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Emerging real time analytics based health start-ups: opportunities during covid-19

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ABSTRACT

Indian population has potential threat of communicable and non-communicable diseases. The low preventive health measure is a cause of major loss to the economy. Integration of the cloud platform with remote wearable sensors not only helps the health stakeholders to capture the patient vitals but also perform predictive analysis during COVID-19. Raising timely alarms through Internet of Medical Things and Artificial Intelligence has wide application in preventive care through real time analytics. However, Health Merchandise Startups using artificial intelligence and machine learning for timely device delivery face delay in making themselves available and affordable for Remote patients of Tier II and III. This study takes a health service provider perspective and seeks to study problem situation systemically by using a casual loop model. Finally, analysis of the feedback loops is done to be able to come out with suitable strategies for COVID-19 patients of Remote locations.

INTRODUCTION

The IoT/AI (internet of things/artificial intelligence) based health startups are building a complete health ecosystem for the benefit of people worldwide, connecting patients, care givers, doctors and hospitals with a common threat. Smartphone was initially meant for making and receiving phone calls, has now become a medium to share a rich stream of personal data on a cloud-based platform [1] "Corona viruses are of viruses which may cause illness in animals or humans. In humans, several coronaviruses are known as cause respiratory infections ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and severe acute respiratory syndrome (SARS). The most recently discovered virus causes coronavirus disease COVID-19." Many Indians returned to work as the economy opened up gingerly, while things are turning uglier for the economy as well as for start-ups, there are some bright sparks as well. Due to technology, people in worldwide got more awareness about this virus and with the help of a technology and the other technologies like AI helps in performing its capabilities through nature of risk and assisting with medical

advancements like: -

- **Monitoring Hospital visitors and patients using AI**: Facial scanner and thermal scanners are helping to identify the facial attributes and fever conditions of the people.
- **Remote monitoring**: There is a sensor-based technology if we placed that sensor under the patient mattress can track the heart rate, respiratory rate and body movement it helps to take care of COVID patients.
- **COVID voice detector:** The AI tool will detect the infected one by evaluating the sound of their cough and breathe problems.

Use of IOT:

IOT is playing vital role in limiting the spread of virus and helps the treatment of infected people like touch free attendance, sanitization conformity, supervising of body temperature. Now warehouse, hospitals and offices are using it.

- Tracking the coronavirus pandemic
- Connected Thermometers
- Smart wearable
- IOT buttons

There is a tremendous potential of Wearable ECG systems to bring revolution in treatments for various cardiovascular diseases (CVD). Patients with Chronical ailments will be benefited most by these types of wearable remote systems. Use of sensor-based ECG wearable have bring a revolutionary change in the world of ambulatory ECG monitoring this helped in early treatment of patient suffering from cardiovascular deceases [1].

Continuous ECG graph monitoring of the of geriatric patients and offering them with preventive care at a preliminary stage would drastically reduce the aberration stances. Four major applications of wearable devices have been observed like Portable Device, Home Adaptations, Electronic Systems and connected devices [2]. It is also proposed that through smartphones, consumers can obtain most routine lab test, which transfers the ownership of data from health stakeholders to patient [3]. Microcontrollers are used to record physiology-based data with the help of these devices wherein the central controller helps to process the data and generate a message of warning to the person taking care and even help doing the prediction of upcoming disease [4-5].

In order to maximize the benefits from IoT, many consortiums of companies and industry bodies have drafted technology and regulatory protocols to promote standardization and uniformity. There is a dilemma about customer's perception about wearable sensors and marketing of these by companies, this is refer as Baetylus Theorem where people falsely believe that buying such products will benefit to their health [6].

IoT is benefitting both consumers and industries in distinct and innovative ways through varied applications. IoT is helping to create value for stakeholders through availability of information, with the help of technologies such as sensors, networks, standards, augmented intelligence and augmented reality. It is also helping to enhance process efficiencies significantly across industries, particularly Manufacturing and Healthcare thus taking industrial applications to the next level.

Figure 1: Source- Deloitte Analysis, Industry Report, Primary Research.
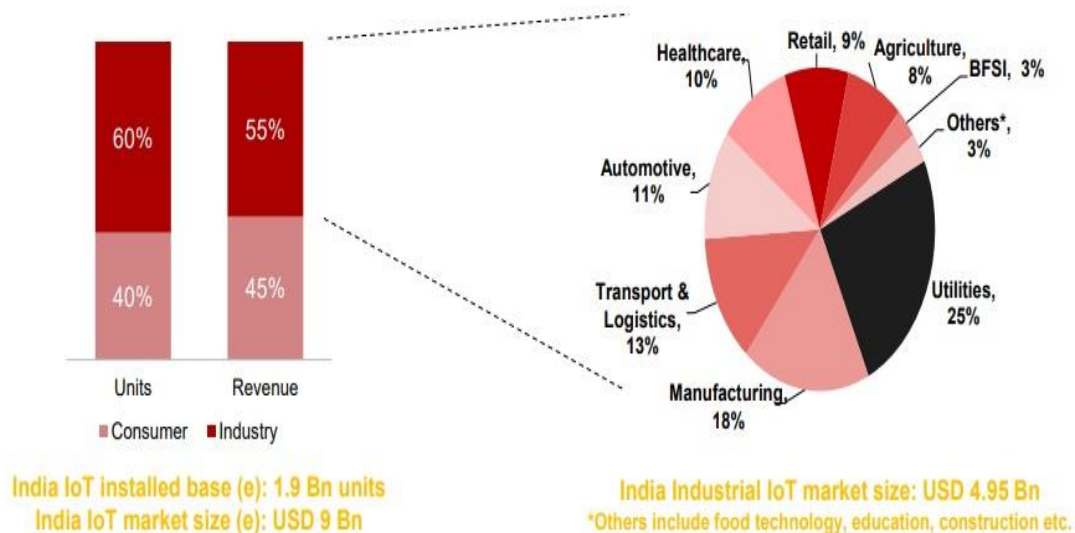
According to a report by FICCI presented by Deloitte on "Indian Medical Electronics Industry Outlook 2020" the Indian demographic Factors offer opportunity for huge growth in medical electronics due to potential demand for healthcare. Health Ministry has launched for the elderly-"National Program for the Health Care of the Elderly (NPHCE)" in India with a provision of INR 288 Crores to invest for same in 2010-2025. A major health problem that is change in disease profile – non-communicable diseases (NCDs) is the leading cause of death. Sedentary lifestyles have led to increase in lifestyle/non-communicable diseases such as cardiovascular diseases, diabetes and cancer etc. Lifestyle diseases such as, obesity, cardiovascular diseases and diabetes are also forecasted to become more pervasive. The Government of India has initiated National Programmed for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS). A Growing number of medical devices are becoming potential wearables in India, including ECG monitors, glucose monitors, blood pressure monitors and pulse oximeters.

Whereas in the developed nations, technologies such as preventive's Body Guardian remote monitoring system or Avery Dennison's Metria wearable Technology are setting the stage to seamlessly deliver patients data to doctors. Bluetooth is key in systems such as 9soulutions IPCS, which uses it to track elderly patient's movement and send health measurement to caregivers. Body Tel uses Bluetooth to allow patients to wirelessly send body measurements to their doctors. Similarly, in a country like India where diabetic patients are high, continuous Glucose monitors (CGM) have a wide scope to not only monitor the glucose level in

human bodies but also help sustain at desired level by injecting insulin time to time. C8Medisensor, a wearable product that conducts non-invasive optical glucose monitoring by transmitting a pulse of light through the skin and constantly updates the data to a Smartphone via Bluetooth.

Health-Tech Verticals for Startups:

To control the spread of corona virus, AI and IOT startups are leveraging the tools and solutions to help the crisis. There is a startup called Indian Robotics are providing its robots into screening and diagnostics these robots help to collect the data from the patients, symptoms exhibited and validation. These robots are enabling a video conference with a doctor from rural locations to help out the people who are facing symptoms like high fever etc. helping out the patients. AI and IOT are became major weapons to tracking and tracing the cases.

Medika bazaar is the start-up which providing the online B2B platform only for doctors and hospitals. The supply chain of this startup in Tier 2, Tier 3 cities and remote locations. They provide all medical equipment's, Masks, Thermometers, Test kits, body covers etc. for doctors through online.

MyLab, Bione, Redcliffe Life Sciences, are the startups which low-cost manufacturing ventilators for covid patients to developing AR based solutions in India. Noida-based biotech startup DNA experts has also developed a testing kit which can increase the total number of tests by reduce the time taken per test. While most testing kits used in India are take around 2.5 hours for result, DNA expert's claims its Covid test takes just 58 minutes to test a sample. The startup is incubated at the state-run Centre for Cellular and Molecular Platforms (C-CAMP).

In this scenario, a large number of Medtech startups are working on diagnostic solutions and preventive healthcare and some as healthcare aggregators. There are two broad categories of Medtech startups. First, that are harnessing technologies like AI and Internet of Things (IoT) to change India's healthcare landscape. The second category according to the Indian Startup Ecosystem, Traversing the maturity cycle report, 2017, are multiple Health-tech Startups in the sub verticals of medical solutions like marketplace for health services, health lab aggregators, Wellness Platforms, Online pharmacies, E- Diagnostic and ambulance aggregators. Amongst the Health Tech startups 87% are B2C and 26% are B2B.

Research Gap:

Their lies a huge gap between the available healthcare start-up services and the adoption by prospective customers seeking affordable healthcare solutions. This conceptual study provides a framework to understand the present real time analytics-based healthcare startup solutions and suitable approaches to extend their availability.

Aim of the Study:

- To categorically identify the framework of healthcare startups in India and their need in COVID-19.
- To identify the approaches on how real time analytics-based healthcare startups are functioning and to what extent they are available to the seeking customers.

RESEARCH METHODOLOGY

This research is exploratory, diagnostic and conclusive in nature. The study would be exploratory as it would explore the various real time analytics-based health start-ups in India. The methodology used in this study is based on system thinking [7]. The methodological framework used in this study consists of two phases. First, attempt was made to structure the problem. Second, a casual loop model was developed to capture feedback loops to explain the behavior of the system [8]. This study was limited to qualitative modeling based on system dynamics.

The study would also be conclusive in nature as it would provide meaningful strategies and approaches towards a sustainable healthcare model in India. The study provides a holistic view start-ups that have been able to reduce healthcare service cost by leveraging technologies.

Problem statement:

In this study, the maximum startup funding has been observed in the health tech verticals of 'Tech-Enabled diagnostic services' and 'Anomaly detection and disease monitoring'. However, their availability is limited to Tier I. This research is an attempt to study the contributions made by Real time analytics systems to make them an affordable/ accessible for Tier II and Tier III.

Source of data:

This study is conducted with secondary data which is available from various sources like IoT World Congress Report, Deloitte, Nasscom publications, FICCI Report and research articles which are very relevant to this field.

Data Analysis methods:

Data Analysis would be done using inferential analysis for drawing inferences and interpretations in this study.

Inferences:

Out of the two healthcare startup categories, Real time Analytics startups leverage cloud platform to offer remote healthcare solutions. This category emphasizes the use of Products-as-a-Service model and thus is able to make their service remotely accessible during the COVID-19. They use service-driven business model through AI/IoT healthcare solutions. **Variables gathered form Stakeholder Interviews:**

Further**,** as an analysis of our interviews with the health service providers reinforced the fact that with the introduction of IoT/AI into businesses and society, there is a promise of productivity and efficiency by improving real-time decision making,

solving critical problems and creating new innovative services and experiences in the COVID times. However, insights have been received on how existing health startup services can be leveraged by Tier II and Tier III through affordable innovative services. They laid emphasis on the product-as-a-service subscription model wherein the remote medical device user is charged only if he or she opts to share his medical data for predictive/preventive analysis. The future scope of devices which are based on subscription model for yielding recurring revenue at an affordable cost for Tier II & III customers. However, there are very few startups in healthcare aggregators category which leverage implementation of AI/ML in merchandize

prediction and procurement cost reduction in order to reach in Tier II and Tier III. Adaptive artificial intelligence and machine learning technologies not only have the potential to optimize device performance in real time to improve healthcare but also help to predict the device necessity in the Tier II and III places. Especially for the Diagnostics, IV Diagnostics and Others wherein India has a maximum import dependency.

Diagnostic imaging (e.g. CT scan, X-Ray, MRI, USG, X ray-tubes etc.), IV Diagnostic (lab equipment and reagents, etc.) and Other Medical Device (ECG, opthal equipment, heart lung machine, etc.) form 70% of total import in India in FY1613.

**Table 1**: Healthcare Startups based on Real time Analytics/ Advanced analytics (Health-Tech Category I Indian Startups)

Category: Real time Analytics	Name	Gap	Services	Medtech
Cloud, analytics	Bagmo, or the 'Blood bAG MOnitoring' device	Bagmo addresses the lack of blood availability in rural India, which often leads to death during pregnancy. Objective: The B2B company aims to reduce wastage at blood storage centres, and improve logistics and communication issues.	blood bag monitoring device, Bagmo, which monitors the temperature of blood bags during transportation and storage.	Every blood donation is entered on the cloud platform, after which it is tested and the components (plasma, blood cells, and platelets) are stored in separate bags. A radio frequency identification (RFID) card is attached to each bag, and the unique ID and the refrigerator that stores the bag is stored in the cloud.
Genetic Analytics	Prantae Solutions	Suffering from a pregnancy disorder called preeclampsia Objective: To develop devices and diagnostic solutions, mainly for pregnancy related healthcare.	EyeRa, for early detection of preeclampsia; ProFolU, to monitor kidney health; Salubrious, which provides a solution for hidden hunger; and Embargo, which can detect antibiotics in food products.	Genetic Engineering and Biotechnology, Prantae Solutions received the CII-IPR Award under the 'Startup' category for life sciences for best trademark portfolio.
Advanced analytics, AI/ML.	Waferchip Techno Solution	Continuos monitoring of ECG data and capture real time through Bluetooth	Developed a wearable Electrocardiography (ECG) device called Biocalculus.	It transfers ECG data to an Android application via Bluetooth. If a smartphone is not available, it will store the data up to a month of recording. The device uses artificial intelligence (AI) to generate a clinically actionable report for further diagnosis and treatment.
Cloud Analytics	EzeRX	Affordable IoT based diagonistic solution. EzeRX, which stands for 'Easy for prescription', aims to make the adoption of preventive healthcare approach easy, accessible and affordable	Tests for anaemia, liver, and lung-related medical problems without any blood work and for less than Rs 1	The startup's first product, AJO, which stands for anaemia, jaundice, and oxygen saturation, is a non-invasive, IoT-enabled device
Cloud Analytics/ Predictive Analytics	CardioTrack	Need of Network connected ECG for predictive care CardioTrack helps customers to be aware of upcoming symtoms and heart illness	The key functions of the app include receiving digital data from CardioTrack via Bluetooth interface.	The device via Bluetooth not only captures heart signals but also calculates the calculates the average heart rate. Within it the MicroEMR App which help the phyisician to do predictive analysis .
Advanced analytics, AI/ML.	SiG{}Tuple	Builds intelligent screening solutions to aid diagnosis through AI-powered analysis of visual medical data.	The images are analysed on cloud using state of the art image processing and deep learning techniques	Offers AI solutions to Analyse medical Data. It generates reports containing differential blood counts, visualisations on various blood metrics and suggestions

Table 2: Healthcare Startups based on Healthcare Aggregator Services (Health-Tech Category II Indian Startups)

Category: Healthcare Aggregators	Name	Gap	Services	Medtech
Hyperlocal Health Services	Medikoe	No hyperlocal healthcare-services Objective: Hyperlocal Aggregating Platform for Health Services. It also shows available offers by its service providers on its platform	Few of its partners include Manipal Hospitals, Jiyo Natural (healthy food), NM Medical Diagnostic, Nightingales Home care and Positive Homeopathy.	Platform that provides the list of healthcare and wellness services available in the vicinity, and connects the users to these service providers.
Home Healthcare	Medwell ventures	Need of growing section of the middle-aged and geriatric population seeking comprehensive and accessible health support.	Caregivers across categories including nurses, physiotherapists, attendants and infant care.	Wellness and care programmes ranging from preventive screening to Home Healthcare and palliative care.
Pharmacy Agrregator	Pharmeasy (Competitors are 1 mg.com)	Need of Online medicine delivery	The startup aggregates the customer's need of medicine procurement to sample collection and lab result	Aggregation on technology platform and use of AI for stock projection.
Home Healthcare	Care24	It is a homecare platform which connects the caregivers and patients. They have added travel assistants and equipment renting as part of the platform	The startups facilitates from prescription to complete recovery.	Its services include nurse at home, physiotherapy at home, attendant at home and infant care services. (Other competitors include: Accel and IFC backed Portea , Apollo Hospitals)
B2B Digital Healthtech Platform	Medikabazaar	Need for B2B online marketplace for medical equipment and supplies in India	With a digital catalogue of more than 250,000 products, the Medikabazaar platform enables hospitals and medical establishments to search for their required supplies online, and even compare specifications and prices in real-time	This B2B healthtech platform has a presence in around 20,000 pincodes, catering to hospitals in Tier II and III areas.

Table 3: Use of hi-tech diagnostics is gradually increasing with a slow rate.

Segments/Year	2011-12	2012-13	2013-14	2014-15	2015-16
Diagnostic Imaging	**636**	**638**	**602**	**620**	**757**
Consumables	266	286	280	306	273
IV Diagnostics	**225**	**250**	**277**	**281**	**322**
Patient Aids	203	236	232	227	210
Orthos & Prosthetics	184	204	204	234	249
Dental Products	67	77	97	89	98
Others	**878**	**926**	**941**	**974**	**964**

Figure 2: Casual Loop Model
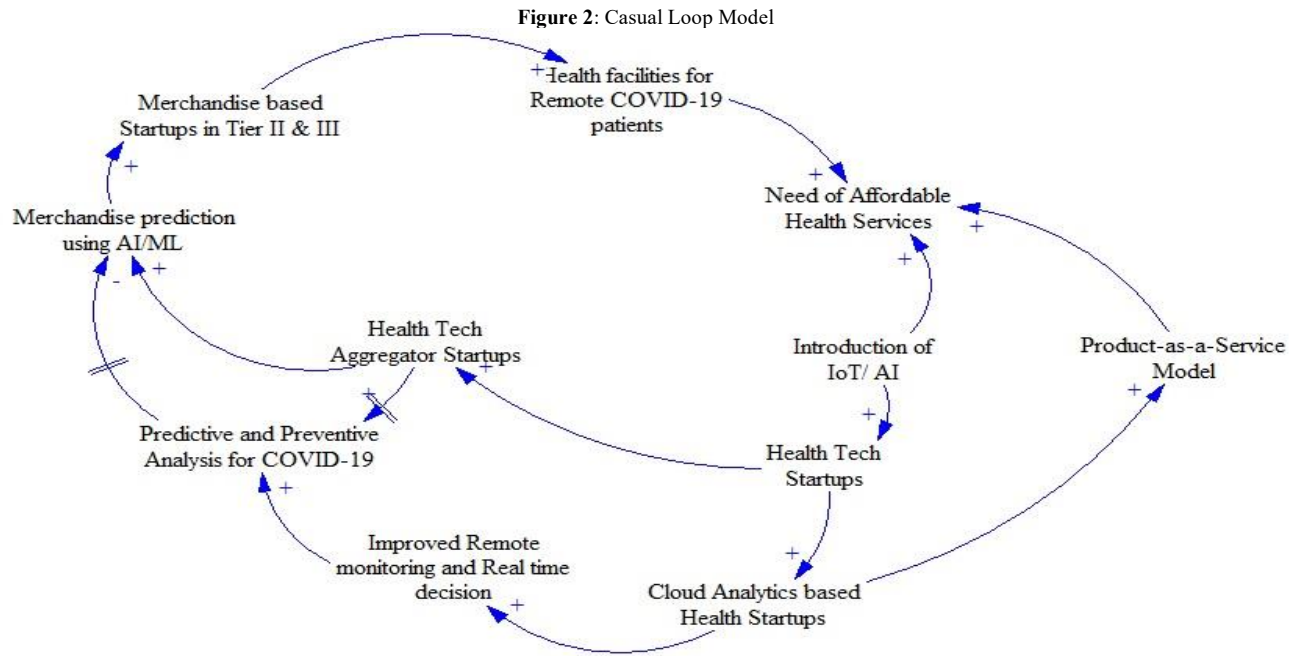
To identify the future potential of the segment wise medical devices in India, Joint Plots are made using python coding. It has been done for extrapolating the future demand of these medical devices and to identify the most promising potential demand segments. Coding is specified in the respective figures.

Figure 3: Diagnostic Imaging Plot

```
sns.jointplot(x='Year',y='Diagnostic Imaging',data=df,kind='reg')
<seaborn.axisgrid.JointGrid at 0xd0df898>
```
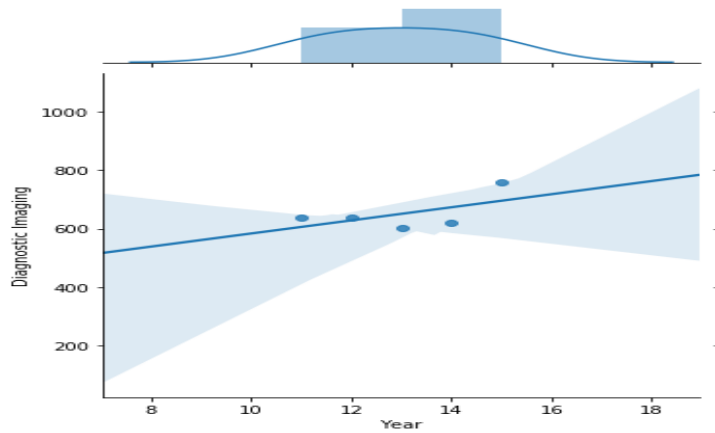

Figure 4: Consumables Plot

```
sns.jointplot(x='Year',y='Consumables',data=df,kind='reg')
<seaborn.axisgrid.JointGrid at 0xda07ac8>
```
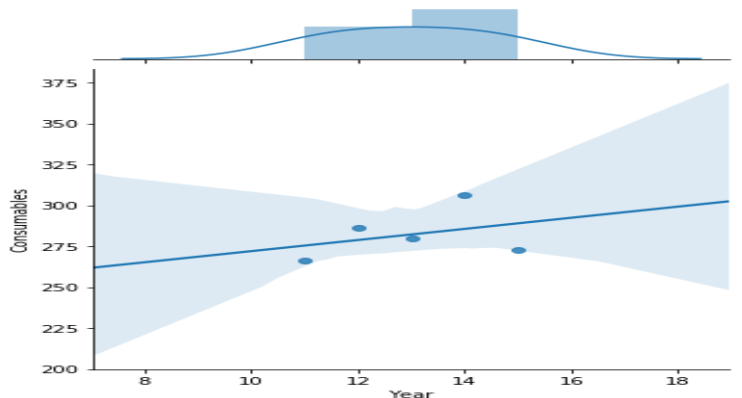
Figure 5: IV Diagnostics Plot

```
sns.jointplot(x='Year',y='IV Diagnostics',data=df,kind='reg')
<seaborn.axisgrid.JointGrid at 0xe116438>
```
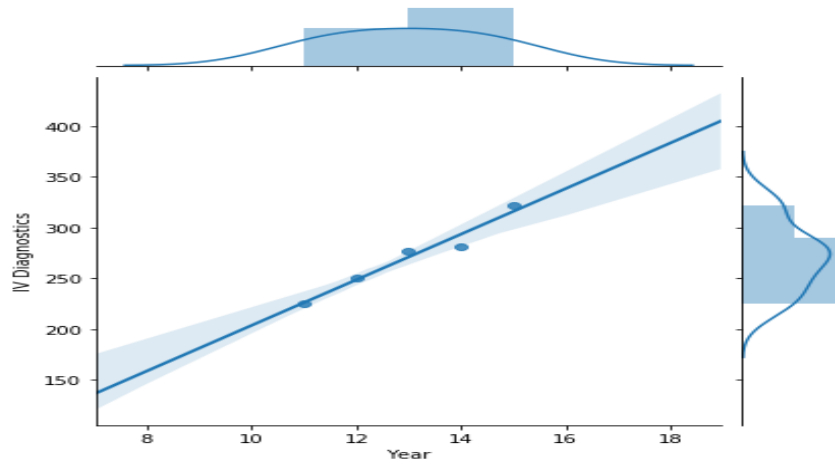

Figure 6: IV Patient Aids Plot

```
sns.jointplot(x='Year',y='Patient Aids',data=df,kind='reg')
<seaborn.axisgrid.JointGrid at 0xe597748>
```
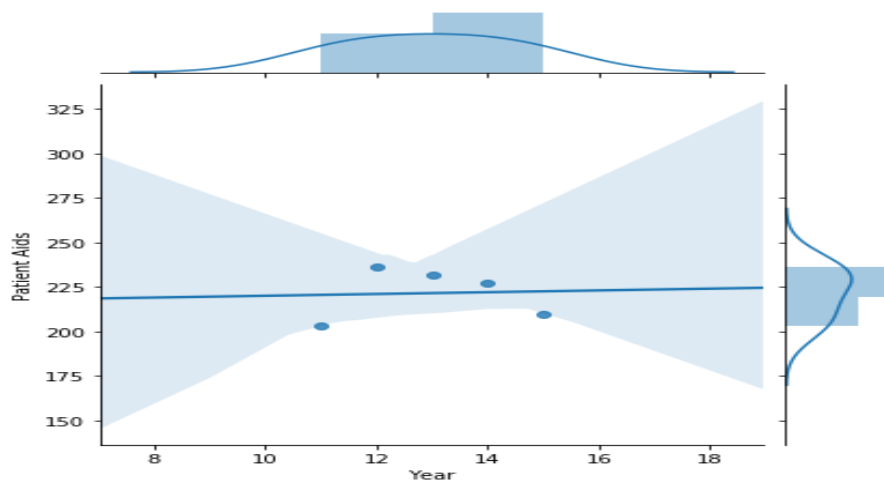

Figure 7: Orthos and Prosthetics

```
sns.jointplot(x='Year',y='Orthos & Prosthetics',data=df,kind='reg')
<seaborn.axisgrid.JointGrid at 0xea44400>
```
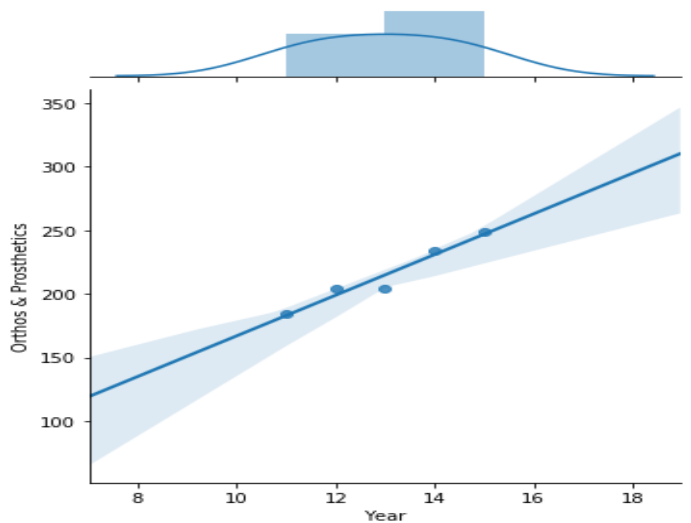
Figure 8: Dental Products
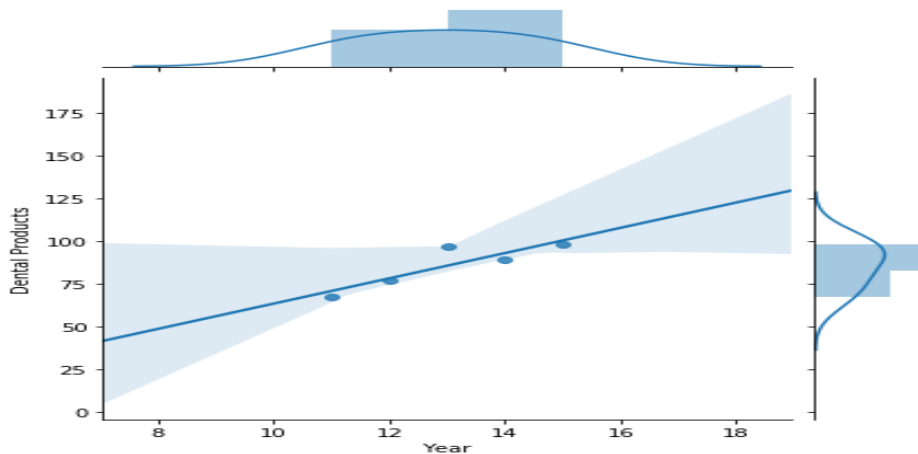
Figure 9: Other Plot
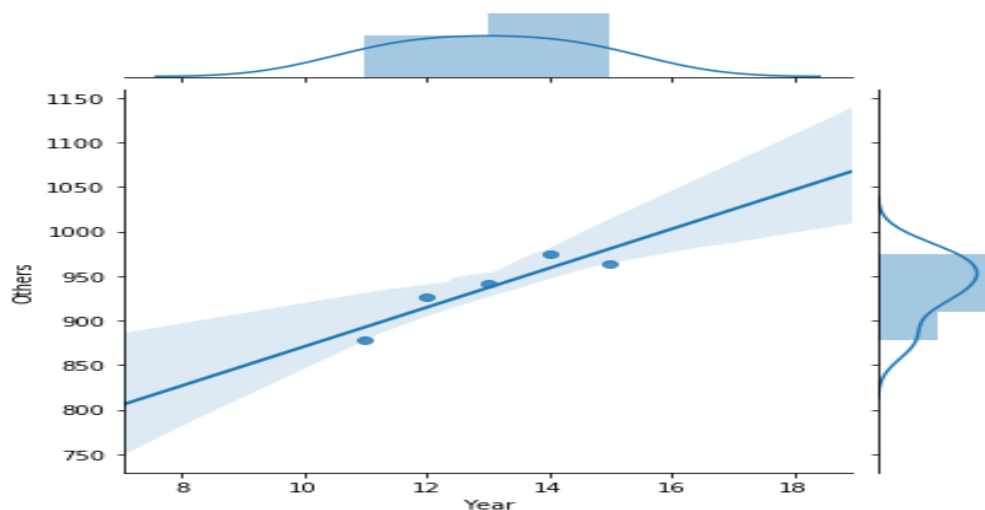
Thus, these plots provide the scope of opportunities in the manufacturing of the devices. As per the plots the maximum demand potential is for Diagnostic Imaging, IV Diagnostics and Others. Currently, out of the 750 medical devices manufacturers present in India, a majority are SMEs and MSMEs (90% have an annual turnover of less than USD 10M) and contribute 30% or (USD 1.1 billion) to the Indian medical devices market. While indigenous medical devices startup manufacturers are yet to scale up for bulk production for tier II and III.

DISCUSSION

The above study deals with systems thinking approach to deal with the availability gap of affordable health services to the remotely located patient. In the causal loop model above there are two reinforcing loops and one balancing loop. It tries to identify that how IoT/ AI/ML based startups can benefit to the COVID-19 patients through Startups based on Cloud Analytics or AI/ML based health

merchandise facilitator. Sensor based health monitoring system could be used for detection of post operative care, sports training, elderly care, rehabilitation and other various field in future [9].

The Product-as-a-Service solution attracts the startups in India with an idea to provide with an open access to their data collection practices and its analysis for preventive strategies during COVID-19. This model not only eases post aberration care but also reduces the risk stances by real time monitoring /diagnosing the health patterns and generating the alerts to stakeholders based on the threshold limits. However, in the balancing loop of the model a delay has been observed in the Merchandise facilitating health startups in Tier II and III locations.

There is a huge scope to capture the cloud data from Tier II & III through seamless integration of IOT/AI/ML startups and clinical practitioners to perform customized medical research. Also, key disease profile varies with every country and so does the

supplementary supporting services of healthcare aggregators who make the core healthcare service accessible. Through the above healthcare startup and funding initiatives, a shift in need has been observed from healthcare category I present in Tier I to its availability/accessibility in Tier II and III. Thus, this study suggests the companies to implement its proprietary Artificial Intelligence (AI) and Machine Learning (ML) tools to report accurate stock projections for medical establishments in these areas and leverage product as a service model to make the devices affordable. Customer's belief that those who use fitness wearable they experience high performance and effort expectancy [10]. Artificial intelligence-based wearables medical system can be affordable by continuous research and development to make early disease detection [11].

In the critical COVID-19 patients, a need was predicted for the ventilators in the remote areas. AI/ML in machines delivery & medicines supply chain/operative care has the potential to timely deliver the required critical devices. Also, there is a huge scope for startups manufacturing Diagnostics Imaging Diagnostics devices for Tier II and III places.

CONCLUSION

IoT/AI in healthcare has a wide potential but the market penetration is quite low in Indian market. IoT/AI enabled health startups have the ability to customize their services in accordance with the local demand especially during COVID-19. Demand of mobile health solutions is driven by a remotely located population where the immediate reachability of the medical devices and services are a challenge. Despite of identified COVID vulnerable Zone health-based merchandise couldn't reach on time. They are also looking for affordable innovative health solutions. Med startups are having a big opportunity to manufacture and supply Diagnostics Imaging & Diagnostics devices for Tier II and III locations in India.

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