

**E- MEDIATION & PREVENTIVE HEALTHCARE:
INSIGHTS FOR HEALTHCARE INDUSTRY**

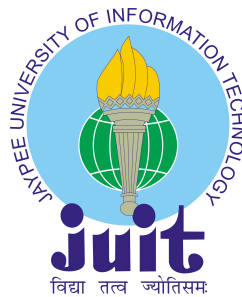
Dissertation submitted in partial fulfillment of the requirement for the degree of

**BACHELORS OF TECHNOLOGY
IN
BIOTECHNOLOGY**

By

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**UNDER THE GUIDANCE OF
DR. ANUPRIYA KAUR**



JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

MAY 2018

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DECLARATION

I hereby declare that the work reported in the B-Tech project entitled “E- Mediation & Preventive Healthcare: Insights For Healthcare Industry” submitted at Jaypee University of Information Technology, Wagnaghat India, is an authentic record of my work carried out under the supervision of Dr Anupriya Kaur. I have not submitted this work elsewhere for any other degree or diploma.

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16th May 2018

CERTIFICATE

This is to certify that the work reported in the B-Tech. project entitled “E- Mediation & Preventive Healthcare: Insights For Healthcare Industry”, submitted by Kshitiz Gupta at Jaypee University of Information Technology, Waknaghat, India is a bonafide record of his original work carried out under my supervision. This work has not been submitted elsewhere for any other degree or diploma.

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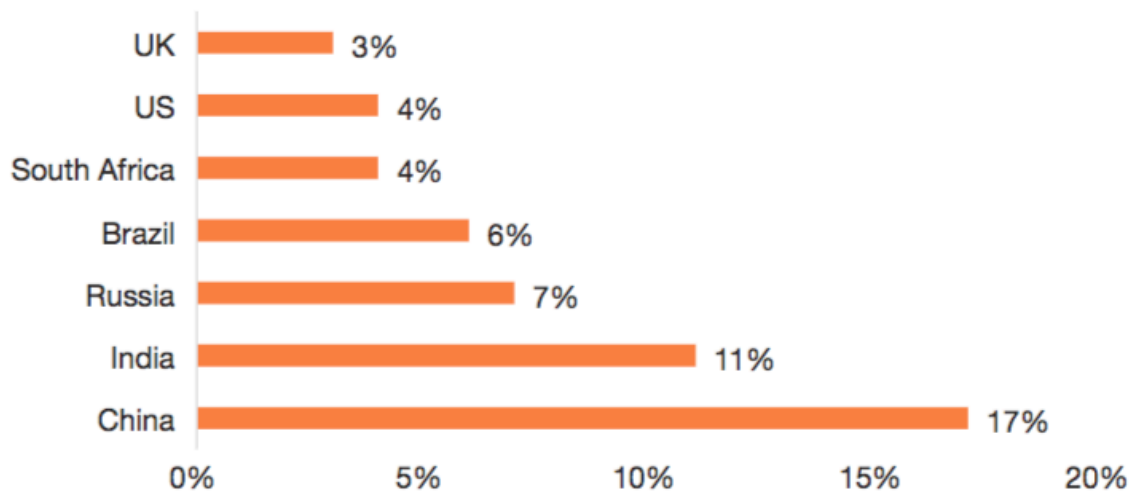
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CHAPTER 1

INTRODUCTION

Since the inception of advanced diagnostics and pathology services, healthcare professionals have benefitted in making precise diagnosis for their patients. Technological advancements have led to manufacture of low cost and efficient kits that yield quick and accurate results. However, the need for technical expertise and knowledge to operate and make use of these techniques leads to requirement of qualified professionals and certified labs. Diagnostic tests remain a crucial aspect in treatment decisions. Overall costs of treatment are reduced if timely and precise diagnosis of the ailment is provided. The Indian healthcare market was estimated at US\$ 35 billion in 2007 ^[1]. Almost a decade after it is estimated at a market size of 100 billion USD in 2015, making it one of the fastest growing industries in India is healthcare. India currently has the 2nd largest CAGR in healthcare (11%) among all Healthcare is one of the fastest growing industries and is expected to expand at a CAGR of 18.3% during 2012–20 to reach 280 billion USD.



Source: World Bank data

Figure 1.1: India's healthcare CAGR

The medical diagnostics sector is a frontrunner and is pegged at a CAGR of 20% and estimated to be around \$32 bn in 2018 from \$5bn in 2012.^[2]

As per an article authored by Manish Dashputre in BusinessWorld, published on May 9 2016, The Indian diagnostic industry comprises of over 1,00,000 laboratories. Out of these, 70 per cent labs cater to pathology services and around 30 per cent cater to radiology and imaging requirements.^[3]

The pathology market constitutes mainly of IVD (In vitro diagnostics) segmenting to - Biochemistry, Immunoassays, Hematology, Microbiology, Urinalysis, Coagulation, Molecular Diagnostics and Tissue Diagnostics. Biochemistry, Hematology and Immunoassays dominate the market with 65-70% share of the market.^[4]

Segments	% share	Size of Market (Rs Cr)	Reagents (% share to segment)	Equipment's (% share to segment)
IVD	100%	4500 - 5000		
Biochemistry	23% - 25%	1060	75%	25%
Immunoassays	22%	1000	90%	10%
Hematology	18-20%	800 - 900	62%	38%
Microbiology	5% - 6%	240 - 276	80%	20%
Urinalysis	3%	114.65	83%	17%
Coagulation	2%	102	70%	30%
Molecular Diagnostics	2%	90-100	99%	1%
Tissue diagnostics				
Others				

Figure 1.2: India's IVD market share^[5]

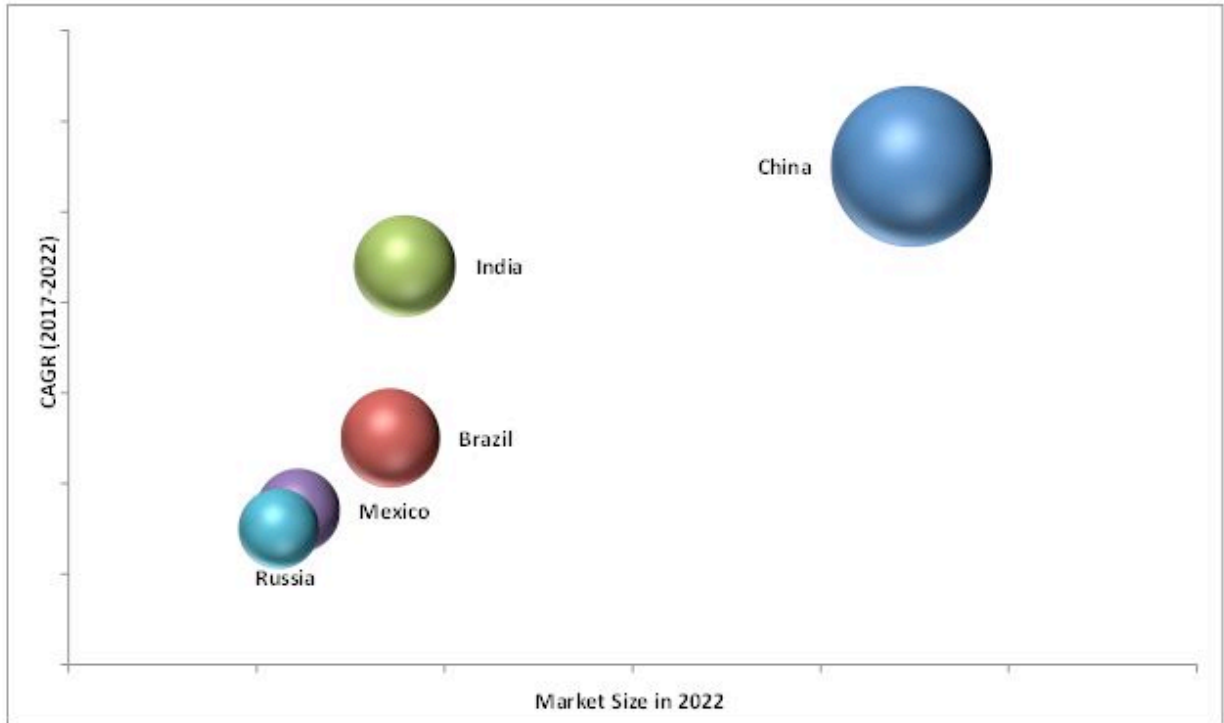


Figure 1.3: In Vitro diagnostics market in BRIC and other emerging countries by country, 2022 (USD Billion) ^[6]

1.1 Surging Foreign Direct Investment

The Industry is growing at a strong 20% CGAR and has received \$4.3bn in FDI over the past 7 years. New entrants into the market include both domestic and international businesses that are eyeing opportunities this exponentially growing domain. With the introduction of FDA in Diagnostic and Healthcare industry, a lot of investment is being pumped in these regions and companies are eyeing these yet untapped regions as potential markets for growth. Global partnerships have become substantial to India’s growth plans. In 2015, India reached a record \$59 bn yielding a 70 rise. This renewed international focus can be investment, product innovation, local partnerships and medical tourism. Foreign Investment in healthcare continued to rise. A 51% increase to 17.5 billion USD was observed from June 2012 to June 2015. Investments In healthcare and life sciences sector witnessed a 54% jump to \$ 155mn between Q4 2014 and Q4 2015. ^[7]

Medical Tourism is booming due to low medical costs in the country - e.g. A surgery in India costs one-tenth of those in most developed countries. Industry continues to grow with a CAGR of 30% (increasing from \$2.8 bn in 2015 to \$ 38.4 bn USD by 2025)

In 2013, India had close to 2,30,000 medical tourists, mostly from emerging economies.

The Indian government is also promoting venture funding and passing favorable government policies to support it. For example, the Make in India initiative allows 49% FDI in the insurance and pension pharmaceuticals. India rose by two places in A.T. Kearney's FDI top 10 places for FDI investment. Some of the market players are innovating with their methods and enabling a larger reach and bigger access to Healthcare & Diagnostic services. SRL labs for example has invested Rs.450 Cr and tied up with 3 states in India to provide diagnostic and pathological services. Under a PPP (Public Private Partnership) model, the brand has set up 23 labs in 10 districts in the state of Himachal Pradesh with a vision to enable robust healthcare services across the state. Recently KIMS Hospital received \$200mn in investment from True North (private equity). The fund infusion will help the chain grow and diversify it's offerings across the country.^[8]

“We believe that private equity has a key role in funding Indian healthcare services to address the sector's supply-demand gap. True North has played an active part by investing in the sector and it continues to be a key focus area for us. We have had the opportunity to evaluate numerous organizations in this space and have made nine investments across our different funds,” said Satish Chander, managing director of True North.

Certainly this domain is of growing importance to big businesses and influences the population in numerous ways.

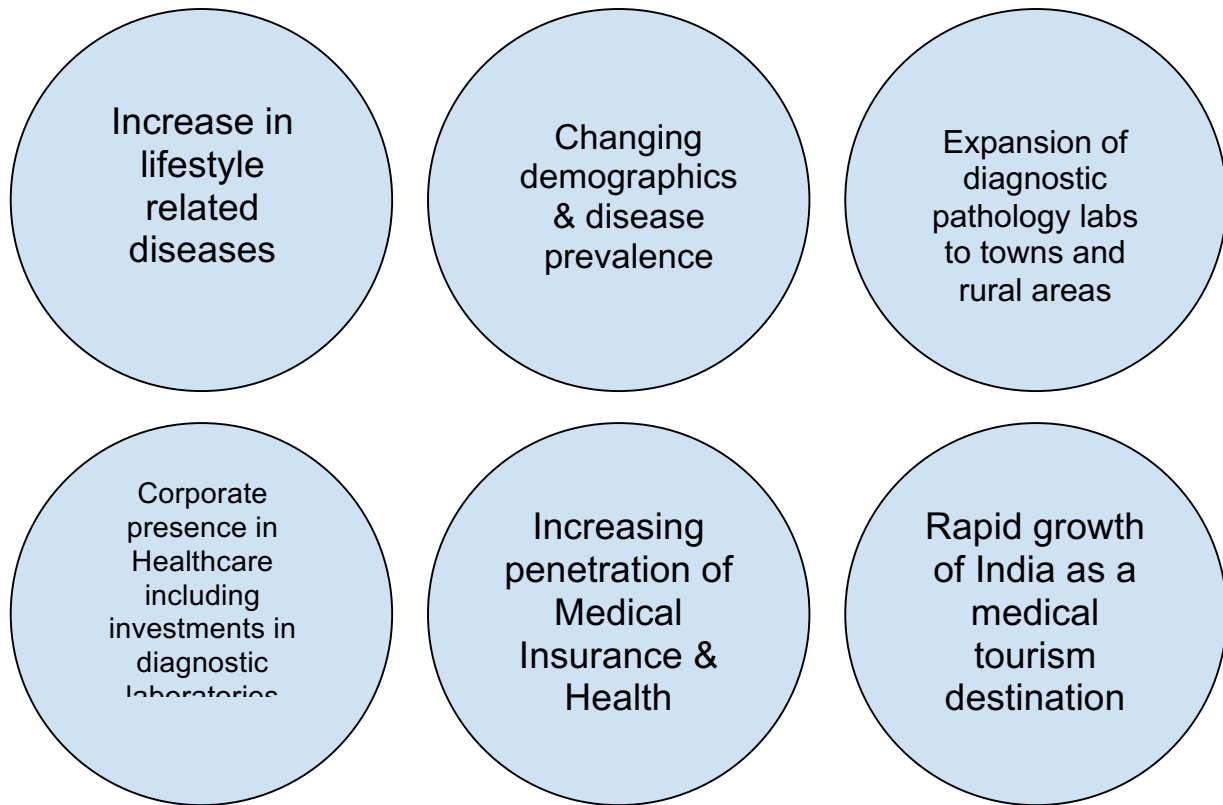


Figure 1.4: Growth drivers for medical healthcare services industry

1.2 Digital in Healthcare - The way forward:

Growing penetration and innovations in communication & technology has led to tremendous growth in the last decade. In this fast paced growth where virtual and physical atmospheres are leveraging a close to 45% of engagement and exchange through World Wide Web, the role of digital technology to improve business operations, scales and growth is obvious.^[9] Digital technology has changed methods for delivery models by harnessing data to drive decisions and automating many processes in the flow. India's digital connectivity is expected to grow from 15% in 2014 to 80% access in 2034, with rural Internet users increasing by 58% annually.^[10] This trend can drive the adoption of telemedicine and other digital technologies, thereby increasing access to healthcare. With this growing digitally literate population, India has set the stage for the next wave of digital disruption and investments in healthcare in the world.^[11]

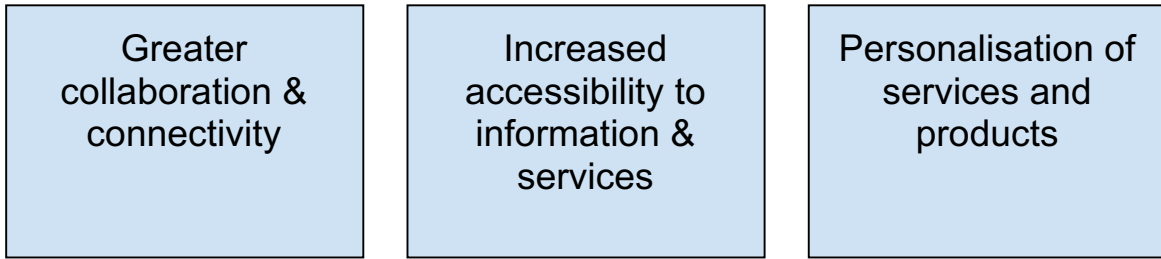


Figure 1.5: Drivers of digital adoption

Many market leaders in the healthcare industry are laying their foundation with help of technology & innovation to offer all in one solutions in form of their services. Medicines, Ambulance, Diagnostics and Home care services etc are a phone tap away. It is not only enabling these companies to reach a wider market but also resulting into cost cutting of services availed by one single platform. Unification of healthcare sector, will enhance customer experience and benefit by integration of services saving money, time and effort. Platforms based in E-Healthcare have reduced customer pain points by offering, user friendly, cost friendly and transparent services/delivery to the users.

“The healthcare segment is relatively untapped e-commerce segment and has tremendous potential in terms of revenue growth and overcoming the challenges of this industry. A number of players have come up in the market and offer e-commerce solutions on access, affordability, cost comparison, information database and much more to this sector.” [12]

1.3 Current Scenario in Healthcare services industry

The development of any industry is judged according to it's trends. Fashion or series of improvements in a directed space helps understand the future prospects and opportunities of the industry. A report by PwC - Indian healthcare on the cusp of a digital transformation, explains about the upcoming trends that will drive the industry growth. It is important to understand the importance of these technologies in-order to keep in pace with the growing times in a globally competitive environment.

Few ongoing trends in the industry are:^[13]

1.2.1 **Value added services & packaged tests**

Due to increasing competition and introduction of new innovative practices, the offerings at diagnostic labs has widened. A large number of labs have started to offer bundled tests bringing down costs for the patient and enabling a wider portfolio activation on their end. Value added services such as e-reporting, online patient databases and free consultation of test results have also been introduced.

1.2.2 **Telemedicine**

Telemedicine refers to the remote diagnosis and treatment of patients by means of telecommunications technology. Such technologies have enabled a wider reach across the country bringing quality healthcare services at the doorstep of even the remotest and inaccessible villages across India.

1.2.3 **Public Private Partnerships**

As discussed earlier, brands like SRL have partnered with Governments to streamline and bring quality tests at affordable rates to patients through strategic tie ups and partnerships. These tie ups not only ensure advancement, induction of latest technology and innovation in the infrastructure but also fill a very significant gap between civil society, governments and private industry.

1.2.4 **Tie-ups - Between hospitals and diagnostic chains**

A lot of hospital chains have started to tie-up with established diagnostic chains to provide quality tests results to their patients. These hospitals have ditched the traditional in-house diagnostic facilities and instead leveraged the new technologies. Hospitals benefit by obtaining credible diagnostic results without having to bear costs for infrastructure, regulatory approvals and maintenance.

1.2.5 **Wearables**

These are technologies that consumers can wear, such as watches, that can collect/interpret data about the consumer. These have progressed people's health, such as heart rate and BP, and have even helped them manage their health better.

Forrester predicts by 2020, wearables will be central to business, healthcare and personal systems.^[14]

1.2.6 **Cloud Data**

Increasing penetration of internet is enabling remote storage and access for digital files through several cloud platforms. It is being leveraged by numerous industries to add accessibility on its platform and services. Cloud services these days are being used to store data and replace isolated manual register systems. The stored data is also put through intelligence and analysis software systems using different analytical methods and algorithms to derive insights from the data. This data is being collected and analysed to improve business processes, predict market shifts and create personalised customer experiences.

For example, In 2011, Singapore rolled out a National Electronic Health Record (NEHR) system, which allows patient healthcare records to be shared across the entire healthcare system.^[15]

CHAPTER 2

BACKDROP OF THE PROBLEM

Residents of Tier-1 cities like Delhi, Mumbai, Chennai and Bangalore have been enjoying these benefits since a long time now. Premium services and tests in these cities are a phone tap away. However, regions like Himachal Pradesh and Uttarakhand where connectivity and logistical challenges are a big hurdle due to the terrain, making these services accessible is a big task in itself. Population of these demographic regions are largely dependent on labs based in Government Hospitals and Clinics run by private practitioners- keeping them away from world class services. There is a huge gap that needs to be addressed and catered to in these regions. The private healthcare service providers constitute a major 72% of the total healthcare expense in India. The unorganized sector is growing at a rapid pace but has problems of it's own:

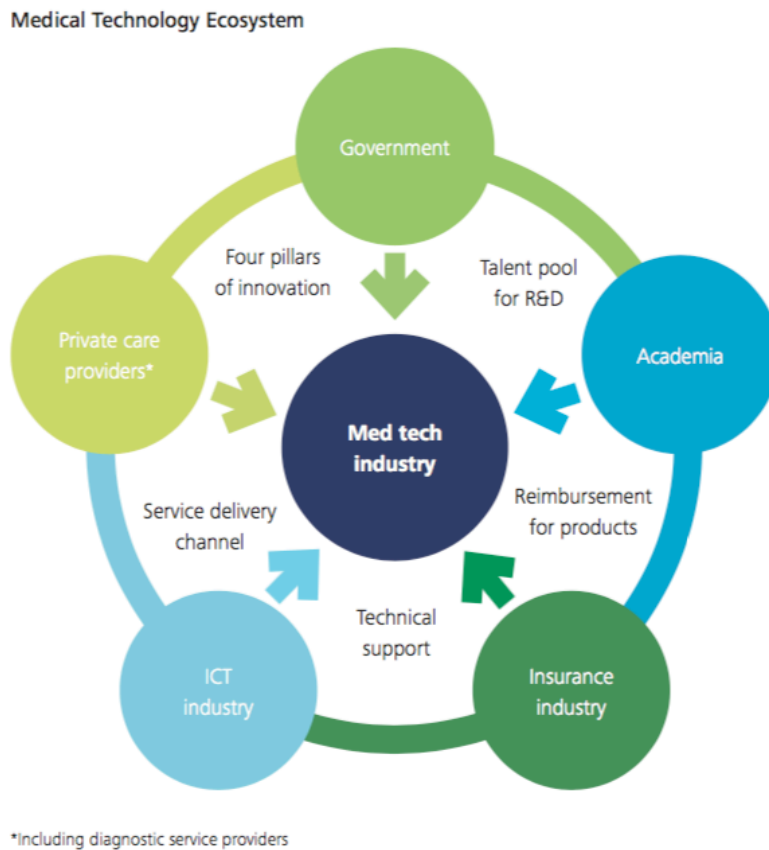


Figure 2.1: Stakeholders of the Healthcare services industry

2.1 Lack of Accreditation:

“A lot of centers have mushroomed like Mom and Pop stores. Absence of regulation and vigilance in diagnostic industry is leading to low standards and quality of tests. Most of these centers are not even run by certified physicians.” said Dr. RK Gandhi, Founder of Apex Diagnostics, Solan. According to estimates provided by PwC in their recent report, there are approximately 30,000 laboratories that service to 1.25 million patients per day. This includes specialized laboratories, laboratory facilities in hospitals and nursing homes, and small testing centers with basic facilities. The facilities and services offered at these labs vary widely. The National Accreditation Board of Laboratories (NABL) benchmarks these laboratories. Yet the number of accredited laboratories remains minimal. According to details on the NABL website, 783 medical laboratories have been accredited as of 31 January making less than 1% of Indian diagnostic labs accredited, leaving the sector unorganized and highly fragmented. Absence of regulations and a control authority is leading to unethical practices and losing credibility of the results.

No established regulations ensuring standards in terms of infrastructure, technology, qualification of personnel and quality of test results for setting up and running any diagnostic lab is present. As a result, the sector is crowded by small labs to bridge demand and supply constituting almost a 85-90% of the diagnostic industry. Presence of a benchmarking mechanism is needed to add credibility of the diagnostic lab results. Often doctors have been found to order retests for their patients adding to time, money and trauma borne by the already distressed patient. Rejections of diagnostic test reports by Physicians due to absence of trust on the results (Lack of protocols followed, Equipment calibration systems and maintenance) often lead to bloating of treatment costs. This is big gap highlighting the credibility of tests issues by the lab and requirement of a system to benchmark and ensure authenticity of these diagnostic tests. Developed towns of Himachal Pradesh like Shimla, Solan and Mandi witness an absence of accredited labs. Of the 100,000 labs in the country, only 700 are accredited to NABL (0.7%) The entire state of **Himachal Pradesh** has only 4 accredited labs.

Quality: Inconsistent quality standards

Less than 1% of India's hospitals are accredited.²⁸



Source: PwC analysis

Figure 2.2: Absence of consistent quality standards

2.1.1 Rules & Regulations:

Clinical Establishment Act 2010 has been enacted by Supreme Court of India to ensure minimum standards and quality in laboratories. However, enforcement is a state subject. As on April 2017, only 10 states—Uttar Pradesh, Uttarakhand, Rajasthan, Bihar, Jharkhand, Sikkim, Mizoram, Arunachal Pradesh, Himachal Pradesh, and Assam—had implemented it, leaving a large number of laboratories unregulated.^[16]

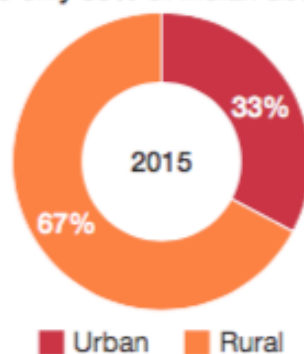
2.2 Gaps in Healthcare services

Problems of skilled manpower and technicians are prevalent in areas inhabited by majority of the population of the country. Access to specialist care in rural India, skewed doctor to patient ratios, long waiting times and little time available for doctors consultation are basic problems owing to the infrastructural issues. India has less than $\frac{1}{3}$ per capita compared to China. Almost one hundredth compared to that of USA. India lies much below WHO's standards.

Number of beds, nurses, and doctors per 1,000 people in India, is the lowest in the world ^[17]

- 0.8 beds / 1000 people
- 0.6 doctors/ 1000 people

Even though the majority of India's population lives in rural areas, they have only 33% of Indian doctors.



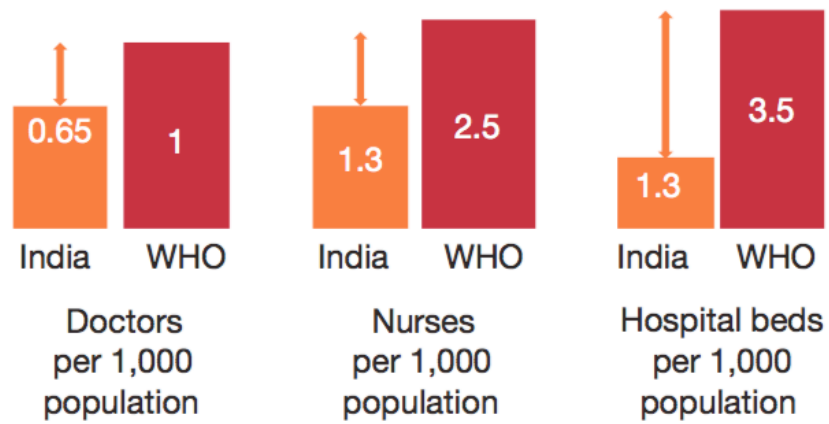
Source: PwC analysis

Figure 2.3: Percentage of doctors in rural & urban India

To top this, of the 100,000 labs in the country, only 700 are accredited to NABL (0.7%)

The entire state of **Himachal Pradesh** has only 4 accredited labs. A poor diagnostics industry will mean higher number of patients due to improper diagnosis. Doctors will tend to spend more time analysing the gaps and shortcomings of the reports. A stronger diagnostics industry therefore will ensure the infrastructural gap in hospitals will be minimised and not burdened.

India does not meet minimum WHO recommendations for healthcare workforce and infrastructure



Source: PwC analysis

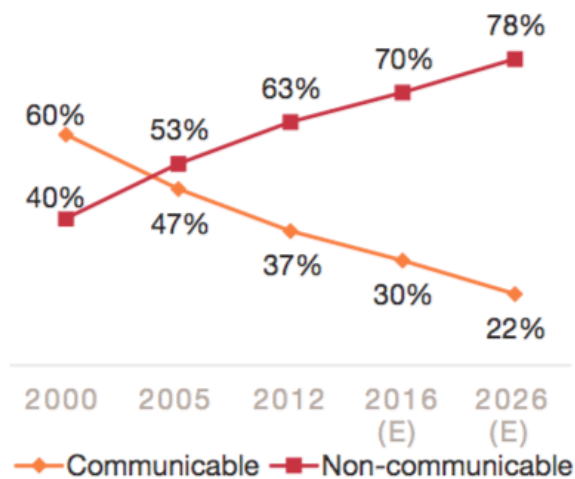
Figure 2.4: Healthcare workforce & infrastructure India vs WHO standards

2.3 Lifestyle & Preventive Healthcare

“It is estimated that roughly 40% of the adult population already has a chronic condition (asthma, diabetes, hypertension, osteoarthritis) or at significant risk of developing the condition due to family history, eating and sedentary habits, pollution and air quality.” said Anil Kumar, Founder & CEO, SmartRx in his article Healthcare Transformation in India Through Technology published in 2017. [18]

Due to increase in lifestyle changes, non communicable diseases have emerged as a major public health problem in the country. High stress levels, Aging population and sedentary lifestyle has contributed to the problem. India is being referred to as the diabetes capital of the world. Cancer, Heath diseases have witnessed a steep surge in prevalence. Demand for spinal implants, joint replacements and medical accessories is driving demand for diagnostics as well as treatment equipments.

Non-communicable diseases account for a greater share of the disease burden in India, with an expected cost of 23,000 crore INR within a decade.



Source: PwC analysis

Figure 2.5: Communicable & Non Communicable disease prevalence from 2000- 2026

Young population getting exposed to diseases like diabetes and hypertension at an early age signify the urgency to adopt Preventive Healthcare mechanisms at a broader level.

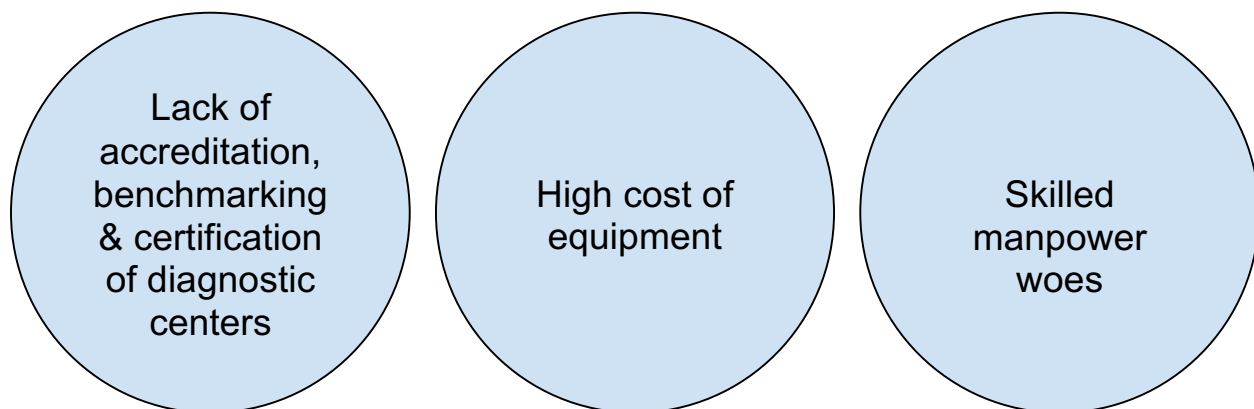


Figure 2.6: Challenges for healthcare diagnostics industry

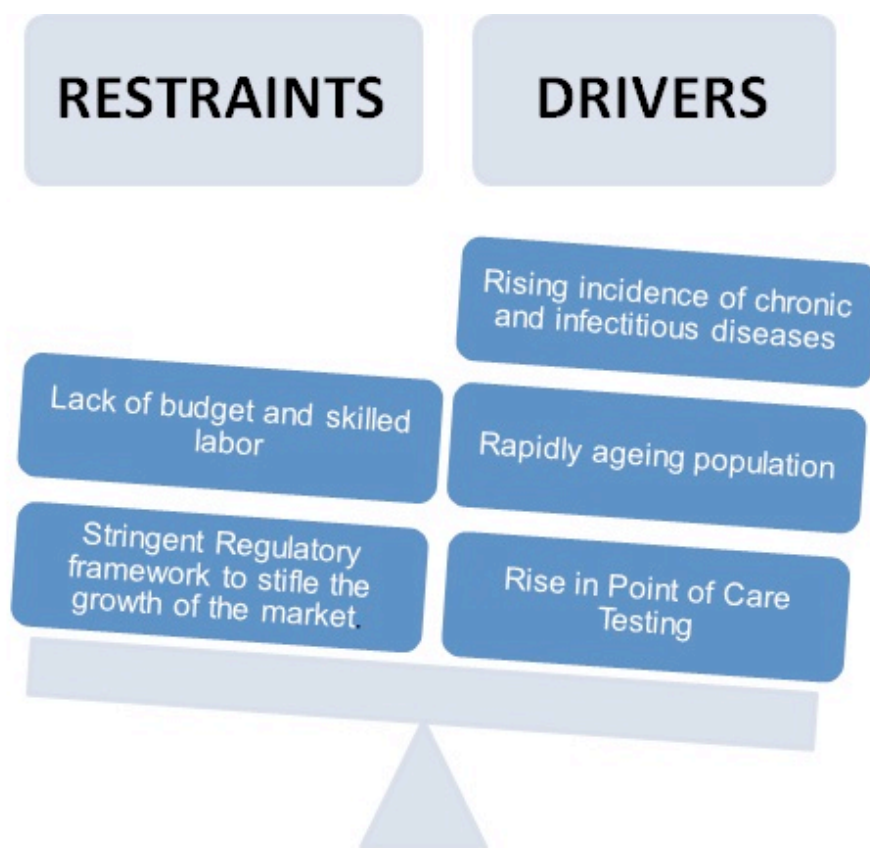


Figure 2.7: Restraints and Drivers for the healthcare diagnostics industry ^[19]

CHAPTER 3

RESEARCH OBJECTIVES & METHODOLOGY

3.1 Rationale:

To discern the gaps in extending healthcare/diagnostic services to the target group, explore consumer attitude towards preventive healthcare and offer insights to improve diagnostic services.

3.2 Objectives of the Study:

Based on the discussions in previous 2 sections, chalked out objectives are outlined below:

- 1) To determine available facilities and practices at diagnostic centers in Solan & Mandi region on the basis of:

A) Laboratory operational details:

- a) Accreditation status
- b) Type of facility
- c) Ownership
- d) Staff Size
- e) Patient Footfall

B) Laboratory facilities:

- a) Wellness Package Availability
- b) Insurance Assistance
- c) Equipment Availability
- d) Test Availability
- e) Cost & Turnaround Time of diagnostic tests

C) E-facilities:

- a) Website & Social Media

- b) E- Reporting & Appointment
- c) Cloud Database
- d) Payment Methods

- 2) Respondent profiling and attitude measurement of patients from Solan & Mandi cities towards Preventive Healthcare on the basis of gender, location, income, education etc. and study variation of behavioral practices of the respondent.

3.3 Methodology:

3.3.1 Data Collection & Sample Profile

Comparative study design between two major towns of Himachal Pradesh - Solan & Mandi was done. Primary drivers for choosing these cities are due to establishment of these cities as budding industrial hubs witnessing a lot of influx of population from parts of Himachal Pradesh. These areas boast a hilly terrain and cater to healthcare needs to a lot of nearby areas. These areas require to improve access, availability and affordability of medical diagnosis. ^[20]

A set of structured questionnaire was used for data collection. An onsite personally administered survey was conducted at all major laboratories in these cities. The sample surveys consisted of 84 responses from Solan and 80 responses from Mandi. A total of 164 respondents participated in the survey with 83 males and 81 females. Out of estimated 24 labs operating in both the cities, 14 were surveyed (58%).

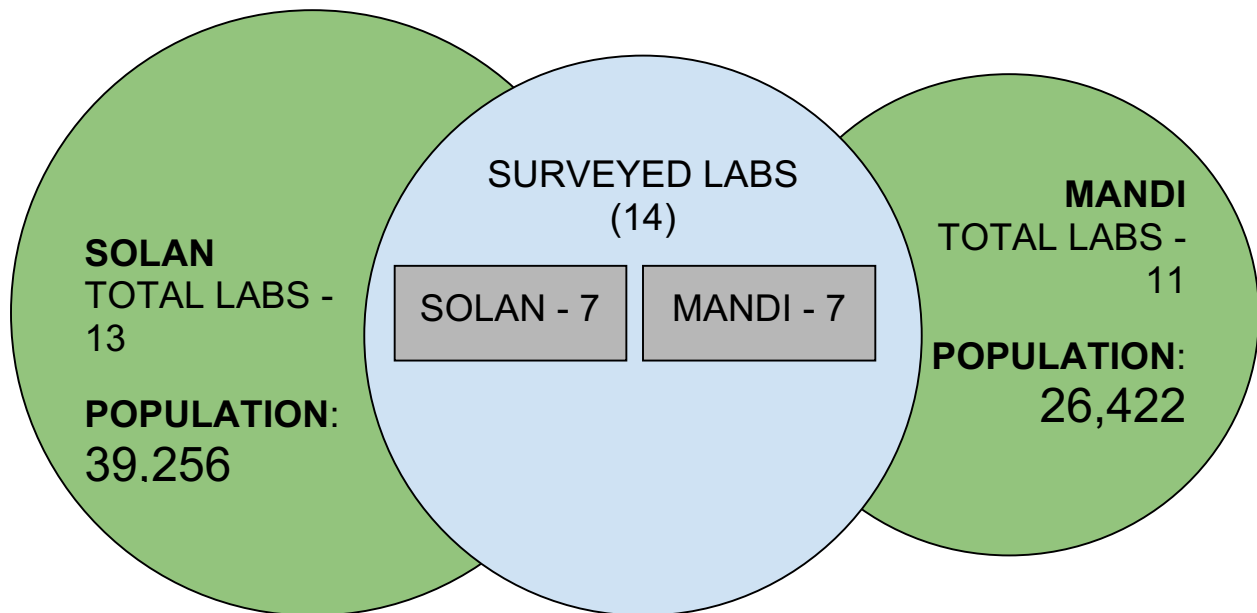


Figure 3.1: Diagnostic Laboratories Surveyed vs Actual

Sample Profile - PATIENT SURVEY (Main Study)

Survey Location	Solan	Mandi
Sample Size	84 (51.2%)	80 (48.8%)
Socio-demographic variables	Frequency (%)	Frequency (%)
Gender		
Male	40 (47.6%)	43 (53.8%)
Female	44 (52.4%)	37 (46.2%)
Age		
18 to 24 years	30 (35.7%)	24 (30%)
25 to 38 years	20 (23.8%)	16 (20%)
39 to 50 years	28 (33.3%)	23 (28.8%)
51 to 60 years	6 (7.1%)	12 (15%)
More than 60 years	-	5 (6.3%)
Monthly Income		
Not applicable	36 (42.9%)	14 (18.8%)
Less than 10,000	10 (11.9%)	33 (41.3%)
10,001 to 25,000	18 (21.4%)	14 (17.5%)
25,001 to 70,000	16 (19%)	14 (17.5%)
More than 70,000	4 (4.8%)	4 (5%)
Education		
Others	8 (9.5%)	22 (27.5%)
Matriculate	28 (33.3%)	22 (27.5%)
Graduate and above	48 (57.1%)	36 (45%)
Resident Status		
Local	52 (61.9%)	42 (52.5%)
Outstation	32 (38.1%)	38 (47.5%)
Internet Usage		
Active	62 (73.8%)	61 (76.3%)
Not Using	22 (26.2%)	19 (23.8%)

Email usage		
Active	32 (38.1%)	22 (27.5%)
Not Using	52 (61.9%)	58 (72.5%)
WhatsApp Usage		
Not Using	26 (31%)	18 (22.5%)
Daily	48 (57.1%)	47 (58.8%)
Weekly	10 (11.9%)	15 (18.8%)
Severity of Ailment		
Chronic	36 (42.9%)	43 (53.8%)
Non- Chronic	48 (57.1)	37 (46.3%)
Purpose of Visit		
Prognosis	24 (28.6%)	26 (32.5%)
Diagnosis	34 (40.5%)	24 (30%)
Follow-up	26 (31%)	30 (37.5%)
Annual Health checkup		
Regular	25 (29.8%)	34 (42.5%)
Irregular	59 (70.2%)	46 (57.5%)
Healthy Diet		
Regular	44 (52.4%)	25 (31.3%)
Irregular	40 (47.6%)	55 (68.8%)
Insurance		
Yes	16 (19%)	17 (21.3%)
No	68 (81%)	63 (78.8%)
Type of Test		
Package	8 (9.5%)	16 (20%)
Individual	58 (69%)	48 (60%)
Multiple Individual	18 (21.4%)	16 (20%)

Sample Profile - LAB SURVEY (Main Study)

Survey Location	Solan	Mandi
Sample Size	7 (50%)	7 (50%)
Demographic variables	Frequency (%)	Frequency (%)
NABL Accreditation status		
Available	-	1 (14.3%)
Not Available	7 (100%)	6 (85.7%)
Type		
Collection Center	2 (28.6%)	1 (14.3%)
Diagnostic Lab	5 (71.4%)	6 (85.7%)
Ownership		
Government	-	1 (14.3%)
Private	6 (85.7%)	4 (57.1%)
PPP	1 (14.3%)	2 (28.6%)
Patient Footfall		
Small (<100)	6 (85.7%)	6 (85.7%)
Medium (100- 400)	1 (14.3%)	1 (14.3%)
Large (>400)	-	-
Insurance Assistance		
Available	-	-
Not Available	7 (100%)	7 (100%)
Wellness Package		
Available	4 (57.1%)	3 (42.9%)
Not Available	3 (42.9%)	4 (57.1%)
Health camps		
Yes	2 (28.6%)	4 (57.1%)

No	5 (71.4%)	3 (42.9%)
Equipment availability		
Pathological Microscope	4 (57.1%)	5 (71.4%)
Analyser	6 (85.7%)	5 (71.4%)
Autoclave	5 (71.4%)	4 (57.1%)
Centrifuge	6 (85.7%)	5 (71.4%)
Website		
Available	3 (42.9%)	4 (57.1%)
Not Available	4 (57.1%)	3 (42.9%)
Social Media		
Facebook	2 (28.6%)	3 (42.9%)
JustDial	2 (28.6%)	2 (28.6%)
Cloud Storage		
Available	3 (42.9%)	3 (42.9%)
Not Available	4 (57.1%)	4 (57.1%)
Payment Modes		
Online	1 (14.3%)	1 (14.3%)
Cash	7 (100%)	7 (100%)
Debit/Credit Card	2 (28.6%)	5 (71.4%)
eWallets	4 (57.1%)	3 (42.9%)
Reporting		
By Hand- At Lab	7 (100%)	7 (100%)
Telephone/Phone call	6 (85.7%)	3 (42.9%)
SMS/WhatsApp	6 (85.7%)	2 (28.6%)
eMail	4 (57.1%)	2 (28.6%)

3.3.2 MEASURE

The measure of Preventive Healthcare was adopted from an earlier study "An Attitudinal Analysis of Preventive Health Care Information Users: With Insights from Social Media" ^[21] published in Atlantic Marketing Journal in 2015 and was carried out by Joseph D. Cangelosi and David Kim of University of Central Arkansas and Edward Raneli University of West Florida. It consists of 7 point Likert Scale with 1 standing for Total disagreement and 7 for Total Agreement. Cronback Alpha measured at 0.707 meeting the threshold limit of 0.6. As per Nunnally (1978) that advises reliabilities of 0.70 or better (but not much beyond than 0.80) for basic research. ^[22]

3.3.3 STATISTICAL ANALYSIS

Descriptive data was analysed on Mean and Frequency score. ANOVA, Chi Square and Binomial logistic regression was used for analyzing the following research questions:

RQ1.) What are laboratory operational details in the area of Solan & Mandi with respect to:

- a) Accreditation status
- b) Type of facility
- c) Ownership
- d) Staff Size
- e) Patient Footfall

RQ2.) What are laboratory facilities in the area of Solan & Mandi with respect to:

- a) Wellness Package Availability
- b) Insurance Assistance
- c) Equipment & Test Availability
- d) Cost & Turnaround Time of diagnostic tests

RQ3.) What are e-facilities available in Diagnostic laboratories in the area of Solan & Mandi with respect to:

- a) Website & Social Media
- b) E- Reporting, Consultation & Appointment
- c) Cloud Database
- d) Payment Methods

RQ4.) What is the patient attitude towards Preventive Healthcare (PHC)? What is the impact of demographics like age, gender, income and education on Preventive Healthcare?

RQ5.) Interrelationship between demographic factors and Healthcare behaviour (Healthy diet, Insurance subscription and Annual health checkup)

RQ6.) Does demographic variables and PHC attitude predict Healthcare behaviours like

- a) Healthy Diet intake
- b) Insurance Subscription
- c) Annual Health checkups

CHAPTER 4

DATA ANALYSIS & FINDINGS

4.1 Descriptive Data

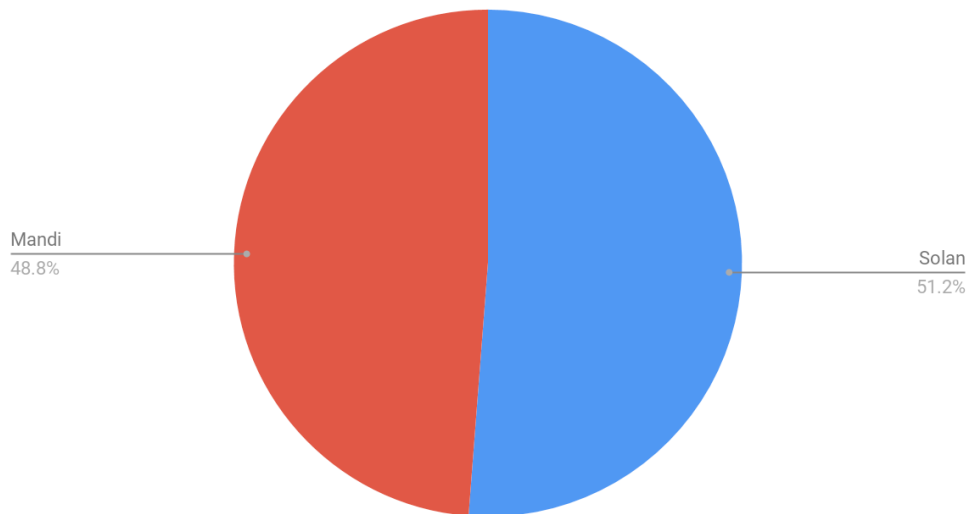
Data analysis for Patient and Lab survey questionnaires are as follows:

Patient Survey Form

Responses in the survey form were taken on-site from patients visiting the lab with some ailment/diagnosis.

1) Surveys in Solan & Mandi city

Survey forms in Solan & Mandi



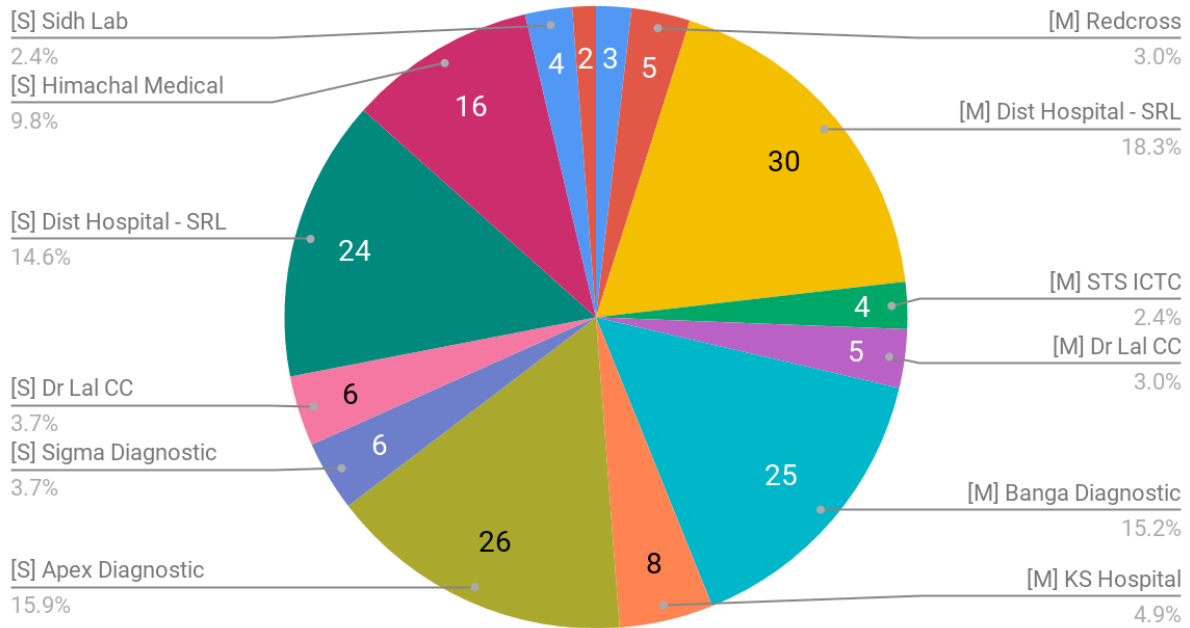
A total of 164 responses are captured from both Solan and Mandi city. 84 patients were surveyed in Solan while 80 in Mandi.

2) Surveys according to Consulting Labs

Large volume of patients visiting the government labs based in district hospitals shows the trust that population has on these facilities due to doctor credibility and subsidized prices of the diagnostic tests.

Lab	Frequency
[M] Mandav Hospital	3
[M] Redcross	5
[M] Dist Hospital - SRL	30
[M] STS ICTC	4
[M] Dr Lal CC	5
[M] Banga Diagnostic	25
[M] KS Hospital	8
[S] Apex Diagnostic	26
[S] Sigma Diagnostic	6
[S] Dr Lal CC	6
[S] Dist Hospital - SRL	24
[S] Himachal Medical	16
[S] Sidh Lab	4
[S] Durga Lab	2

Visitation frequency in surveyed labs

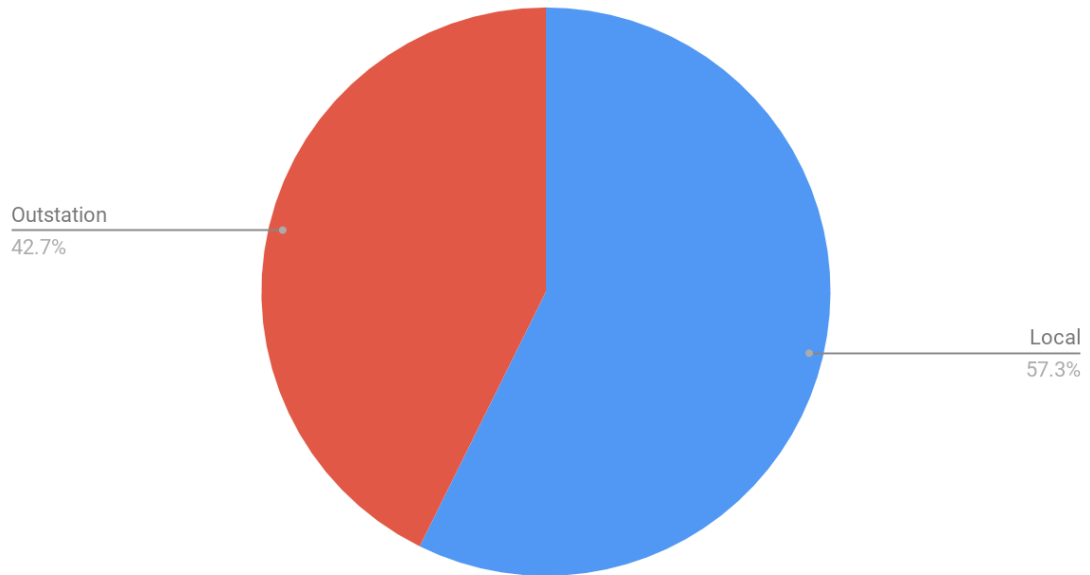


3) Resident Status

People travelling more than 20 kilometers from the diagnostic lab were labelled as “outstation” whereas the rest were labelled as “local”.

Residence	Frequency
Local	94
Outstation	70

Residence location of respondents

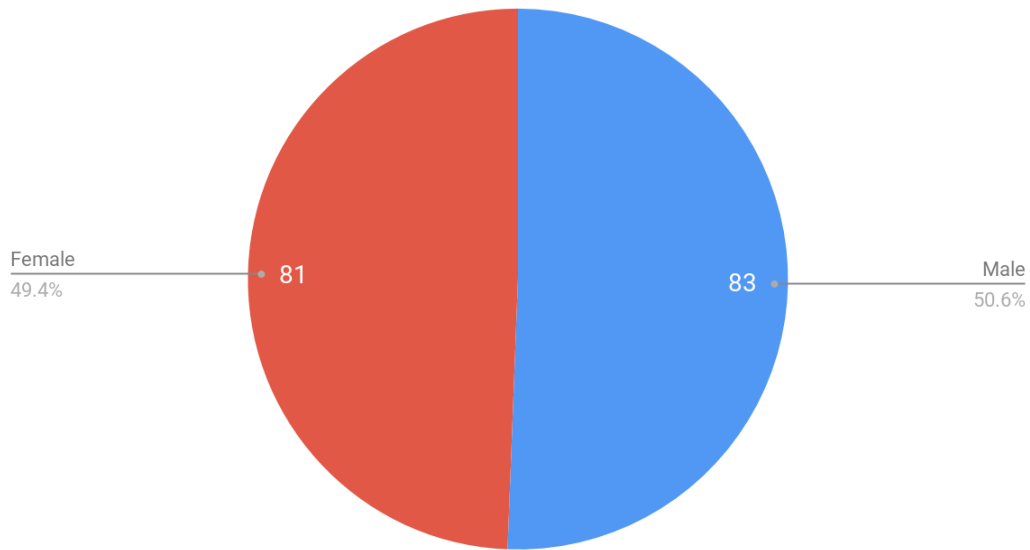


A significant number of population is travelling large distance to get their diagnostic tests done. A more uniform and consistent presence of diagnostic lab facilities needs to be present to provide universal access to these basic healthcare infrastructure services.

4) Gender

Gender	Frequency
Male	83
Female	81

Gender split



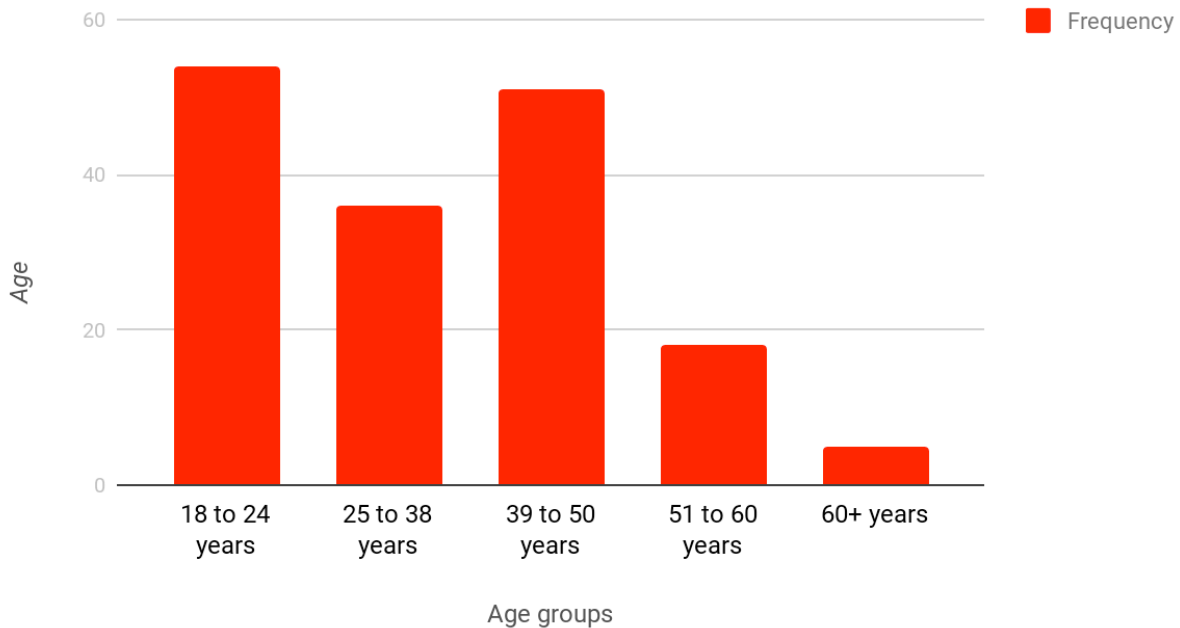
No gender skew was observed in the responses. It is healthy for the population since equal participation from both the genders is observed. Concern by females towards their health is remarkable. A healthier women will contribute to to build a healthier household.

5) Age

Age was categorized into 5 groups differentiated according to onset of diseases.

Age groups	Frequency
18 to 24 years	54
25 to 38 years	36
39 to 50 years	51
51 to 60 years	18
60+ years	5

Age group split



Highest footfall was by youngsters between 18 to 24 years of age and by people in 39-50 year old bracket. A concern towards health can be seen in both the age groups. A higher number of young population denotes the surge in demand for such facilities and services in the coming years as this population converts into the earning population. Low numbers of population with age more than 50 might be due to home collection.

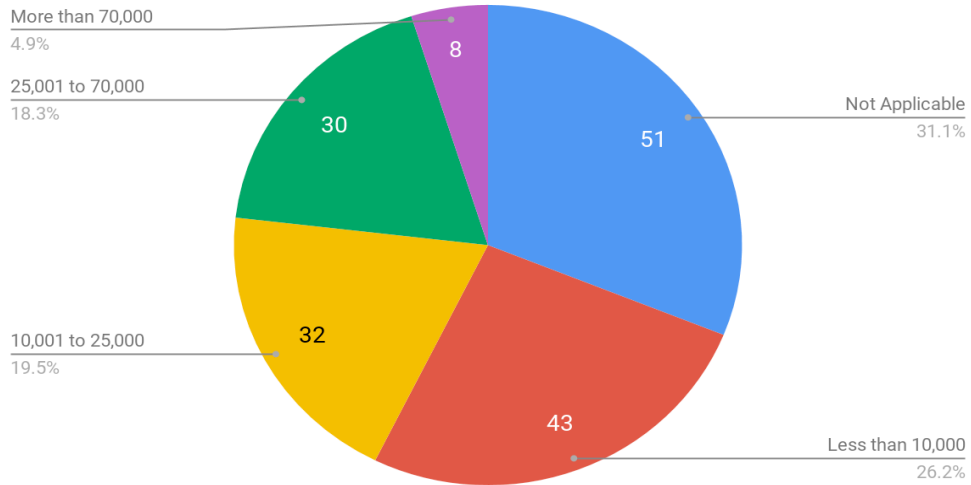
6) Monthly Income

Income of all the respondents was charted into 5 categories for easier identification of financial status.

Income category	Frequency
Not Applicable	51
Less than 10,000	43
10,001 to 25,000	32

25,001 to 70,000	30
More than 70,000	8

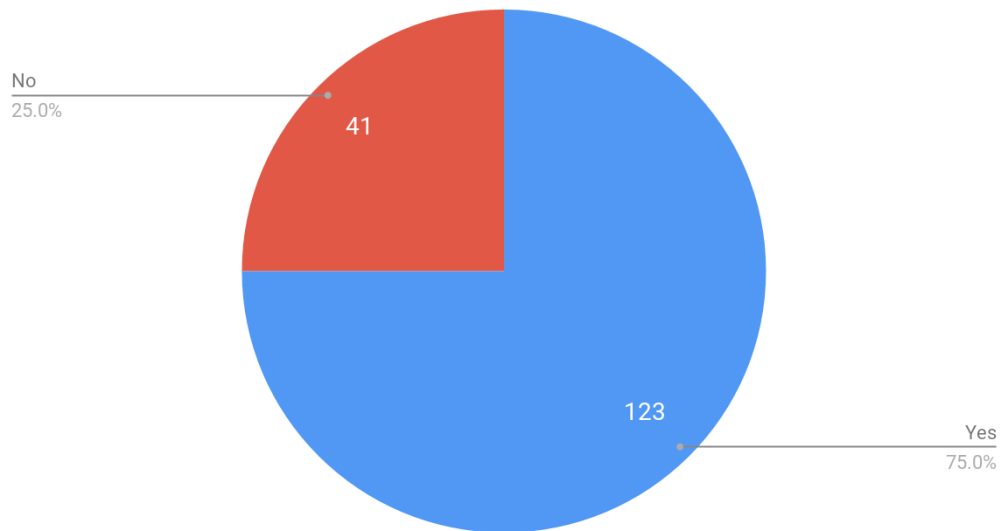
Income category split



7) Internet connection

Respondents were also mapped on their usage of Internet. Increasing penetration and importance of affordable internet especially after the launch of Reliance Jio shows another important aspect of awareness and knowledge in the population.

Internet Usage Split

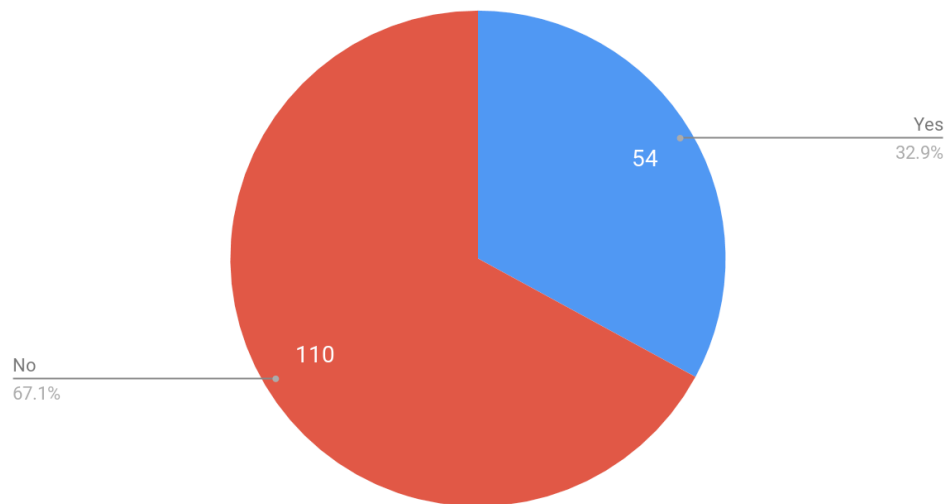


75% of the respondents responded positively signifying higher awareness and knowledge amongst the population. Services through e-platforms can be disseminated easily to lower the stress on labs and provide access to patients to facilities at the comfort of their homes. There is no need as such to educate the population on using internet, thereby eliminating the learning curve on patient's end.

8) E-Mail

Response	Frequency
Yes	54
No	110

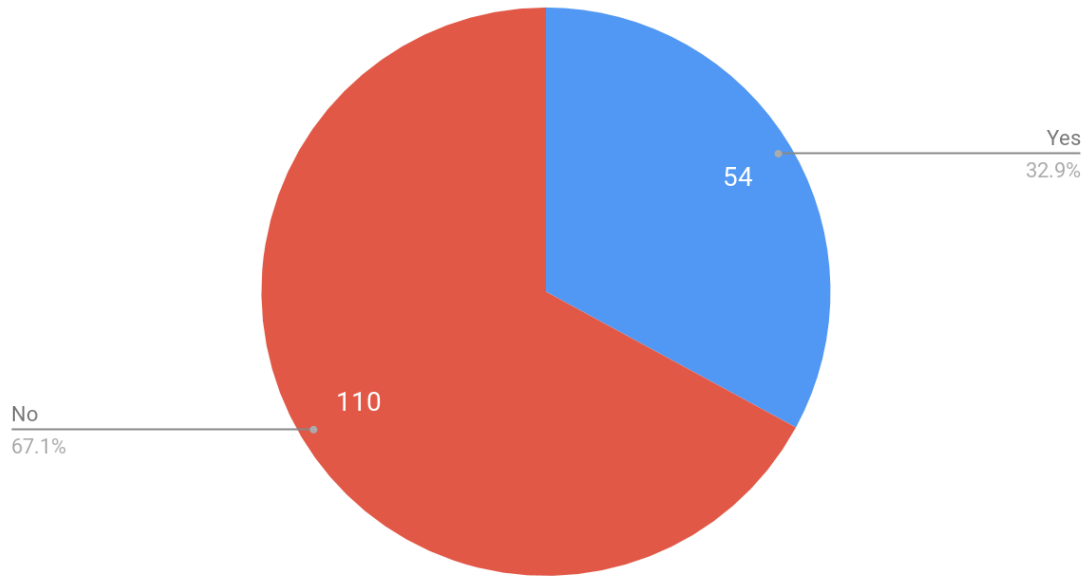
Email usage split



A very low number - about 33% of the population engaged in using email services actively. Despite the presence of a high Internet usage amongst the population, a small number using email services signifies reluctance or absence of need from the patient.

9) Annual Health Checkup

Annual Health Checkup

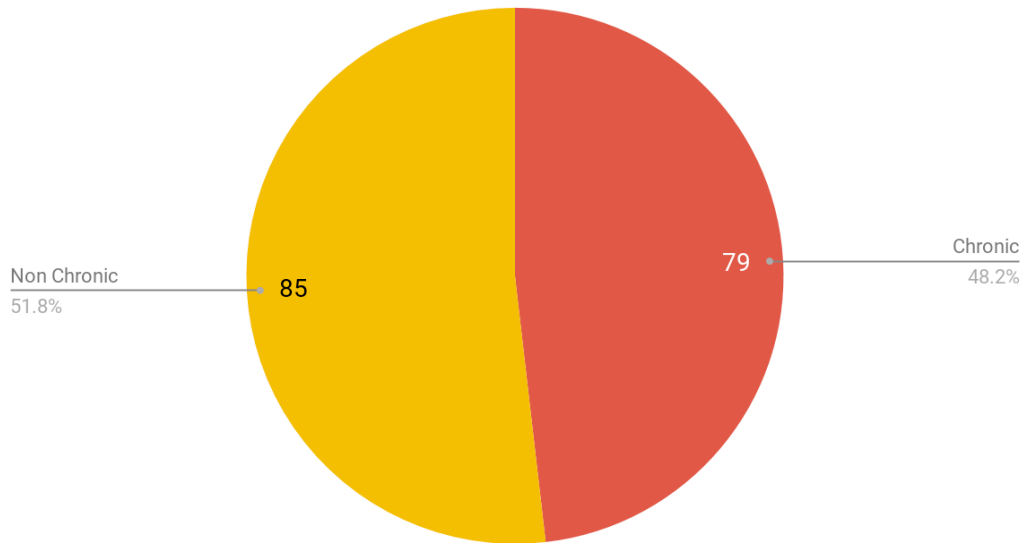


Almost 70% of the respondents did not undergo routine healthcare checkups. Root causes might be lack of awareness and reluctance to visit the doctor. Implications of this can be severe, due to rising cases of non communicable ailments as discussed previously in the report. There is a need to push Preventive healthcare by government and diagnostic labs.

10) Type of Disease

On the basis of severity of ailment the patient visited the lab, the responses were labelled under Chronic (for diseases lasting 3 months or more) and Non Chronic (for diseases lasting less than 3 months)

Severity of ailment

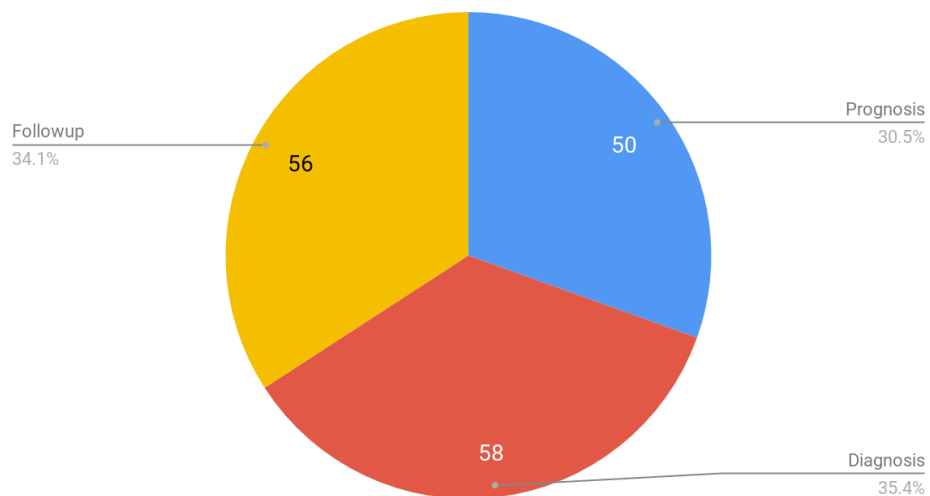


Almost equal percentages of patient visited the lab for tests. There is no change in attitude due to severity of ailment in the population.

It is a good and very positive characteristic that signals a healthy adoption potential for Preventive Healthcare by the population.

11) Purpose of Visit

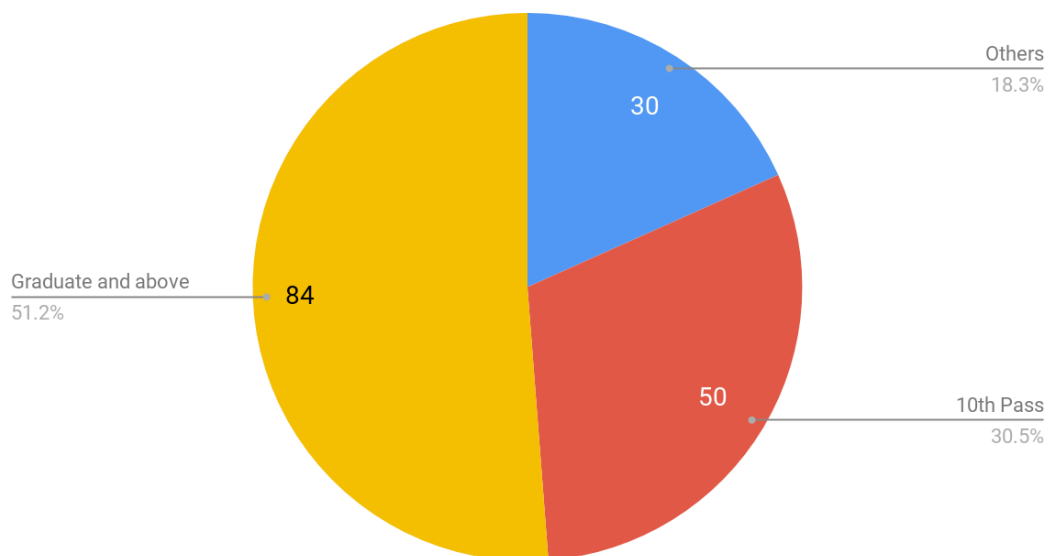
Purpose of Visit



An equal proportion of visits were made for Diagnosis, Prognosis and Follow-up by the patients. This denotes sincerity in patient response throughout the course of disease. No skewness or patient dropouts was observed along the treatment. This shows that the patients are concerned towards their health and take regular updates with the doctor before, during and after the onset of disease.

12) Education

Education Split

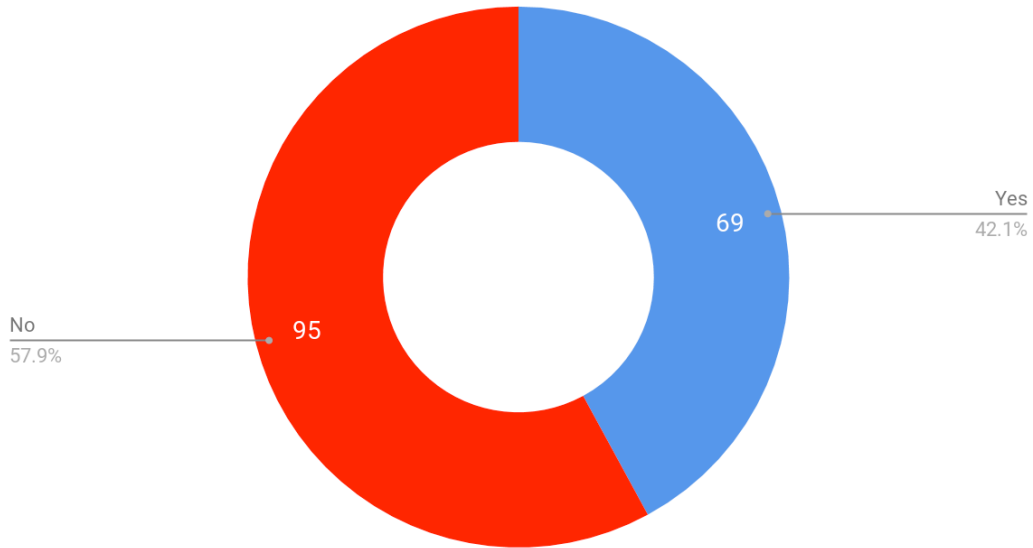


A big majority of the population had received some or the other level of formal education - about 81.7%. The state of Himachal Pradesh has a literacy rate of 76.6%. It creates a healthy environment to run awareness campaigns. The population will be more receptive towards these campaigns leading to a better lifestyle for them.

13) Healthy Diet

Observation was made upon the Preventive Healthcare scale responses that the population has a positive attitude towards Preventive Healthcare. In order to know whether this shows in the daily habits of the population, we introduced a parameter to know the dietary intake of healthy foods like Oats, nuts, juices and probiotic drinks.

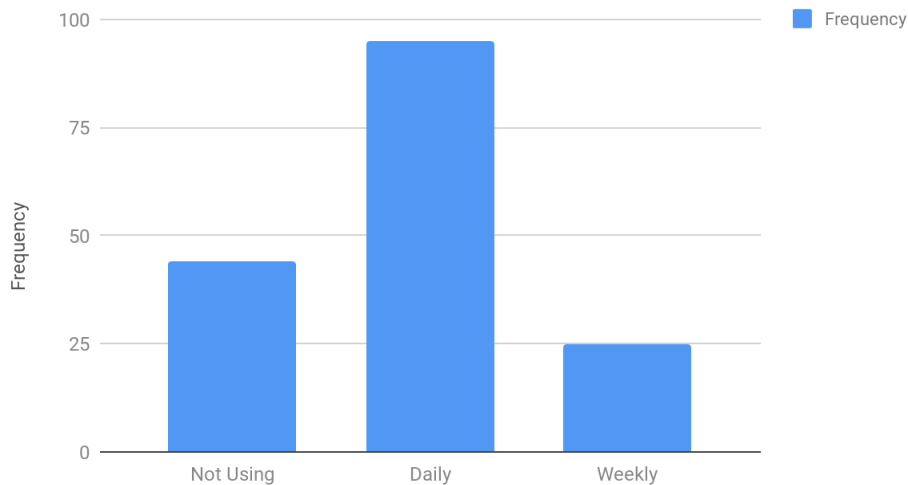
Healthy Diet Consumption



About 57% of the population isn't consuming a healthy diet on a regular basis despite having a positive attitude towards it. Reluctance to incur the expenditure or the effort could be the reasons. Sensitisation campaigns should be run to raise awareness amongst the population. A healthier diet will directly impact a healthier health and lifestyle of the population.

14) Whatsapp usage

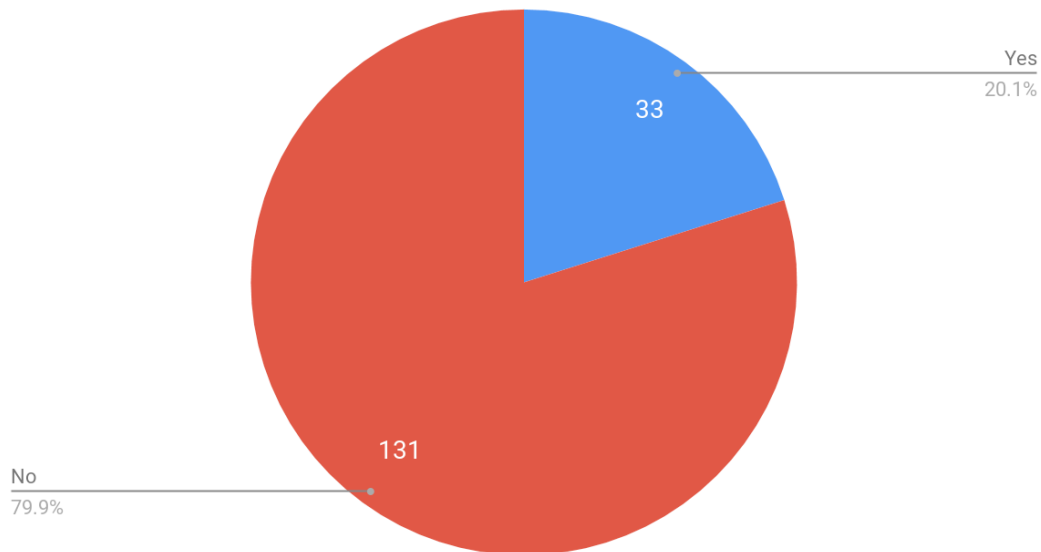
Frequency of WhatsApp usage



58% of respondents were found to be using WhatsApp on a daily basis. Presence of awareness for using e-modes of communication amongst population of all ages, genders and education can be seen. These observation speculate high adoption rates for e-facilities.

15) Insurance

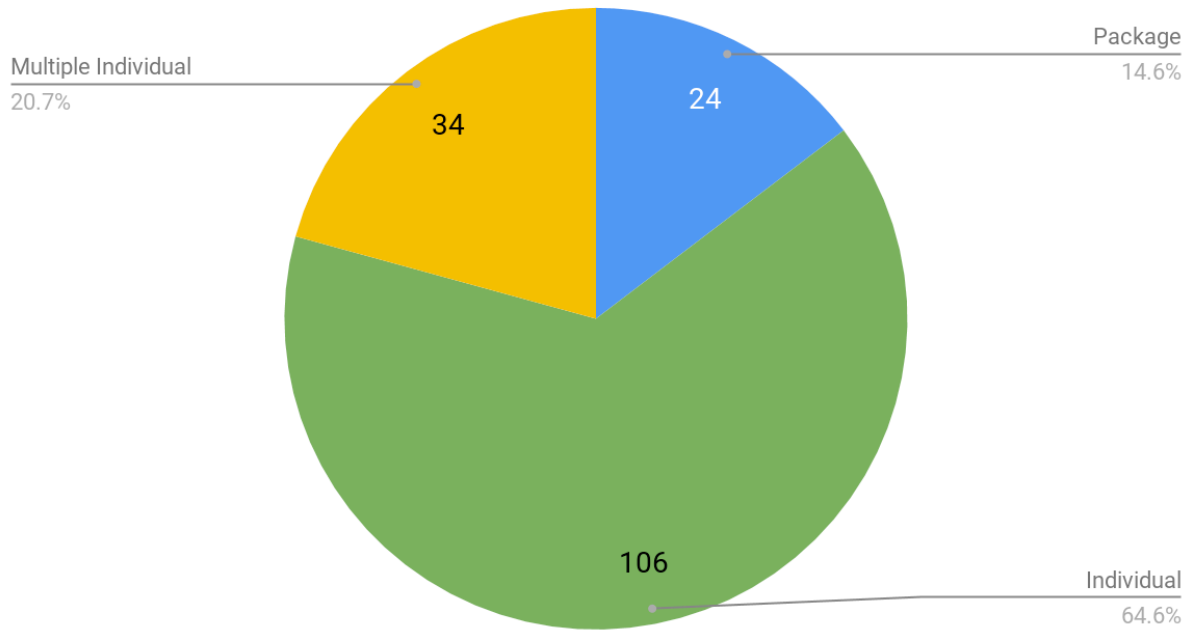
Insurance Policy



Less than 10% of the Indian population is covered under health insurance scheme. Observed rates are double of the National average but there needs to be a significant shift in the number of people being insured by Insurance schemes. Despite the easy availability and increased awareness about Insurance, about 80% of the respondents did not have an active insurance policy, putting them at a high risk of financial burden during any ailment or disease.

16) Type of tests

Type of test



64.6% of the respondents took a single/individual diagnostic test. About 21% took multiple individual tests whereas around 14% took packages offered by the diagnostic centers. A significantly low number of population subscribing to offerings by centers as a packaged deal denotes absence of attitude towards a precautionary healthcare. Most individuals took a single individual test - usually Haemogram or Blood sugar.

Following are the findings for Research question 1:

RQ1.) What are laboratory operational details in the area of Solan & Mandi with respect to:

- a) Accreditation status
- b) Type of facility
- c) Ownership
- d) Staff Size
- e) Patient Footfall

Operational details of research labs surveyed are as follows-

1) Accreditation Status

	Solan	Mandi
Accredited labs	0	1
Not Accredited labs	7	6

Only 1 out of 24 labs in city of Mandi and Solan are accredited. In a big industrial town with large population influx from neighbouring areas, there is a need for quality and standardised diagnostics. Absence of accreditation leads to non uniform results and improper diagnosis by the physicians. Often doctors have been found to order retests for their patients adding to time, money and trauma borne by the already distressed patient. Rejections of diagnostic test reports by Physicians due to absence of trust on the results (Lack of protocols followed, Equipment calibration systems and maintenance) often lead to bloating of treatment costs.

2) Type of facility:

	Solan	Mandi
Collection Centers	2	1
Diagnostic Labs	5	6

Out of 14 surveyed labs in the two cities, 11 were diagnostic labs were operating with full operations while 3 were collection centers were just sample collection facilities.

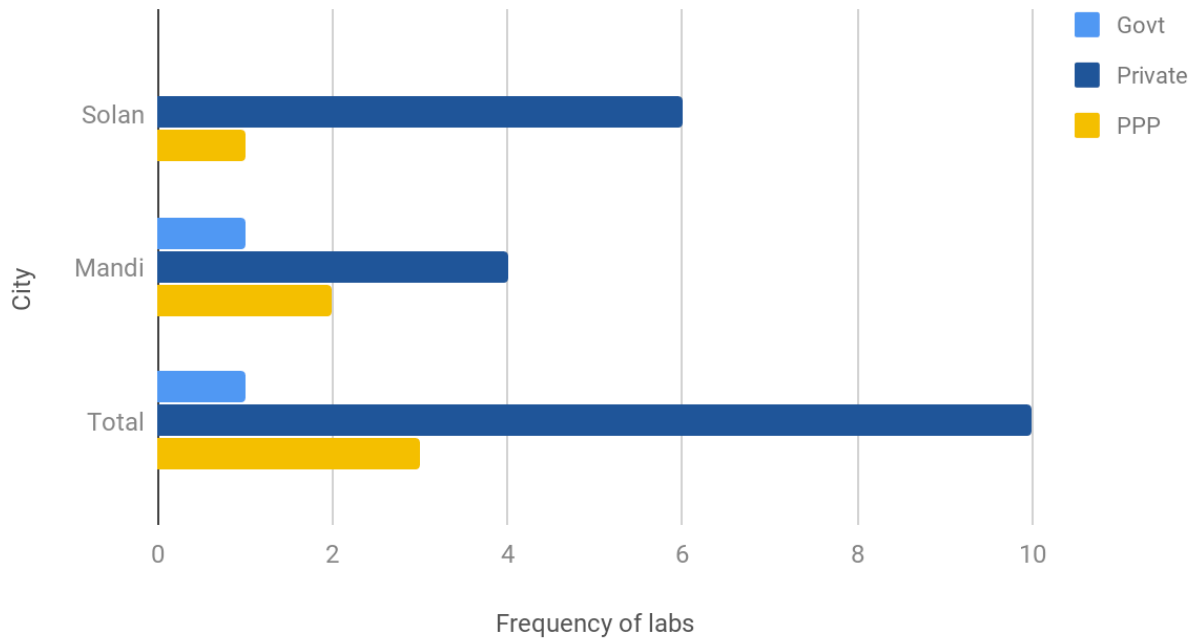
Less number of collection centers may lead to:

- 1) Under-utilisation of resources (equipments) at diagnostic centers.
- 2) Non uniform distribution of lab facilities available to patients. Some patients might have to travel larger distances to avail the same facilities.
- 3) Over burdening of some diagnostic centers due to skewed distribution of labs.

3) Ownership:

	Govt	Private	PPP
Solan	0	6	1
Mandi	1	4	2
Total	1	10	3

Govt, Private and PPP



About 71% of the labs present in both the cities are operated by private owners. There are 3 labs operating under Public Private Partnership model while just 1 is a government owned entity. The area is dominated by private players that have started to offer premium facilities but at a high cost, unaffordable to most patients. Government controlled diagnostic labs on the other hand have a fraction of available testing and are supplemented with poor management and faulty infrastructure.

High number of private labs under absence of an accreditation authority will lead towards a unorganized, unregulated market. It might lead to inconsistent result reports, dominance on cost and quality of tests as well. Since a large number of population in Himachal Pradesh still believes in Government appointed doctors, they visit government hospitals adding to burden on the infrastructure, long queues and increases patient distress.

4) Patient Footfall (daily):

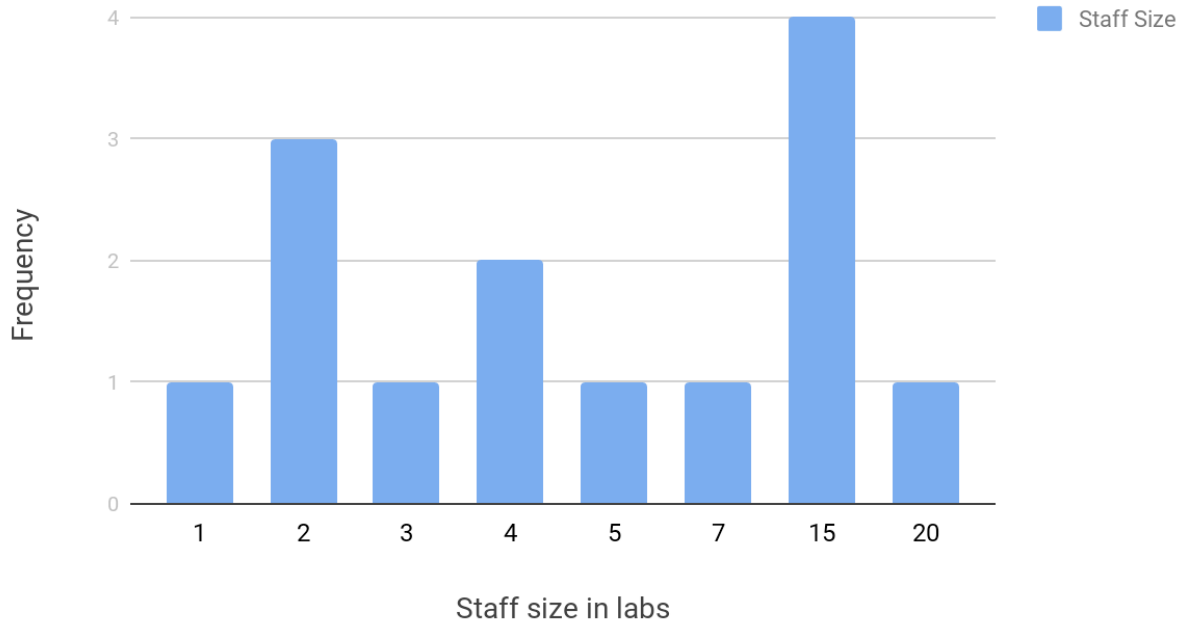
	Solan	Mandi	Total
Less than 100	6	6	12
100 - 400	1	1	2
More than 400	0	0	0

85% of labs had a patient footfall less than 100 (daily). There is lack of awareness leading to small numbers at the centers. Both the towns have a combined total population of around 70,000 - yet there are not many people visiting these labs. This speaks of another gap that needs to be addressed.

5) Staff Size

The staff size employed at the surveyed diagnostic chains (doctors, paramedics, housekeeping etc) was maximum at 20 at just a single lab. Staff size of 15 and 2 were most common with frequencies of 4 and 3.

Staff Size Frequency



A well staffed and equipped facility will ensure better results, care and management at the diagnostic lab. Both Solan and Mandi have fairly well staffed centers when compared to their requirements. However, skill levels might vary.

Following are the findings for Research question 2:

RQ2.) What are laboratory facilities in the area of Solan & Mandi with respect to:

- a) Wellness Package & Healthcare Camps Availability
- b) Insurance Assistance
- c) Equipment & Test Availability
- d) Cost & Turnaround Time of diagnostic tests

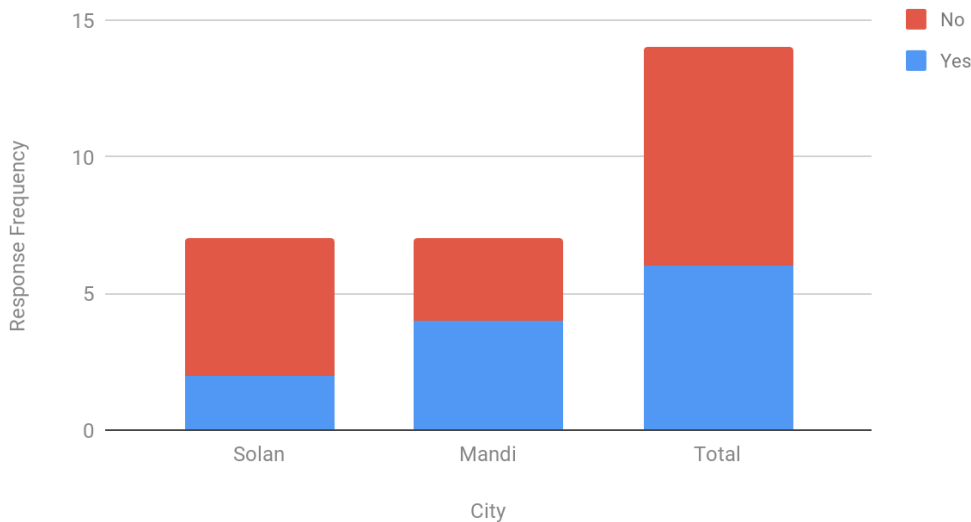
1) Wellness Packages

	Solan	Mandi
Wellness Package		
Available	4 (57.1%)	3 (42.9%)
Not Available	3 (42.9%)	4 (57.1%)

2) Health Camps

Response	Solan	Mandi	Total
Yes	2	4	6
No	5	3	8

Yes and No

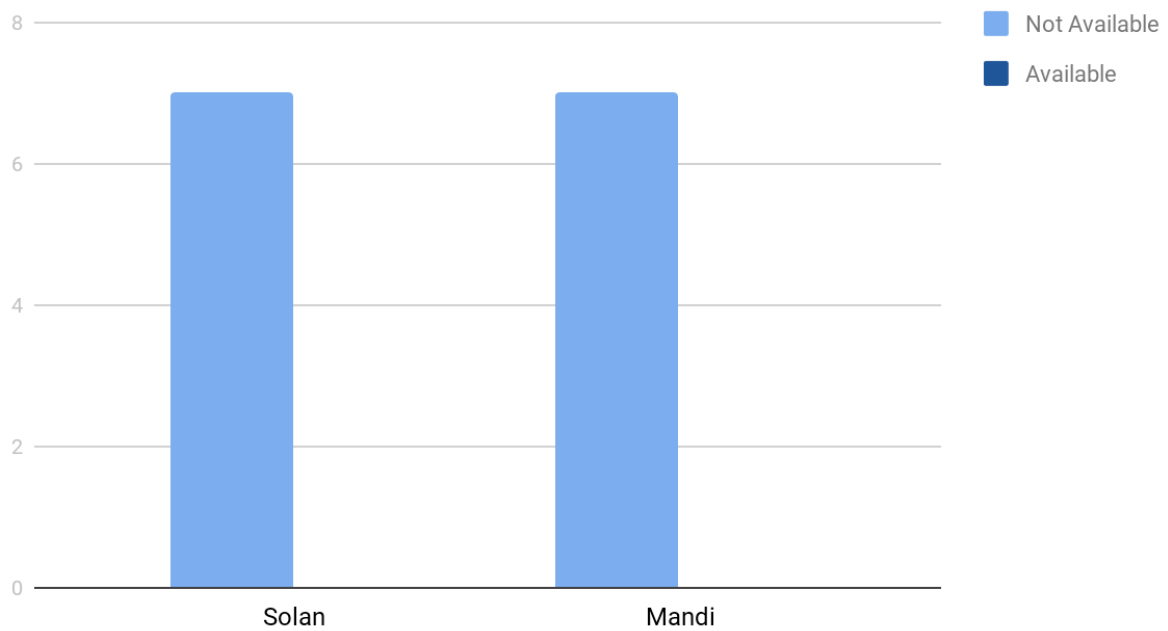


Only 42% of diagnostic lab facilities arrange for regular Healthcare camps. These camps are essential to create awareness, draw participation towards a healthier lifestyle by the population. These camps are initiatives undertaken by labs themselves. These camps also benefit the labs and generate more customers, brand awareness in the market. A lower organizational rate of these camps denotes the low involvement or lack of interest from the diagnostic labs, hampering growth for both population and the labs.

3) Insurance Assistance

	Solan	Mandi
Insurance Assistance		
Available	-	-
Not Available	7 (100%)	7 (100%)

Insurance Assistance



None of the 14 surveyed labs offered insurance assistance facility. In order to offer holistic services to the customer and leverage the growing importance of Insurance facilities, assistance needs to be provided on a laboratory level.

4) Equipment Frequency

Equipment	Solan	Mandi	Total	Surveyed	% of availability
Pathology Microscope	4	5	9	14	64
Analyser	6	5	11	14	79
Autoclave	5	4	9	14	64
Centrifuge	6	5	11	14	79

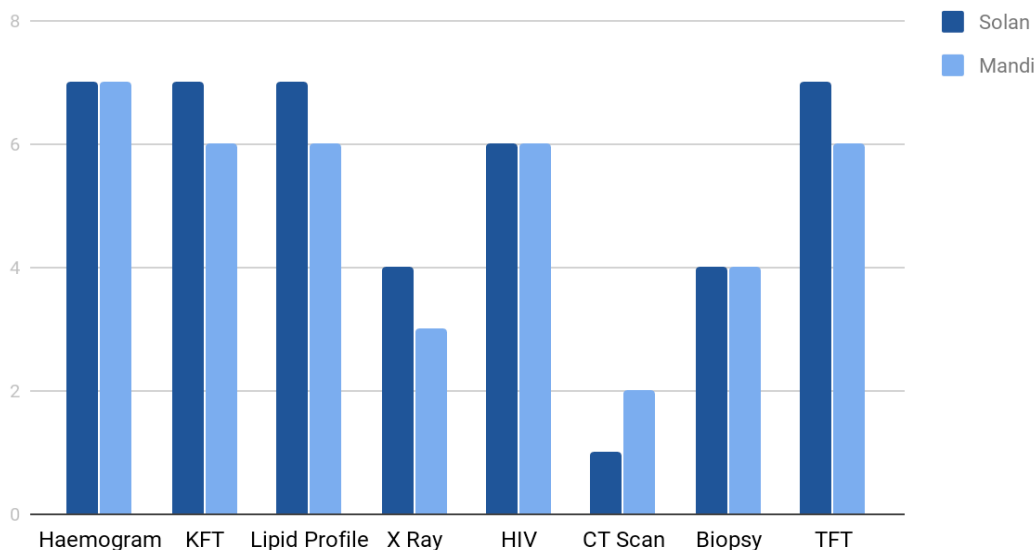
Only 64% of labs had a functional Pathology microscope and Autoclave present whereas a less than 80% of labs had a functional Analyser and Centrifuge. Most laboratories were found to be sharing equipments to save costs. However, improper maintenance and calibration of these equipments were found during the lab visits. Chances of cross contamination as huge risking the quality of samples and quality of reporting. Absence of these standard equipments in diagnostic labs shows the absence of basic infrastructure and facilities in labs.

5) Test Availability

TEST	AVAILABILITY	Solan	Mandi
Haemogram	Available	7	7
	Not Available	0	0
KFT	Available	7	6
	Not Available	0	1

Lipid Profile	Available	7	6
	Not Available	0	1
X Ray	Available	4	3
	Not Available	3	4
HIV	Available	6	6
	Not Available	1	1
CT Scan	Available	1	6
	Not Available	2	5
Biopsy	Available	4	3
	Not Available	4	3
TFT	Available	7	0
	Not Available	6	1

Test Availability - Solan and Mandi



6) Turnaround Time for Diagnostic Tests

Availability of major tests was a big concern and one of primary drivers behind the study. We benchmarked delivery time for 6 major tests - Haemogram, KFT, CT Scan , Chlorides Vitamin D and Thyroid. 5 out of 6 tests remained unavailable at minimum 1 of the labs (KFT and Thyroid) whereas CT Scan remained unavailable at 11 of the 14 surveyed labs.

Name of Test	N	Minimum (Hour)	Max (Hour)	Mean
Haemogram	14	0.20	24	5.6143
KFT	14	NA	24.00	5.9286
CT Scan	14	NA	2.00	0.4286
Chlorides Test	14	NA	24.00	6.8571
Vitamin D	14	NA	56.00	21.4286
Thyroid	14	NA	72.00	22.0714

1) Haemogram

Time	Frequency	Percent
20 minutes	3	21.4
1 hour	3	21.4
2 hours	1	7.1
4 hours	3	21.4
5 hours	1	7.1
8 hours	1	7.1
24 hours	2	14.3
Total	14	100.0

2) Kidney Function Test (KFT)

Time	Frequency	Percent
Not Available	1	7.1
1 hour	5	35.7
2 hours	1	7.1
4 hours	3	21.4
8 hours	2	14.3
24 hours	2	14.3

Total	14	100.0
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3) **CT Scan**

Time	Frequency	Percent
Not Available	11	78.6
2 hours	3	21.4
Total	14	100.0

4) **Chlorides Test**

Time	Frequency	Percent
Not Available	5	35.7
2 hours	2	14.3
4 hours	3	21.4
8 hours	1	7.1
24 hours	3	21.4
Total	14	100.0

5) Vitamin D Test

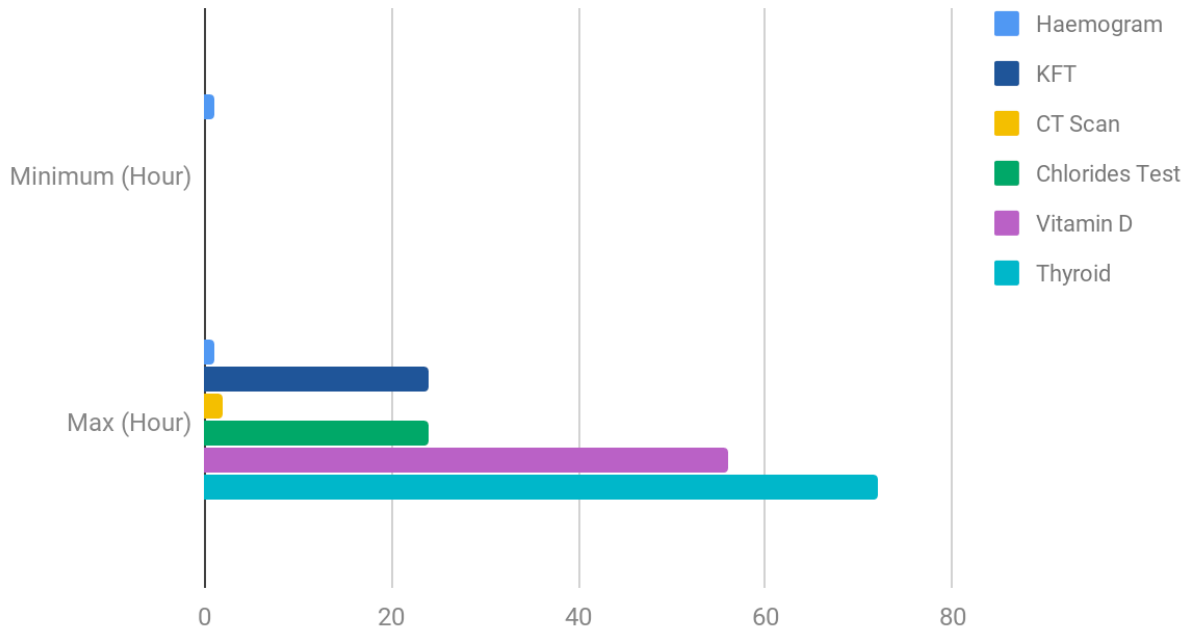
Time	Frequency	Percent
Not Available	3	21.4
2 hours	2	14.3
24 hours	6	42.9
48 hours	2	14.3
56 hours	1	7.1
Total	14	100.0

6) Thyroid Test

Time	Frequency	Percent
Not Available	1	7.1
1 hour	1	7.1
2 hours	2	14.3
4 hours	2	14.3
8 hours	1	7.1
24 hours	4	28.6
48 hours	1	7.1
72 hours	2	14.3

Total	14	100.0
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Range of Turnaround Time



5 out of 6 tests remained unavailable while a Thyroid function test took a maximum time of 72 hours for delivery. Crucial test are still unavailable in many labs. Absence denoted the underdeveloped infrastructure in the hill towns like Solan and Mandi. A skewness was observed with reference to efficiency between labs of delivering results in the same circle. Standardisation of services can significantly improve service for the industry.

Following are the findings for Research question 3:

RQ3.) What are e-facilities available in Diagnostic laboratories in the area of Solan & Mandi with respect to:

- a) Website & Social Media
- b) E- Reporting, Consultation & Appointment
- c) Cloud Database
- d) Payment Methods

	Solan	Mandi
Website		
Available	3 (42.9%)	4 (57.1%)
Not Available	4 (57.1%)	3 (42.9%)
Social Media		
Facebook	2 (28.6%)	3 (42.9%)
JustDial	2 (28.6%)	2 (28.6%)
Cloud Storage		
Available	3 (42.9%)	3 (42.9%)
Not Available	4 (57.1%)	4 (57.1%)
Payment Modes		
Online	1 (14.3%)	1 (14.3%)
Cash	7 (100%)	7 (100%)
Debit/Credit Card	2 (28.6%)	5 (71.4%)
eWallets	4 (57.1%)	3 (42.9%)
Reporting		
By Hand- At Lab	7 (100%)	7 (100%)
Telephone/Phone call	6 (85.7%)	3 (42.9%)
SMS/WhatsApp	6 (85.7%)	2 (28.6%)
eMail	4 (57.1%)	2 (28.6%)

Following are the findings for Research question 4:

RQ4.) What is the patient attitude towards Preventive Healthcare (PHC)? What is the impact of demographics like age, gender, income and education on Preventive Healthcare?

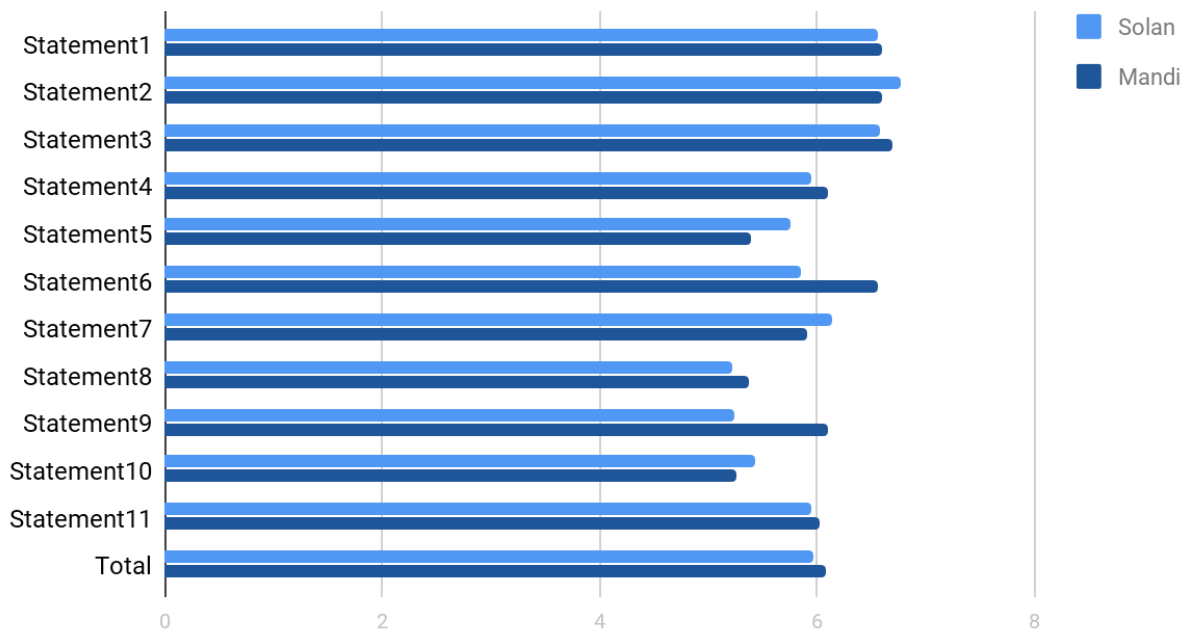
A) Preventive Healthcare Attitude Measurement Scale

As per reports quoted in Section 2.3 of the report, A growing need for Preventive healthcare facilities especially amongst young generation has to be addressed by various stakeholders in the Indian diagnostic industry. We utilised an attitude measurement scale^[21] developed by Joseph D. Cangelosi and David Kim of University of Central Arkansas and Edward Ranelli University of West Florida to gauge the attitude of respondents towards Preventive Healthcare. The responses were evaluated on a scale of 1 (Least likely) to 7 (Most likely). Only 20% of the respondents had an active Insurance Policy, 42% actively engaged in consumption of a healthy diet and lifestyle and 36% took a health checkup annually. We drew correlations using One Way ANOVA technique and Chi Square Technique to get insights for Objective 2. The mean value for all 11 statements in the questionnaire was 6.0218 with a standard deviation of 0.68992. The attitude of the surveyed population showcased a positive attitude at a mean of 6.02 on a scale of 7. Respondents carried an attitude to engage in regular exercise, intake nutrition, have a regular source of healthcare, keep surroundings clean and even commit a portion of income towards pharmaceutical expenses.

<i>Statements</i>	Mean	Standard Deviation
<i>Statement 1</i>	6.5732	0.69230
<i>Statement 2</i>	6.6829	0.61431
<i>Statement 3</i>	6.6341	0.69197

<i>Statement 4</i>	6.0244	1.31975
<i>Statement 5</i>	5.5854	1.47745
<i>Statement 6</i>	6.2012	1.28789
<i>Statement 7</i>	6.0244	1.26273
<i>Statement 8</i>	5.2866	1.60048
<i>Statement 9</i>	5.6541	1.96806
<i>Statement 10</i>	5.3415	1.72474
<i>Statement 11</i>	5.9874	1.69507
<i>PHC Total</i>	6.0218	0.68992

Mean values of PHC statements



B) One way ANOVA Results - FOR PATIENT SURVEY FORM

1) Preventive Healthcare attitude & Education

One way ANOVA between PHC and Education denotes significant correlation between the two. Out of the 3 education categories, all carried a mean value of around 6 with an exception of Others varying by .4 points with a mean value of 5.672.

		Mean	F Value	P Value	Significance
Education	Others	5.6721	4.635	0.011	Significant
	Matriculate	6.1180			
	Graduate & above	6.0886			
	Overall	6.0218			

2) Preventive Healthcare attitude & Annual Checkup

One way ANOVA between PHC and Annual Health checkup denotes significant correlation between the two.

		Mean	F Value	P Value	Significance
Annual Health Checkup	Yes	6.2165	7.084	0.009	Significant
	No	5.9137			

3) Preventive Healthcare attitude & Insurance

One way ANOVA between PHC and Insurance denotes a non Significant correlation between the two.

		Mean	F Value	P Value	Significance
Insurance	Yes	6.0528	0.078	0.781	In - significant
	No	6.0140			

4) Preventive Healthcare attitude & Gender

One way ANOVA between PHC and Gender denotes a non Significant correlation between the two. There is no biases based on gender is observed. Males and Females of the surveyed population do not vary in their point of views towards Preventive healthcare. Mean values for both the genders are identical.

		Mean	F Value	P Value	Significance
Gender	Male	6.0221	0.000	0.996	In - significant
	Female	6.0215			

5) Preventive Healthcare Attitude & Age

One way ANOVA between PHC and Age denotes a non Significant correlation between the two. Age and PHC alone are not related and any of the 5 age categories do not demonstrate an affinity forwards Preventive Healthcare.

		Mean	F Value	P Value	Significance
Age	18 to 24 years	5.8956	1.095	0.361	In - significant
	25 to 38 years	6.0101			
	39 to 50 years	6.1707			

	51 to 60 years	5.9343			
	60+ years	6.1818			

6) Preventive Healthcare attitude & Income

One way ANOVA between PHC and Income denotes a non Significant correlation between the two. Slight variations can be observed amongst the 5 income categories surveyed, however, no significant observations can be made from this.

		Mean	F Value	P Value	Significance
Income	Not Applicable	6.0830	1.953	0.105	In - significant
	>10,000	5.8918			
	10,001 to 25,000	5.9205			
	25,001 to 70,000	6.2890			
	>70,000	5.7576			

7) Preventive Healthcare attitude & Internet Usage

One way ANOVA between PHC and Internet usage denotes an significant correlation between the two. Internet users carry a mean value of 6.12 compared to a mean value of 5.71 of non Internet users. This denoted that Internet users are more sensitive towards acknowledging the importance of Preventive Healthcare due to higher levels of awareness.

		Mean	F Value	P Value	Significance
Internet Usage	Yes	6.1265	11.138	0.001	Significant
	No	5.7133			

8) Preventive Healthcare attitude & Healthy Diet

One way ANOVA between PHC and Healthy Diet denotes a non significant correlation between the two. No relations could be derived from the technique denoting relationship between consumers of healthy dietary habits and attitude towards Preventive Healthcare.

		Mean	F Value	P Value	Significance
Diet	Yes	6.1094	1.772	0.185	In - significant
	No	5.9596			

9) Age and Type of Severity of Ailment

One way ANOVA between Age and Severity of Ailment denotes an significant correlation between the two. Chronic ailment patients have a mean value of 2.48 compared to 2.11 of Non Chronic ailment patients.

		Mean	F Value	P Value	Significance
Severity of Ailment	Chronic	2.4810	4.324	0.039	Significant
	Non - Chronic	2.1176			

10) Location & Education

One way ANOVA between Location and Education denotes a significant correlation between the two. Education category Others with individuals having no formal education carry a mean value of 1.73 compared to an average value of 1.43 by individuals with an education of matriculate or above.

		Mean	F Value	P Value	Significance
Education	Others	1.7333	4.606	0.011	Significant
	Matriculate	1.4400			
	Graduate & above	1.4286			

Following are the findings for Research question 5:

RQ5.) Interrelationship between demographic factors and Healthcare behaviour (Healthy diet, Insurance subscription and Annual health checkup)

1) Gender & Internet Connection

A Chi-square test of independence performed to analyse the relation between Gender and Internet Connection. The relation was non significant. No biasedness was observed on the basis of Gender on Internet connection. This denotes uniform and consistent presence of Internet facilities across both genders.

$$X^2(1, N=164) = .073, p < 0.78$$

		Internet Connection		Total
		Yes	No	
Gender	Male	63	20	83
	Female	60	21	81
Total		123	41	164

2) Age & WhatsApp Usage

A Chi- square test of independence performed to analyse the relation between Age and Whatsapp Usage. The relation was non significant.

$$X^2 (8, N=164) = 9.907 , p < 0.272$$

		Whatsapp Usage Frequency			Total
		Not Using	Daily	Weekly	
Age	18 to 24 years	10	33	11	54
	25 to 38 years	9	20	7	36
	39 to 50 years	18	30	3	51
	51 to 60 years	6	8	4	18
	60+ years	1	4	0	5
Total		44	95	25	164

3) Age and Monthly Income

A Chi- square test of independence performed to analyse the relation between Age and Monthly Income. The relation was non significant.

$$X^2(16, N=164) = 49.703, p < 0.056$$

		Monthly Income					Total
		Not Applicable	>10,000	10,001 to 25,000	25,001 to 70,000	>70,000	
Age	18 to 24 years	22	4	10	16	2	54
	25 to 38 years	3	17	10	6	0	36
	39 to 50 years	12	19	8	6	6	51
	51 to 60 years	10	3	3	2	0	18
	60+ years	4	0	1	0	0	5
Total		51	43	32	30	8	164

4) Healthy Diet & Gender

A Chi- square test of independence performed to analyse the relation between Healthy Diet & Gender. The relation was non significant.

$$X^2(1, N=164) = .854, p < 0.429$$

		Gender		Total
		Male	Female	
Healthy Diet	Yes	32	37	69
	No	51	44	95
Total		83	81	164

5) Healthy Diet and Monthly Income

A Chi- square test of independence performed to analyse the relation between Healthy Diet & Monthly Income. The relation was significant.

$$X^2 (4, N=164) = 16.310, p < 0.003$$

		Monthly Income					Total
		Not Applicable	>10,000	10,001 to 25,000	25,001 to 70,000	>70,000	
Healthy Diet	Yes	25	10	10	18	6	69
	No	26	33	22	12	2	95
Total		51	43	32	30	8	164

6) Healthy Diet and Education

A Chi- square test of independence performed to analyse the relation between Healthy Diet and Education. The relation was significant.

$$X^2 (2, N=164) = 8.742, p < 0.012$$

		Education			Total
		Others	10th Pass	Graduate and above	
Healthy Diet	Yes	7	18	44	69
	No	23	32	40	95
Total		30	50	84	164

7) Healthy Diet & Age

A Chi- square test of independence performed to analyse the relation between Healthy Diet and Age. The relation was non significant.

$$X^2 (4, N=164) = 1.564 , p < 0.81$$

		Age					Total
		18 to 24 years	25 to 38 years	39 to 50 years	51 to 60 years	60+ years	
Healthy Diet	Yes	26	13	20	8	2	69
	No	28	23	31	10	3	95
Total		54	36	51	18	5	164

8) Insurance & Gender

A Chi- square test of independence performed to analyse the relation between Insurance & Gender. The relation was non significant.

$$X^2 (1, N=164) = .439 , p < 0.507$$

		Gender		Total
		Male	Female	
Insurance	Yes	15	18	33
	No	68	63	131
Total		83	81	164

9) Insurance & Monthly Income

A Chi- square test of independence performed to analyse the relation between Insurance & Monthly Income. The relation was non significant.

$$X^2 (4, N=164) = 2.053 , p < 0.725$$

		Monthly Income					Total
		Not Applicable	>10,000	10,001 to 25,000	25,001 to 70,000	>70,000	
Insurance	Yes	12	8	8	4	1	33
	No	39	35	24	26	7	131
Total		51	43	32	30	8	164

10) Insurance & Education

A Chi- square test of independence performed to analyse the relation between Insurance & Education. The relation was non significant.

$$X^2 (2, N=164) = 1.284 , p < 0.5$$

		Education			Total
		Others	10th Pass	Graduate and above	
Insurance	Yes	7	12	14	33
	No	23	38	70	131
Total		30	50	84	164

11) Insurance & Age

A Chi- square test of independence performed to analyse the relation between Insurance & Age. The relation was non significant.

$$X^2(4, N=164) = 3.509, p < 0.47$$

		Age					Total
		18 to 24 years	25 to 38 years	39 to 50 years	51 to 60 years	60+ years	
Insurance	Yes	9	7	14	3	0	33
	No	45	29	37	15	5	131
Total		54	36	51	18	5	164

12) Annual Checkup & Gender

A Chi- square test of independence performed to analyse the relation between Annual Checkup & Gender. The relation was non significant.

$$\chi^2(1, N=164) = 1.044, p < 0.33$$

		Gender		Total
		Male	Female	
Annual Health Checkup	Yes	33	26	59
	No	50	55	105
Total		83	81	164

13) Annual Checkup & Age

A Chi- square test of independence performed to analyse the relation between Annual Checkup & Age. The relation was significant.

$$\chi^2(4, N=164) = 13.390, p < 0.009$$

		Age					Total
		18 to 24 years	25 to 38 years	39 to 50 years	51 to 60 years	60+ years	
Annual Health Checkup	Yes	12	12	20	12	3	59
	No	42	24	31	6	2	105
Total		54	36	51	18	5	164

14) Annual Checkup & Monthly Income

A Chi- square test of independence performed to analyse the relation between Annual Checkup & Monthly Income. The relation was significant.

$$X^2 (4, N=164) = 9.163 , p < 0.057$$

		Monthly Income					Total
		Not Applicable	>10,000	10,001 to 25,000	25,001 to 70,000	>70,000	
Annual Health Checkup	Yes	20	16	5	13	5	59
	No	31	27	27	17	3	105
Total		51	43	32	30	8	164

15) Annual Checkup & Education

A Chi- square test of independence performed to analyse the relation between Annual Checkup & Education. The relation was non significant.

$$X^2 (2, N=164) = 2.421 , p < 0.297$$

		Education			Total
		Others	10th Pass	Graduate and above	
Annual Health Checkup	Yes	9	15	35	59
	No	21	35	49	105
Total		30	50	84	164

Following are the findings for Research question 6:

RQ6.) Does demographic variables and PHC attitude predict Healthcare behaviours like

- a) Healthy Diet intake
- b) Insurance Subscription
- c) Annual Health checkups

REGRESSION:

A logistic regression was performed to ascertain the effects of Age, Gender and Preventive healthcare attitude on the likelihood that participants will

- a) follow a healthy diet
- b) subscribe to Insurance
- c) Go for routine health checkups.

1) Healthy Diet

		Healthy Diet	
		Yes	No
Healthy Diet	Yes	0	64
	No	0	90

	Nagelkerke R ²	χ^2	P value	Classified	Age	Gender	PHC
HEALTHY DIET	.024	2.771	.428	Not Applicable	.571	.520	.172

The logistic regression model was statistically non significant.

$\chi^2(3) = .428, p < .05$. The model explained 2.4% (Nagelkerke R^2) of the variance in healthy diet and correctly classified 58.4% of cases.

The Nagelkerke R^2 value shows a 2.4% variation by the predictor factors and is non significant.

Age, Gender and attitude towards Preventive healthcare (PHC) do not predict or correlate any similarity towards consumption of a healthy diet. Point of view for intake of a healthy diet is irrespective of Gender, Age and PHC Attitude.

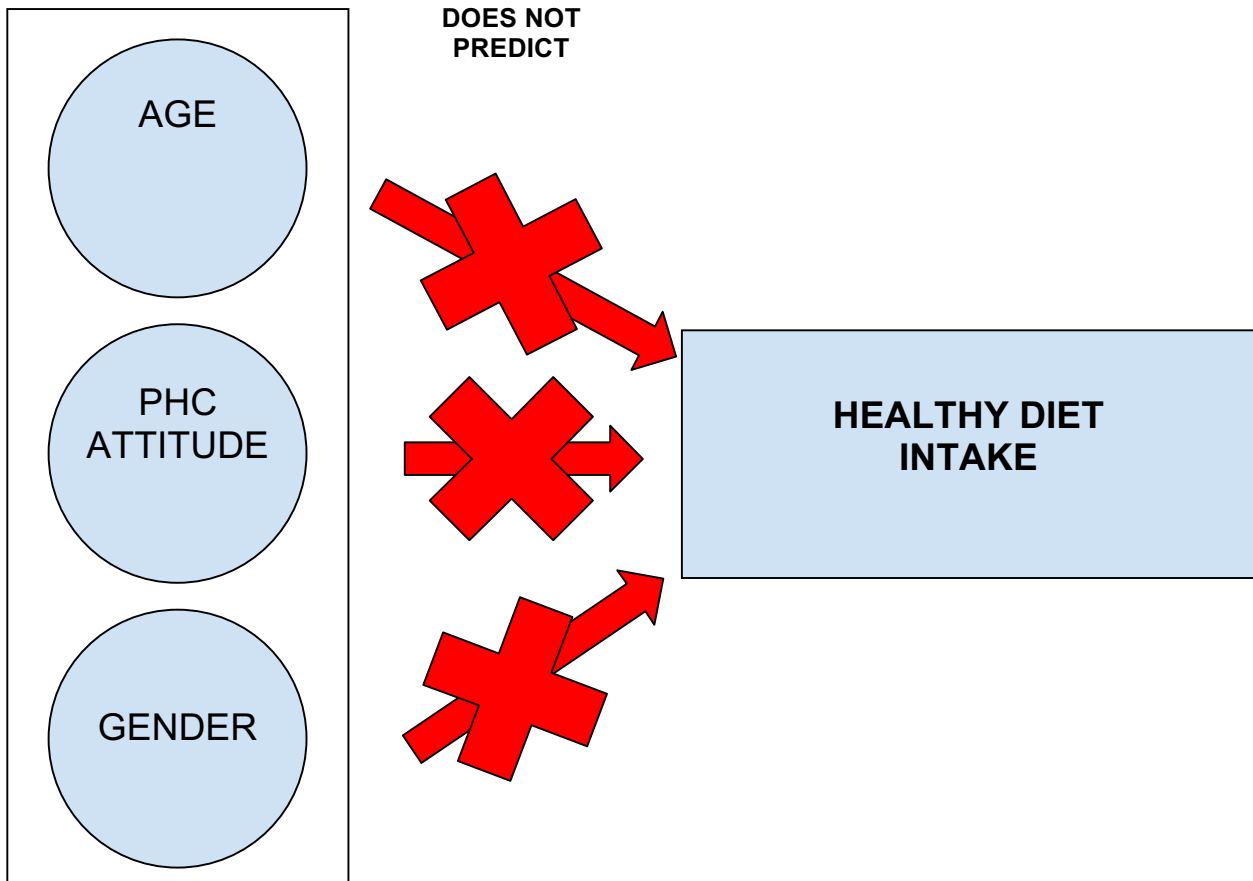


Fig 4.1: Proposed prediction model for age, attitude, gender for healthy diet intake

2) Insurance

		Insurance	
		Yes	No
Insurance	Yes	0	31
	No	0	123

	Nagelkerke R ²	χ^2	P value	Classified	Age	Gender	PHC
Insurance	.006	.630	.889	Not Applicable	.773	.467	.805

The logistic regression model was statistically non significant.

$\chi^2(3) = .889, p < .05$. The model explained 0.6% (Nagelkerke R²) of the variance in healthy diet and correctly classified 79.9% of cases.

The Nagelkerke R² value shows a 0.6% variation by the predictor factors and is Non Significant.

Age, Gender and attitude towards Preventive healthcare (PHC) do not predict or correlate any similarity towards Insurance Subscription. Point of view for Insurance is irrespective of Gender, Age and PHC Attitude.

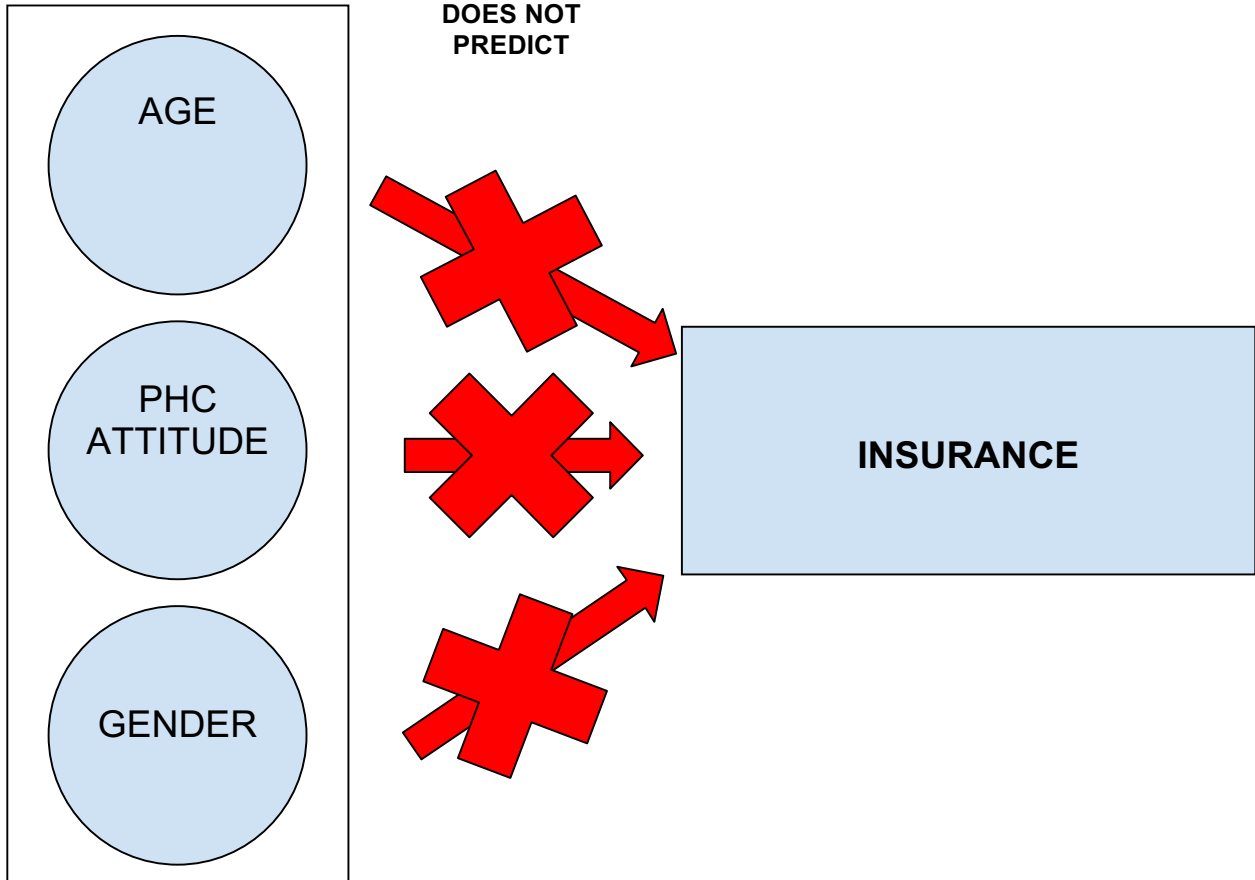


Fig 4.1: Proposed prediction model for age, attitude, gender for Insurance

3) Annual Health Checkup

Step 0		Annual Health Checkup	
		Yes	No
Annual Health Checkup	Yes	0	55
	No	0	99

	Nagelkerke R ²	χ^2	P value	Classified	Age	Gender	PHC
Annual Health Checkup	.178	21.434	.000	Applicable	.001	.416	.026

Step 1		Annual Health Checkup	
		Yes	No
Annual Health Checkup	Yes	23	32
	No	15	84

The logistic regression model was statistically significant.

$\chi^2(3) = 21.434, p < .05$. The model explained 17.8% (Nagelkerke R²) of the variance in healthy diet and correctly classified 69.5% of cases.

The Nagelkerke R² value shows a 17.8% variation by the predictor factors and is fairly significant. Age and attitude towards Preventive healthcare (PHC) predict a similarity towards Annual Health Checkup.

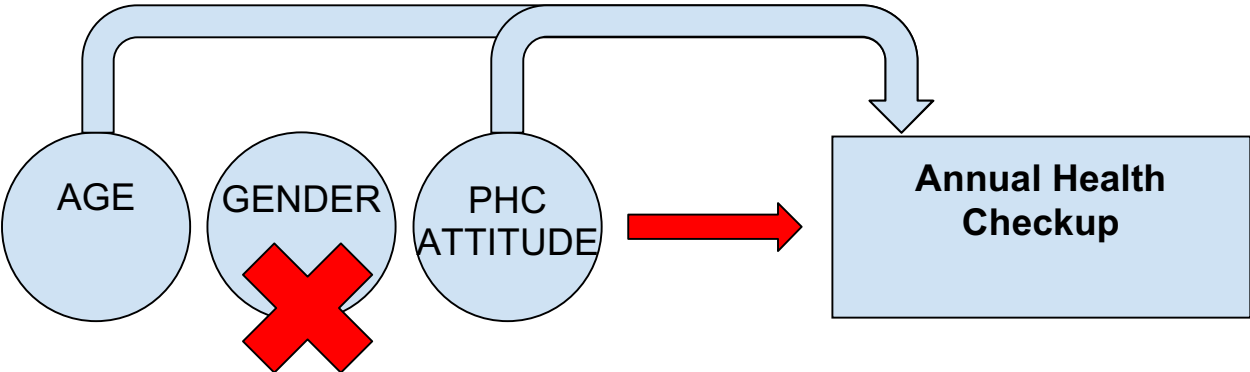


Fig 4.3: Proposed prediction model for age, attitude, gender for annual health checkup

Age and Annual Health Checkup Crosstabulation				
		Annual Health Checkup		Total
		Yes	No	
Age	18 to 24 years	12	42	54
	25 to 38 years	12	24	36
	39 to 50 years	20	31	51
	51 to 60 years	12	6	18
	60+ years	3	2	5
Total		59	105	164

A cross tabulation of Age and Annual Health Checkup shows a higher awareness in the Younger generation for Annual Checkups. It is a good sign for a healthy and growing population. The youngsters can be stimulated to drive elderly population towards this healthier habit of checkups.

ANOVA to study significance between Annual Health Checkup and PHC attitude

Annual Health Checkup & PHC		Mean	F Value	P Value	Significance
	Yes	6.2165	7.084	0.009	Significant
No	5.9137				

CHAPTER 5

DISCUSSION & CONCLUSION

5.1 THEORETICAL CONTRIBUTIONS

5.1.1. Need for a stronger and rigorous Accreditation system:

Private clinics and services have mushroomed to cater to growing demand in the sector. As discussed in Section 2.1 of this report and confirmed in response to Research Question 1, the system needs a stronger accreditation system to keep the diagnostic sector under check. Only 1 out of 14 surveyed labs in both the cities of Solan and Mandi is accredited. FDI as discussed in Section 1.1 encouraging huge investments into the sector. Basic need for the system at present are regulations for this sector. Clinical Establishment Act 2010 as discussed in Section 2.1.1 are not sufficient to cater to current setup and organizational structure.

Government must need to setup vigilance systems in urgency and ensure enforcement with stringency to prevent unorganization of the sector that could go beyond control and lead to unreasonable demands by the vendors.

5.1.2. Sample collection through Satellite centers

Out of 14 surveyed labs in the two cities, 11 were diagnostic labs were operating with full operations while 3 were collection centers were just sample collection facilities. As discussed in Section 2 of response to Research Question 1, In-order to provide uniform access to healthcare facilities, more satellite collection centers should be operated across different parts of the city and managed from a master diagnostic lab (within the city) to process samples and send reports. There will be less logistical issues and more coverage that can be offered within the city. However, sample handling and transit needs to be carried out in caution with proper procedure and safety. Considering 43% of respondents had to travel more than 15 kms for their test, there is certainly a big market for service providers. Resource sharing among independent lab facilities can also ensure better services for the patients and cost cutting at the laboratory's end. These satellite collection

centers can be opened to decentralize the crowd on a single lab outlet - especially in government hospitals. District hospital in Mandi has 4 labs opened inside the hospital premises divided according to the nature of tests and equipment available.

5.1.3. Need to innovate with unique models of Ownership

High percentage (71%) of private lab facilities shows a dominant position of private service providers in the market. Incompetence of government facilities to leverage the trust and credibility of population on it has to be addressed through unique models. Public Private Partnership (PPP) is bringing affordable healthcare within the reach of majorities in the country. GE, SRL and B Braun are examples that have partnered with state governments under PPP route to provide accessible and affordable healthcare facilities. The emerging trend of corporate players tapping in small towns and rural areas provide ample opportunities of growth for all stakeholders.

5.1.4. Increase number of patient walkins

85% of labs had a patient footfall less than 100 (daily). There are still not enough people visiting the lab facilities. Absence of engagement programs like Healthcare camps and Wellness Packages was observed. 57% of labs had never arranged any Healthcare camp while 50% of the labs did not offer any Wellness Packages. None of the surveyed labs offered any Insurance assistance to the patients in spite of a high degree of awareness towards it. Diagnostic labs to engage more population towards the benefits of a healthier health and push the local populations to get regular health checkups.

5.1.5. Improvements to Test and Equipment availability & Turnaround time

As discussed in Section 4 in response to Research question 2, improper maintenance, unavailability of lab equipments and calibration shows the absence of basic infrastructure and facilities in these labs. Absence of basic diagnostic tests and delayed turnaround time for crucial tests in many labs is a big concern. Services at many labs need to be redesigned and optimised to minimise patient distress and offer facilities that save time and cost.

5.1.6. Push for Digital engagement

Out of 14 labs surveyed, only 50% had an active website for their diagnostic centers. 43% of labs maintained a database on cloud while 35% and 28% of labs had Facebook and Instagram presence. 14% of the surveyed labs accepted online payment and 50% accepted payments through Cards and e-Wallets. As discussed in Section 1.2, digital will disrupt the Healthcare industry facilitating more services at the tap of a button. Laboratories should adopt such platforms to enable quicker and flexibility in their offerings. The Internet engagement was mapped to be at 75% compared to a national average of 40% in 2011 census. The upcoming years will witness such trends and the population will be looking forward to adopt these services increasing the demand for technology significantly. Value added services such as e-reporting discussed in Section 1.2.1 was offered by just 43% of the labs. The current government's ambition to provide health cover to more than 40% of the Indian population and nearly 100 million families will yield one of the biggest healthcare schemes in the world. However, these ambitious project must be backed by a strong infrastructure in-order to be successful and technology will undoubtedly be a building pillar towards this goal

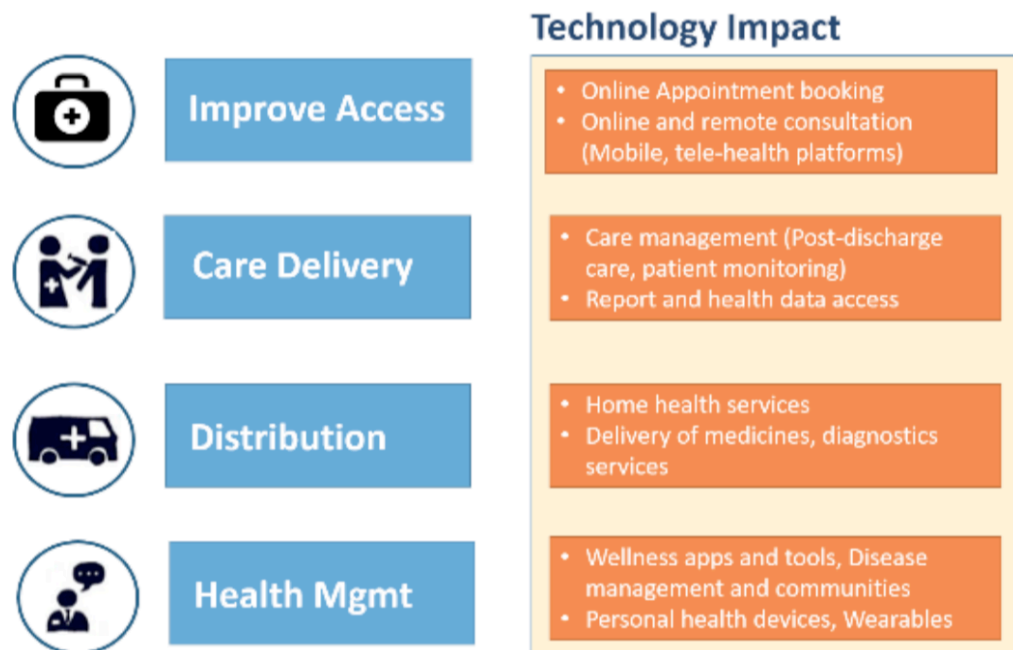


Figure 5.1: Technology interventions

5.1.7. Preventive Healthcare is significantly related to Education and Internet Usage

As discussed in response to one way ANOVAs for Research question 4, a positive attitude towards Preventive healthcare has significant correlations with education and Internet Usage. Individuals with higher degree of awareness - through formal education and/or internet access showed higher affinity and a positive attitude to adopt PHC. A big majority of the population had received some or the other level of formal education - about 81.7%. The state of Himachal Pradesh has a literacy rate of 76.6%. It creates a healthy environment to run awareness campaigns. The population will be more receptive towards these campaigns leading to a better lifestyle for them.

5.1.8. Gender, Age and Income have no significance on Preventive Healthcare

As discussed in response to one way ANOVAs for Research question 4, Gender, Age and Income categories of the population are not related to PHC attitude. It is a good sign denoting no skewness due to such factors and explains a consistent and uniform attitude regardless of gender, age and income category. Males and Females across all age groups and Income categories of the surveyed population do not carry any different in their attitude.

5.1.9. Education and Monthly Income have significant impact on Healthy Diet

Individuals with some level for formal schooling and sufficient Monthly Income tend to consume a healthy diet on a regular basis. This shows economic skewness and lack of awareness among individuals without any degree of formal education.

5.1.10. Gender and Age have no significance on Healthy diet

Males and Females across all age categories did not show any skewness on intake of a healthy diet. The attitude was found to be uniform which denotes a healthy attitude in the population.

5.1.11. Monthly Income, Education, Age and Gender do not have any significance on Insurance subscription

Less than 10% of the Indian population is covered under health insurance scheme.

Despite the easy availability and increased awareness about Insurance, about 80% of the respondents did not have an active insurance policy, putting them at a high risk of financial burden during any ailment or disease. It was important to discover the factors that contribute in hesitation to buy Insurance policy. No significant pattern was observed amongst Males and Females from different economic categories, education and age groups with respect to purchase of Insurance policy.

5.1.12. Age and Monthly Income are significant in getting Annual Health Checkups

Age and Monthly income are correlated for getting Annual Health checkups. Young population and individuals with sufficient monthly income are regular in getting health checkups. Considering from a PHC point of view, it is essential to have regular health checkups for a healthy lifestyle. It is a good attitude in the upcoming generation and certainly the young generation can push forward the trend to the elderly.

5.2 IMPLICATIONS

The proposed model discussed in Section 4.1 of the report, discusses various aspects that could be picked up by various stakeholders in the Healthcare Industry. There is no existing study done by taking state of Himachal Pradesh in focus. Considering the strong push for National Health Protection Scheme announced in 2018 budget, significant infrastructural developments are required over the platform.

Key stakeholders to this study are:

1. Policy Makers (National Health Protection Scheme)
2. Marketeers and Investors
3. Wellness service providers
4. NGO
5. Data analytic firms
6. Veterinary Diagnostics

Platform can be extended not only for diagnostic labs but can also be extended to blood banks, physiotherapy, dialysis centers.

Global tech progress is still unharnessed by the system. Significant steps need to be taken to put India on a global map as a top service provider in the industry.

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APPENDIX A



**Survey Form for Patients:
Demographic and Patient attitude measurement towards PHC**

Project Title- E-Medication & PHC: Insights for Healthcare Industry

**Jaypee University, Wagnaghat
Solan**

Survey Location : Solan / Mandi	
Name of Patient:	
Consulting Lab:	Annual health checkup : Y / N
Hometown:	Education
Gender: M / F / T	<input type="radio"/> N/A
Age:	<input type="radio"/> 10 th Pass
Monthly Income:	<input type="radio"/> Graduate and above
<input type="radio"/> Not Applicable	Email: Y / N
<input type="radio"/> >10,000	Healthy diet : (Oats, Muesli, Green Tea) Y / N
<input type="radio"/> 10,001 – 25,000	WhatsApp Usage Frequency
<input type="radio"/> 25,001 – 70,000	<input type="radio"/> Not Using
<input type="radio"/> >70,000	<input type="radio"/> Daily
Internet Connection: Y / N	<input type="radio"/> Weekly
Disease: Chronic / Non Chronic	<input type="radio"/> Monthly
Purpose of Visit:	Insurance: Y / N
<input type="radio"/> Diagnosis	Type of test:
<input type="radio"/> Prognosis	<input type="radio"/> Package
<input type="radio"/> Follow-up	<input type="radio"/> Individual
	<input type="radio"/> Multiple Individual

Respondent Attitude towards Preventive Healthcare

TOTALLY DISAGREE 1 2 3 4 5 6 7 TOTALLY AGREE

1. I am responsible for taking steps to engage in regular exercise, fitness and weight control
2. Nutritional information and awareness is an important part of a healthy lifestyle
3. I am responsible for my own well-being
4. Stress management and reduction is an important part of a healthy lifestyle
5. I have a regular source of health care
6. When I go to the doctor, we regularly discuss the results of his/her diagnosis
7. I have a clear concern for the impact of the environment on my health
8. I consciously commit a portion of my income to pharmaceutical expenditures
9. It's the doctor's job to keep me healthy
10. A health savings account is an important part of my overall health care plan
11. My health is outside of my control

APPENDIX B



**Survey Form for Diagnostic Labs:
Identification of Lab Facilities**

Project Title- E-Medication & PHC: Insights for Healthcare Industry

**Jaypee University, Wagnaghat
Solon**

Name of Lab:	
Location:	NABL status:
City:	<input type="radio"/> Accredited
<input type="radio"/> Solan	<input type="radio"/> Not Accredited
<input type="radio"/> Mandi	Ownership:
Type	<input type="radio"/> Government
<input type="radio"/> Collection Site	<input type="radio"/> Private
<input type="radio"/> Diagnostic Lab	<input type="radio"/> PPP
Patient Footfall:	Staff size:
<input type="radio"/> Small (<100)	1. Physicians:
<input type="radio"/> Medium (100- 400)	2. Paramedics:
<input type="radio"/> Large (401+)	3. Housekeeping:
	4. Other:
Turnaround time (Sample collection to report) - in hours	
1. Haemogram :	
2. KFT/LFT :	
3. CT Scan :	
4. Thyroid Function Test :	
Cheapest Test: _____ (INR)	Wellness package: Y / N
Costliest Test: _____ (INR)	Package cost: _____ (INR)
Insurance assistance: Y / N	Health Camps: Y / N
Equipment Available:	Test availability:
<input type="radio"/> Electron Microscope`	<input type="radio"/> Haemogram
<input type="radio"/> Analyzer	<input type="radio"/> KFT/LFT
<input type="radio"/> Autoclave	<input type="radio"/> Lipid Profile
<input type="radio"/> Centrifuge	<input type="radio"/> X-Ray
	<input type="radio"/> HIV
	<input type="radio"/> CT Scan
	<input type="radio"/> Electromyography (EMG)
	<input type="radio"/> Thyroid Function Test

II – e-Facilities / Value added services

Website – Y / N

Database / Cloud Storage: Y / N

Social media channels:
<input type="radio"/> Facebook
<input type="radio"/> Instagram
<input type="radio"/> JustDial
<input type="radio"/> Any Other

Payment modes:
<input type="radio"/> Online
<input type="radio"/> Debit/Credit Card
<input type="radio"/> eWallets (PayTm, BHIM, Tez)
<input type="radio"/> Cash

Reporting:
<input type="radio"/> By hand – At lab
<input type="radio"/> By hand – At client residence
<input type="radio"/> Telephone/ Phone call
<input type="radio"/> SMS / WhatsApp
<input type="radio"/> eMail

e-Appointment:
<input type="radio"/> Not Available
<input type="radio"/> Telephone / IVR
<input type="radio"/> Internet (website)
<input type="radio"/> Mobile App

e-Consultation:
<input type="radio"/> Not Available
<input type="radio"/> Via Phone
<input type="radio"/> Internet

Sample Collection:
<input type="radio"/> Onsite
<input type="radio"/> Satellite collection centers
<input type="radio"/> Home Collection: Y / N Radius of collection if yes : _____ Mode of reporting : (e-Reporting / By Hand / By Phone)

III – Maintenance

PROCESS	FREQUENCY
1. Floor Mopping	_____ (in hours)
2. Equipment Calibration	_____ (in weeks)
3. Quality management team visit	_____ (in weeks)
4. Collection Room sterilization	_____ (in days)
5. Disposal Method of samples	_____
6. Seating capacity of waiting room	_____ (persons)