	88.2	0.652
	Disagree	26(11.2)	24(12.6)	11.8	
Telemedicine already available in healthcare in India	Agree	149(64.2)	157(82.6)	72.5	<0.001
	Disagree	83(35.8)	33(17.4)	27.5	

Note: p value <0.05 and *p value <0.001 are statistically significant

As shown in Table 4, 85.3% respondents agreed that telemedicine system can be integrated within the existing system (p<0.001). 84.1% of the participants were willing to pay for telemedicine in India. 83.9% of the respondents were willing to include the telemedicine in their practice. However these findings were not statistically significant.

Table 4. Variables Related to Willingness about Telemedicine by course

Questions	Levels	Clinical Courses [n(%)]	Non-Clinical Courses [n(%)]	Total (%)	p-Value
Are you willing to pay for telemedicine in India	Agree	195(84.1)	160(84.2)	84.1	0.965
	Disagree	37(15.9)	30(15.8)	15.9	
Are you willing to see doctor through video conferencing	Agree	185(79.7)	161(84.7)	82	0.184
	Disagree	47(20.3)	29(15.3)	18	
Will you download telemedicine application and use it for	Agree	199(85.8)	165(86.8)	86.3	0.752
	Disagree	33(14.2)	25(13.2)	13.7	

consultation					
Will you advise your friends to use telemedicine	Agree	199(85.8)	169(88.9)	87.2	0.332
	Disagree	33(14.2)	21(11.1)	12.8	
Will you ever include or practice telemedicine in your practice	Agree	194(83.6)	160(84.2)	83.9	0.870
	Disagree	38(16.4)	30(15.8)	16.1	
Telemedicine system can be integrated within existing system	Agree	180(77.6)	180(94.7)	85.3	<0.001
	Disagree	52(22.4)	10(5.3)	14.7	

Note: p value <0.05 and *p value <0.001 are statistically significant

DISCUSSION:

Present study is a descriptive cross sectional study conducted to assess the knowledge, perception and willingness of healthcare students towards telemedicine. It provides robust estimates that can be utilized for future developments in the area of healthcare technology.

Our study findings revealed that 43.1% of participants had low awareness about telemedicine while the perception (95.3%) and willingness (84.1%) among participants was high towards it .

Our study findings related to knowledge is consistent with the findings of other studies where only 19.4% could describe telemedicine correctly and its use (Dey & Bhattacharya, 2016). A study conducted in northern Iran among 532 clinicians has reported that the majority of their study participants (96.1%) had low knowledge regarding telemedicine (Ayatollahi et al., 2015). Another Study conducted in Puducherry, India among 120 professionals in a tertiary hospital have also shown the similar results where it was found that 59% had low knowledge about telemedicine (Zayapragassarazan & Kumar, 2016). However, one study reported that education improves the knowledge with hands-on experience which helps in changing the attitude of the user (*2.Pdf*, n.d.)

As per our study findings, participants had high perception rate towards telemedicine .In this view, Kirubel Biruk and Eden Abetu revealed that 64% had a positive attitude towards it(*Knowledge and Attitude of Health Professionals toward Telemedicine in Resource-Limited Settings: A Cross-Sectional Study in North West Ethiopia*, n.d.). Another study conducted in Pakistan indicated that telemedicine is preferred by (71.11%) (Baig et al., 2014). Study conducted in Riyadh have also shown that the perception of physician under various departments towards telemedicine is positive (90%) (*(PDF) Assessment of Physician's Knowledge, Perception, and Willingness of Telemedicine in Riyadh Region, Saudi Arabia*, n.d.).

According to the current study, even though participants had low knowledge regarding telemedicine, the majority of them were willing (84.1%) to adopt and pay for this technology. These study findings are consistent with the study conducted among 150 PG students of tertiary hospitals in West Bengal where they stated that 76% of the study population were willing to pay for telemedicine (Dey & Bhattacharya, 2016). As per a study conducted in Riyadh among 391 physicians, it was found that 95% of them reported their willingness to start this technology and use it to consult in a larger institution (*(PDF) Assessment of Physician's Knowledge, Perception and Willingness of Telemedicine in Riyadh Region, Saudi Arabia*, n.d.). Study conducted in Pakistan have shown that 50.8% of participants want the smaller hospitals to be connected with a bigger hospital through telemedicine for better healthcare service delivery(Baig et al., 2014). In Romania, 52.29% of the study population have said that quality of medical treatment would improve using telemedicine while 58.7% believed that it would reduce medical error (Badea et al., n.d.). As per another study conducted in Nigeria among 110 health professional 54.2% were in support of telemedicine for routine care (Abodunrin & Akande, 2009). Whereas in Malaysia, out of 532 clinicians 80% of respondents wanted to connect remote districts through telemedicine (Izham et al., 2010).

Though telemedicine has been implemented in India by law from 25th March 2020 there are lots of challenges ahead such as lack of understanding, awareness, communication, trust on technology and high cost. The main reason for this could be attributed to the fact that the exposure to telemedicine of healthcare students in India is limited as compared to other countries (Dey & Bhattacharya, 2016) . The present study reveals important information about the knowledge, perception and willingness on the part of healthcare students who are expected to be the future of the healthcare sector

and shoulders the responsibility on the widespread adoption of telemedicine. Nonetheless, this study was administered online via a structured questionnaire due to Covid lockdown hence we couldn't conduct an in depth interview with respondents. Further studies are required to assess the issues being faced by the students in the adoption of telemedicine.

Thus the results of the present study conclude that student's knowledge of telemedicine technology is limited with high perception and willingness towards its adoption. Even though telemedicine has become part of our medical act, it is suggested that before implementation, it is essential to increase user's knowledge of the technology and illustrate its capabilities and benefits. Enhanced knowledge and clear perceptions of technology will help them to accept it.

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CONFLICT OF INTEREST:
There is no conflict of interest among authors

ANNEXURE

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CASE STUDY:

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