Original Research Paper

Public Health

REMOTE HEALTH SERVICES AND ITS IMPLICATIONS ON HUMAN RESOURCES FOR HEALTH AND PATIENT SATISFACTION: E-UPHC MODEL

Santos Das*	MPH, Apollo Tele Health ServicesKrishe Sapphire Building, HiTech City
Sangita Reddy	PhD (Hons), Apollo Tele Health Services
Vikram Thaploo	PGDBM, Apollo Tele Health Services
Ayesha Nazneen	PGDBM, Apollo Tele Health Services
Akhila Kosuru	MBBS, Apollo Tele Health Services

ABSTRACT

Background: Shortage of human resources at Urban Primary Health Centres (UPHC) is a reason why diseases often go untreated and medical tests get ignored, causing a burden on the system in India. Telemedicine or remote health services could be a solution to bridge the gap between critical demand and supply of healthcare personnel at distant places.

Methods: This study is a descriptive review and cross-sectional feedback survey. Descriptive data of 183 e-UPHC's teleconsultation and laboratory visits were analyzed to understand the pattern of disease and efficacy of this method A structured questionnaire in the form of five-point Likert scale was developed to evaluate the satisfaction level of patients. Chi square test was performed to study the association between level of satisfaction with demographics. Factor analysis was used to reduce the dimensionality of the variables. The collected data was analyzed using IBM SPSS version 25 statistical software.

Findings: Patients availed majority of e-UPHC services for non-communicable diseases (NCDs). At least 66.07% of complete blood picture (CBP) and 16.95% urine tests constituted over one-fourth of all laboratory tests. Studies found that 95.5% patients were 'satisfied' and 'highly satisfied' with improvement in health condition following teleconsultation, which resulted in an overall 97% 'satisfied' and 'highly satisfied' patients. Gender was also a strong predictor of patient satisfaction. In a unit, increase in male score, lead to 1.679 increase in the patient satisfaction score with a 95% CI of 0.480–2.88 at a p value 0.006.

Interpretation: Telemedicine provides new possibilities to confront the paucity of specialist doctors. In this study, patients' satisfaction with remote healthcare services underlined the reasons behind its increasing acceptance. The findings from the study strengthens the case for the need of specialist consultants remotely at primary health care level to address NCDs and other disease burden.

KEYWORDS :

Background

India may have made great advances in providing healthcare services to its 1.30 billion-plus people, but it still faces challenges in tackling and treating non-communicable diseases (NCD) and chronic ailments, nutritional deficiencies, and maternal & child illnesses. Covid-19 has further added to the burden of the healthcare system of the country.

Historically, Primary Health care system is envisaged to provide health services to the vast population of India. Primary Health Centers was introduced in the health system in 1946 on recommendation of Bhore committee primarily for the rural population (Ministry of Health and Family Welfare (Government of India), 2013). Before 1983, schemes under five-year plans were used for health service delivery (Aakriti Grover & R. B. Singh, 2019). The first health policy of 1983 and subsequent at 2002 contemplated health from a holistic perspective but urban health was not prioritized (Policy & Nhp-, 1983) . National Rural Health Mission, 2005 did not specify services for the urban population hence kept the scope of urban health service delivery in ambiguity.

Rural populace was prioritized for primary healthcare over urban deprived population (Agarwal, 2011). First time on the recommendation of Krishna Committee, 1992 urban health post was initiated to address the urban health problems(MOHFW, 2013). Until 2013, urban areas had multiple forms of primary health centers with no standard norms like urban health posts, urban health centers, urban health and family welfare centers and differ from state to state.

With rapid urbanization, the health concerns of urban poor were taken into serious consideration which resulted in introduction of Urban Primary Health Centers (UPHC) in

2013(Ministry of Health and Family Welfare (Government of India), 2013). First time, health needs of the urban population are being methodically and nationally addressed with standard norms for service delivery (Ministry of Health and Family Welfare, 2015).

Justification of the study

In India, to provide quality health services to a vast population, with shortage of human resources for health like specialist consultants is an impeding factor. In India density of physician per 1000 population is 0.758 (WHO, 2016) as compared to neighboring states 0.881 Sri Lanka, 0.978 Pakistan and 1.812 in China (Anand & Fan, 2016). The shortage of specialist doctors has a plausibility to increase the disease burden and mortality for the rural and urban population. As per Global Burden of disease study, burden of NCDs in India is projected to increase especially in urban areas; diabetes will increase from 40.9 million to 69.9 million and obesity will affect 52.1 million by 2030 (Dandona et al., 2017).

Shortage of specialist consultants at Urban Primary Health Centers (UPHC) is leading towards burden of untreated cases and tests. Further, the availability of laboratory services at UPHCs are limited due to lack of qualified biochemist, pathologist and lab technicians. Telemedicine or remote health services is one of the solutions to address the critical demand and supply gap of the specialist consultants, biochemist and pathologist through remote health services (A Singh et al., 2020). To improve the situation and reduce the level of burden at tertiary care, the state of AP envisaged remote specialist workforce along with strong pool of onsite general physician, nurses, and midwives at e-UPHCs.

Electronic Urban Primary Health Centers (e-UPHC) was

initiated by Government of Andhra Pradesh and Apollo Tele Health Services to strengthen the primary health care service delivery for urban disadvantaged population. The idea was to standardize and digitalize the entire service flow of 183 e-UPHCs along with Specialist Teleconsultations and Laboratory Services. Each e-UPHC onsite team includes one MBBS Doctor, two ANM's, one Lab Technician, one Desktop Support Engineer and a General Assistant. Patient could avail Out-Patient services physically from general physician and specialist Teleconsultations from General Medicine, Orthopedics, Endocrinologist and Cardiologist. A fully functional pharmacy (e-Aushudhi) is available at each e-UPHC.

The application of Telemedicine to monitor laboratories remotely introduced the concept of Tele-Diagnostic (Ganapathy et al., 2021). Laboratory services - hematology, biochemistry, pathology and microbiology/serology, is provided through lab technicians at each 183 e-UPHCs and experts like pathologist and biochemist at the hub remotely. Results are provided within four hours of tests. Laboratory Management Information System (LMIS) was applied for data tracking, downloading support and data exchange interface. Telemonitoring of all laboratory processes is ensured by the experts along with implementation of Internal Quality Control and External Quality Assessment System. The availability of laboratory results enables Telemedicine specialist consultants to diagnose and carry out evidence-based practice. Moreover, daily lab tests transactions of 183 e-UPHCs are overseen by a small team of experts consist of pathologist and biochemist.

In compared to service delivery, patient satisfaction is an important indicator for measuring patient centered delivery of quality and effective health care. Patient satisfaction also measures the success of doctors and health centers and leads to customer (patient) loyalty. In this study, the service delivery through technology/Telemedicine is a new concept for the population of Andhra Pradesh.

In this study, we aimed at investigating the implications of the e-UPHC model on HR by analysing the incidences of disease pattern and lab utilisation. Further, we also intended to explore the satisfaction level of patients with telemedicine services. With these results, future recommendations on remote health services could gain traction, thus strengthening the existing public health system.

METHODS
Study Setting, Sample Size, and Sampling Procedures
Descriptive data of 183 e-UPHC's Teleconsultation and laboratory visits were analysed for the period April 2018 to March 2019 to understand the disease pattern, teleconsultation, and laboratory utilisation.

A facility-based cross-sectional study design was applied to understand patient's satisfaction level on the services provided in the e-UPHC. Patients aged over 18 years who visited e-UPHC for telemedicine and telelaboratory services during the said period were considered as "source population". The total sample size of this study was determined using population proportion to size (PPS) formula by taking the assumptions that the patient satisfaction to be 50%, 95% CI and a 5% margin of error with a non-responsive rate of 20%. This resulted in a total of 576 samples for the study. A total of 45 e-UPHCs were randomly selected using the probability proportional to size (PPS) sampling technique from a pool of 183 facilities operating e-UPHC services. Systematic random sampling technique was used to select participants at every e-UPHC for the study. List of patients from the Electronic Health Record were used as sampling frame for selection.

Method of the survey
A structured questionnaire was developed, to assess the patient satisfaction at e-UPHC. During data collection, local language Telugu was used to ensure better understanding of patient feedback. The questionnaire was first developed in English, then translated to Telugu language by a professional translator for consistency. Trained coordinators were appointed for data collection and the principal investigator supervised the data collection process. Before the data collection, mock telephonic interviews were conducted, and a validation was done by three clinical experts.

Measurement
A structured questionnaire with closed answers in the form of five-point Likert scale and two scale used for data collection and measurement. Responses to questions of three dimensions of satisfaction, namely 'Specialist Teleconsultation', 'Quality', and 'Laboratory and Pharmacy services', were standardized to a five point Likert type scale (total 15 questions) (Andemeskel et al., 2019).The response were in the range "1 = Highly Dissatisfied", "2 = Dissatisfied", "3 = Neutral", "4 = Satisfied" and "5 = Highly Satisfied". Two components from the 'service' dimension, for discussion "comfort" and "referral" were "Yes" and "No" (total 7 questions) (Asamrew et al., 2020). Patient consent was taken before collecting the data. Patient confidentiality was maintained throughout the study. Data collection was done after five days of the visit to the e-UPHC by the patient for Teleconsultation with Tele laboratory services.

All data were collected using a computer-assisted telephone communication system (3CX), a software which facilitates storage of documented and recorded information. The collected data was stored in a cloud server managed by Apollo Tele Health Services.

The questionnaire was approved by the Apollo Research Institute, Ethic committee, which provided permission to conduct the study letter no AHJ-022/07-19.

STATISTICAL ANALYSIS
The collected data was entered and analysed using IBM SPSS version 25 statistical software. After data cleaning, descriptive statistics, including mean, SD, frequencies, and percentages, were used to describe the participants.

Chi Square Test was performed to study the association between level of satisfaction and factors such as district, gender and age groups. Factor analysis was used to reduce the dimensionality of the variables. Select critical variables with varimax rotation and loading greater than 0.40 were considered. Based on factor analysis, components were identified, and validation was calculated by Cronbach's alpha. To identify variables associated with the total score as dependent variables and age, gender and districts as independent variables using multiple regression analysis. Level of significance was considered as 0.05 (Emami & Safipour, 2013).

RESULTS
Descriptive Analysis
A total of 11,22,725 unique patients received consultations at e-UPHCs; out of which 2,11,550 (18.8%) availed specialist Teleconsultations from April 2018 to March 2019. 12,685 (1.1%) unique patients took both specialist Teleconsultation and Tele laboratory services.

Total 62.63% women, 37.37% men and 0.01% transgender availed the services during the said period. Women utilized the services more compared to men. Since the services are available within the proximity of their community, it helped women to avail the services with minimal travel to reach e-UPHC.

51 to 60 years age group were the highest service user (21.2%) followed by 41 to 50 years (20.9%). The third highest service takers were 61 to 70 years age group (16.6%) followed by 71 years and above age group (6%). 22.6% geriatric population above 61 years of age benefitted from the e-UPHC services. The availability of the services within the reach of the community helped the geriatric population to visit e-UPHC.

As many as 48.9% cases were consulted with General Medicine, 26.2% with Orthopedics, 19.5% Endocrinologist and 5.4% with Cardiologist. 20.5% cases who took consultation with specialist doctors were also referred for laboratory tests as shown in Table 1.

Table 1. Specialist Teleconsultations and lab referrals from April 2019 to March 2019

Specialist	Specialist Teleconsultations Numbers (%)	Lab Referrals Numbers (%)
General Medicine	1,03,417 (48.9%)	34593 (16.3%)
Orthopedics	55,458 (26.2%)	1909 (0.9%)
Endocrinologist	41,171 (19.5%)	5651 (2.7%)
Cardiologist	11,504 (5.4%)	1323 (0.6%)
Total	2,11,550 (100%)	43,392 (20.5%)

Majority of the services were taken for Diabetes (26.6%), Hypertension (11%), Osteoarthritis/Orthopedic-related conditions (16.1%), ARI (8%), skin conditions (3.2%) and URTI (2.6%). Majority of the services were for non-communicable diseases which includes 26.6% Diabetes, 16.1% Osteoarthritis/ Ortho, 11% Hypertension, 1.4% accidental injuries and 1% for anemia.

The highest number of services were taken for CBP (66.07%) and urine tests (16.95%), which constitute more than one fourth of all laboratory tests as shown in Table 2.

Table 2. Laboratory Tests at e-UPHC

	Name of the Test	Numbers (%)
1	CBP (Complete Blood Picture)	1,18,874 (66.07%)
2	Urine Microscopy	30,491 (16.95%)
3	ESR (Erythrocyte Sedimentation Rate)	5,383 (2.99%)
4	Serum Creatinine	4,503 (2.50%)
5	RBS (Random Blood Sugar)	4,425 (2.46%)
6	Blood Urea	1,665 (0.93%)
7	FBS (Fasting Blood Sugar)	1,630 (0.91%)
8	PPBS (Post Prandial Blood Sugar)	1,551 (0.86%)
9	Malaria Parasite (Slide Method)	1,394 (0.77%)
10	Dengue	1,151 (0.64%)
11	Hemoglobin	734 (0.41%)
12	SGOT	638 (0.35%)
13	SGPT	638 (0.35%)
14	Serum Albumin	628 (0.35%)
15	Total Protein	619 (0.34%)
16	Serum Bilirubin Direct	614 (0.34%)
17	Total Cholesterol	582 (0.32%)
18	Stool Examination	575 (0.32%)
19	Serum Alkaline Phosphates	551 (0.31%)
20	Triglycerides	537 (0.30%)
21	Serum VLDL	483 (0.27%)
22	Serum HDL	464 (0.26%)
23	Malaria Parasite (Rapid Test)	442 (0.25%)
24	Serum Bilirubin Total	421 (0.23%)
25	Serum Bilirubin	347 (0.19%)
26	Sputum for AFB	194 (0.11%)
27	HIV (Human Immuno Virus)	173 (0.10%)
28	HbsAg	88 (0.05%)
29	Blood Group	43 (0.02%)
30	Serum Amylase	33 (0.02%)
31	Clotting Time (CT)	25 (0.01%)
32	Pregnancy Test (Urine)	22 (0.01%)

Altogether 1,07,836 cases were referred outside of e-UPHC for laboratory tests, other specialists' consultations, drugs, x-ray and radiology services. 42,670 patients revisited within 7 days and 71,367 revisited within a month for review. Out of which 3,238 referred for other specialist consultation.

Patient Satisfaction
Population Characteristic
The study had a total of 576 patients as participants. Of them, 201 (35%) were male and 375 (65%) females. The mean age of study participants was 43 years. The highest number of participants – 134 (23%) – came from Kurnool district. Highest participants were from the age group 51 years as shown in Table 3. About 339 (58.9%) study participants availed teleconsultation for the first time.

Table 3 – Population Characteristic of patient satisfaction questionnaire

Variables	%	Numbers
Gender		
Male	35%	201
Female	65%	375
Age		
<35 years	31%	180
35-50 years	33%	190
>51 years	36%	206
District		
Anantapur	11%	63
Chitoor	14%	83
Guntur	10%	56
Kadapa	7%	42
Krishna	11%	62
Kurnool	23%	134
Nellore	6%	37
Prakasam	7%	38
West Godavari	11%	61

In Table 4, Patient Satisfaction is shown in three different categories – "Specialist Teleconsultation-related information", "Teleconsultation Quality-related information" and "Facility Service-related information". With respect to overall patient satisfaction, most of them were satisfied with the services across all the categories. Over 90% of patients were "satisfied" and "highly satisfied" with all the services. While 95.5% patients were "highly satisfied" and "satisfied" with their improvement in health condition after teleconsultation, 40.3% were "highly satisfied" and 52.1% "satisfied" and found the teleconsultation experience similar to face-to-face consultation. Interestingly, 1.6% was "dissatisfied" and 0.3% "highly dissatisfied" with the total length of time taken for the teleconsultation. Also, 2.3% was "dissatisfied" and 0.7% "highly dissatisfied" following non-receipt of medicines at e-UPHC.

The overall satisfaction was measured by using one question from the overall questionnaire "Your overall treatment experience at using teleconsultation starting from appointment, teleconsultation, prescription, laboratory services and medicine". In this section, overall, 97% are "satisfied" and "highly satisfied" with the services. However, 2.1% patients remained "neutral" in their response and only 0.9% patients said they were "dissatisfied" with the services.

Table 4 Satisfaction levels of study participants with different service categories (N = 576)

Parameters	Highly Dissatisfied	Dissatisfied	Neutral	Satisfied	Highly Satisfied	Mean	SD

	Specialist Teleconsultation related information							
1	The courtesy and respect the specialist you saw	-	2 (0.3%)	11 (1.9%)	276 (47.9%)	287 (49.8%)	4.47	.556
2	The explanation of your condition by the specialist	-	3 (0.5%)	8 (1.4%)	309 (53.6%)	256 (44.4%)	4.42	.551
3	Instructions were given to you by specialist doctor wear clear	-	2 (0.3%)	9 (1.6%)	295 (51.2%)	270 (46.9%)	4.45	.547
4	How satisfied you were in following the instructions	-	1 (0.2%)	16 (2.8%)	298 (51.7%)	261 (45.3%)	4.42	.557
5	Did talking to specialist instill confidence and hope in you	-	1 (0.2%)	15 (2.6%)	293 (50.9%)	267 (46.4%)	4.43	.556
6	Is your health condition improved after teleconsultation	-	4 (0.7%)	22 (3.8%)	284 (49.3%)	266 (46.2%)	4.41	.600
	Teleconsultation quality related information							
7	The voice quality of the Teleconsultation session	-	1 (0.2%)	3 (2.1%)	312 (54.2%)	251 (43.6%)	4.41	.543
8	The visual quality of the Teleconsultation session	-	1 (0.2%)	7 (1.2%)	302 (52.4%)	266 (46.2%)	4.45	.531
9	Were you comfortable in using the telehealth system	-	1 (0.2%)	20 (3.5%)	296 (51.4%)	259 (45.0%)	4.41	.568
10	The ease of getting to the e-UPHC	1 (0.2%)	3 (0.5%)	15 (2.6%)	349 (60.6%)	208 (36.1%)	4.32	.568
11	The length of time of the total Teleconsultation was adequate	2 (0.3%)	9 (1.6%)	20 (3.5%)	318 (55.2%)	227 (39.4%)	4.32	.650
12	Was the teleconsultation being different from face-to-face consultation	-	4 (0.7%)	40 (6.9%)	300 (52.1%)	232 (40.3%)	4.32	.631
13	Your overall treatment experience at using teleconsultation starting from appointment, teleconsultation, prescription, laboratory services and medicine	-	5 (0.9%)	12 (2.1%)	287 (49.8%)	272 (47.2%)	4.43	.583
	Facility Service-related information							
14	Are you were satisfied with the laboratory test at e-UPHC	-	1 (0.2%)	19 (3.3%)	323 (56.1%)	233 (40.5%)	4.37	.556
15	Did you received medicines as prescribed by the specialist at e-UPHC	4 (0.7%)	13 (2.3%)	32 (5.6%)	288 (50.0%)	239 (41.5%)	4.29	.734

Table No. 5 shows the number of "satisfied" patients in two scales and seven parameters. As many as 58.9% participants took Teleconsultation for the first time from e-UPHC. Only 41.1% participants were found to have taken Teleconsultation more than once at e-UPHCs. While 96.2% participants irrespective of first- and second-time consultation were satisfied with the privacy of the Teleconsultation. 98.% participants were satisfied with the confidentiality of the Teleconsultation.

Table 5 Two-point scale answers: Patient's satisfaction, (n= 576)

	Parameters	Yes	No	Mean	SD
	Patient comfort and referral related information				
1	Is/was this your first teleconsultation	339 (58.9%)	237 (41.1%)	.59	.493
2	Are you satisfied with the privacy of teleconsultation	554 (96.2%)	22 (3.8%)	.96	.493
3	Are you satisfied with the confidentiality of teleconsultation	567 (98.4%)	9 (1.6%)	.98	.124
4	Were you satisfied with the cleanliness and safe environment of e-UPHC	567 (98.4%)	9 (1.6%)	.98	.124
5	Would you like to use telehealth again	569 (98.8%)	7 (1.2%)	.99	.110
6	Would you like to recommend telemedicine to another person	570 (99.0%)	6 (1.0%)	.99	.102
7	Have you been refereed to higher center from e-UPHC	114 (19.8%)	462 (80.2%)	.20	.399

Table 6 shows the level of association. The participants were representative from all the nine districts. The above districts are divided in three different categories from 0-33 % in low, 34 to 70% in medium, and 71% and above in high. The high performing districts are Anantapur 47.6%, Nellore- 44.7% and Kurnool 41.4%, significantly higher than Prakasam 26.3%, Chitoor-25.3%, Nellore- 36.8% and West Godavari-42.6%. The results showed that satisfaction level was significantly higher in male age group 43.3 % compared to female group 26.9%. The study also found out that satisfaction level is significantly higher in 51 years and above age group 40.8% compared to 32.1% in 35-50 years and 23.9% in less than 35 years. Overall low level of satisfaction is 37.2%.

Table 6. Level of association with District, Gender and Age Level association

District	Low	Medium	High	Chi-square	p-value
Anantapur	33.3	19.0	47.6%		
Chittoor	25.3%	33.7%	41.0%		
Guntur	42.9%	39.3%	17.9%		
Kadappa	42.9%	28.6%	28.6%		
Krishna	53.2%	27.4%	19.4%	62.2	0.000
Kurnool	35.3%	23.3%	41.4%		
Nellore	36.8%	18.4%	44.7%		
Prakasam	26.3%	57.9%	15.8%		
West Godavari	42.6%	37.7%	19.7%		
Total	37.2%	30.2%	32.6%		
Gender	**Low**	**Medium**	**High**	**Chi-square**	**p-value**
Female	40.3%	32.8%	26.9%	16.7	0.000
Male	31.3%	25.4%	43.3%		
Total	37.2%	30.2%	32.6%		
Age	**Low**	**Medium**	**High**	**Chi-square**	**p-value**

<35 years	41.7%	34.4%	23.9%	15.2%	0.004
35-50 years	40.5%	27.4%	32.1%		
>=51 years	30.1%	29.1%	40.8%		
Total		37.2%	30.2%	32.6%	

Table 7 shows, the validity test done by means of principle factor analysis for all items in the questionnaire. The result of the factor analysis for evaluating dimensionality of the items indicated four factors among the 22 items. KMO analysis (cut-off 0.6). The KMO was 0.95 for all items and the Bartlett's Test of Sphericity was significant (Chi-square=7754.98; Df= 231, p<0.001). The four components are significant which consist of the cumulative weightage of 63.71% of all the questions. The four components: "Specialist Teleconsultation and quality", "Teleconsultation approbation", "Teleconsultation comfort" and "Referral which contributes 63.71% of the variation. "Specialist Teleconsultation and quality" consist of 15 questions with a reliability of 0.959 using Cronbach's alpha and contributes variance of 44.61 %. "Teleconsultation approbation" consist of three questions with a reliability of 0.51 and contributes variance of 7.43%. The overall reliability is 0.927 of all the questions.

Table 7: Rotated Component Matrix twenty-two items about Teleconsultation services

		Component			
		1	2	3	4
	Specialist Teleconsultation and quality				
1	How satisfied you were in following the instructions	**.873**	.036	.023	.046
2	Did talking to specialist instill confidence and hope in you	**.870**	.043	.092	.014
3	The courtesy and respect the specialist you saw	**.861**	.007	.024	.022
4	The explanation of your condition by the specialist	**.857**	.104	.028	.008
5	Your overall treatment experience at using teleconsultation starting from...	**.844**	.134	.063	.030
6	Instructions were given to you by specialist doctor were clear	**.838**	.003	.002	.096
7	Is your health condition improved after teleconsultation	**.822**	.005	.005	.069
8	Were you satisfied with the laboratory test at e-UPHC	**.821**	.112	.060	.079
9	Were you comfortable in using the tele health system	**.817**	.108	.054	.034
10	The visual quality of the Teleconsultation session	**.816**	.038	.016	.071
11	The voice quality of the Teleconsultation session	**.800**	.052	.015	.088
12	The length of time of the total Teleconsultation was adequate	**.729**	.185	.003	.054
13	Was the teleconsultation being different from face-to-face consultation	**.709**	.073	.017	.039
14	Did you received medicines as prescribed by the specialist at e-UPHC	**.692**	.029	.082	.008
15	The ease of getting to the e-UPHC	**.671**	.044	.103	.184
	Teleconsultation approbation				
16	Would you like to use telehealth again	.064	**.830**	.092	-.012
17	Would you like to recommend telemedicine to another person	.064	**.803**	-.124	.082
18	Were you satisfied with the cleanliness and safe environment of e-UPHC	.016	**.425**	.370	-.466
	Teleconsultation comfort				
19	Are you satisfied with the privacy of teleconsultation	.026	-.048	**.750**	-.034
20	Are you satisfied with the confidentiality of teleconsultation	.116	.061	**.793**	.026
21	Is this was your first teleconsultation	-.295	-.025	**.290**	.156
	Referral				
22	Have you been refereed to higher center from e-UPHC	.105	.108	.104	**.869**
	Eigenvalues	9.82	1.64	1.49	1.08
	% of variance	44.61	7.43	6.75	4.91
	% of cumulative	44.61	52.04	58.79	63.71

Table 8 provides the regression estimates and the relative effect of gender, age and district for patient satisfaction, which were included for the final multilinear regression model. Gender was also a strong predictor of patient satisfaction. In a unit, increase in male score, lead to 1.679 increase in the patient satisfaction score with a 95% CI of 0.480–2.88 at a p value 0.006. Similarly increase in age score 35 to 50 years, lead to 1.728 increase in patient satisfaction score with a 95% CI of .318–3.318 at a p value .016. Anantpur and Chittoor districts was significantly high related to patient satisfaction.

Table 8 Regression for Gender, age and district (N 576)

Parameters	Unstandardized B-coefficient	Confidence Interval (95%)		p value
		Lower bound	Upper bound	
Gender				
Male	1.679	.480	2.88	.006
Age				
<35 years	.904	-.439	2.300	.204
35-50 years	1.728	.318	3.318	.016
District				
Anantapur	4.514	2.087	6.942	.000
Chittoor	5.182	2.881	7.482	.000
Kadapa	1.541	-1.173	4.255	.265
Krishna	.241	-2.197	2.678	.846
Kurnool	3.354	1.237	5.471	.002
Nellore	3.891	1.111	6.671	.006
Prakasam	2.622	-.167	5.411	.065
West Godavari	1.694	-.758	4.147	.175

DISCUSSION
This study was conducted under the objectives to assess the service delivery at e-UPHC and the level of satisfaction with Teleconsultations and to understand the urban health care delivery gaps.

Service Delivery
The e-UPHC descriptive data had highlighted the prevalence of NCDs in urban areas and the service uptake by the patient. Diabetes, hypertension, osteoarthritis and acute respiratory infections constitute 62% of all cases for which specialist teleconsultation services were availed. These findings are similar to other studies in which the incidences of diabetes (George et al., 2020) and hypertension is highest in urban areas (Rao & Peters, 2015) (Misra et al., 2001). The demand for specialist teleconsultation services for NCDs was also high. Almost half of the cases were treated by General Medicine specialty. The availability of 32 different lab tests strengthened the entire service delivery. Considering the shortage of experts -biochemist and pathologist, remote report interpretation is a viable solution to provide 32 different laboratory tests, with maintaining the quality. It helped general physician in triaging and specialist doctors for diagnosis, treatment and referral. At least, 5837 (2.8%) cases were referred outside for other specialty consultations and

49% cases were referred for lab tests, medicines, eye test and radiology services. Four specialties able to provide services to 98% cases without referring to other specialty. Numerous paper have highlighted the benefits of Telemedicine and this paper further strengthens the discussion(Health Resources and Service Administration, 2021) (Marcolino et al., 2018). A study in Bangladesh has highlighted the potential demand for Telemedicine services in the coastal areas (Iqbal, 2020).

Accessibility
The proximity the e-UPHC services at the community benefitted 62.63% women and 22.6% of the geriatric population to utilize the services within the community. Out of the total patient registered 18.8% patients were referred for specialist Teleconsultation. Out of 18.8% specialist Teleconsultation further 8258 (3.9%) referred to other specialty outside. This indicates that there are need for more specialty in the Teleconsultation services. In the course of the time, Obstetrics and Gynecology specialists were included in the project in 2020.

Patient satisfaction
The internal consistency of the satisfaction components was very good. These components address particularly the patients' experience of Teleconsultation, service quality, facility services and patient comfort.

The study findings depict that patient satisfaction is more than 90% across all parameters. The level of satisfaction in this study was consistent with that of a study at a Teleneurology unit of HHT in Chile (97%) (Constanzo et al., 2019) and at Teleradiology unit in Netherlands (Jacobs et al., 2016) and orthopedic OPD department in India 92% (Kumar et al., 2020).

As shown in Table 4, among parameters used to assess satisfaction, the courtesy and respect of specialist and explanation of the condition attracted highest satisfaction scores. However, domain related to pharmacy and length of time of Teleconsultation showed slight dissatisfaction amongst the patents. A whopping 96.6% patients were satisfied with Tele laboratory services. The addition of Tele laboratory services and the patient satisfaction is one of the critical factors for overall satisfaction of Telehealth services. No similar studies on patient satisfaction with Tele laboratory services is available. Patients are satisfied with the privacy maintained during the Teleconsultation. External factors like cleanliness and safe environment are a key influencer for overall patient satisfaction at e-UPHC. 99% patients would like to recommend Telemedicine to another person which signifies their confidence for the service.

Patient satisfaction had an important implication to understand the service delivery with the introduction of digital health. Telemedicine is a new concept initiated in the Urban Primary Health Centers. The measurement of patient satisfaction will guide the service providers and planners to identify the gaps.

Human Resources for Health
The study shows that with the remote availability of specialist doctors, the burden of NCDs in urban areas can be addressed and early referral will help in the management of high-risk cases. Remote health services are reducing the burden of patient visits at tertiary care by decreasing OPD visits and hospitalisations, and, in turn overall morbidity and mortality by providing specialist teleconsultations within the reach of the community. Provision of full-fledged Tele laboratory services and availability of centralise expertise of biochemist and pathologist remotely is reducing the demand of their presence on every center.

It provides an opportunity for tertiary care hospitals to focus more on critical care rather on walk in patients. Further, it reduces selective dependence on private health sector for specialist treatment, which also means high out of-pocket (OOP) spending on health — causing financial woes for households, especially low socioeconomic groups (Aditya Singh, 2019). The Uttar Pradesh CHC paper have stressed on shortage of specialist doctors and its implication (Aditya Singh, 2019).

Onset of Covid-19 has triggered the need for acceleration of digital health in India. National Telemedicine guidelines 2020 by MOHFW (Board of Governors - Indian Medical Council, 2020), Govt of India is welcome step and acknowledgement of Telemedicine in India. National Digital Health Mission of Government of India is a leap progress for digital health in India.

CONCLUSION
Considering the low doctor to population ratio and low hospitals to population ratio, remote health services is an effective solution to overcome the current disease burden and mortality in India. Telemedicine or remote healthcare provides new possibilities to confront the existing shortages of specialist doctors.

In this study, patient satisfaction with remote health services have highlighted the high acceptance of remote health services, though the extent to which technology can replace face-to-face interactions remains to be seen. The findings from the study strengthen the case for the need of remote presence of specialist doctors for UPHCs to address NCDs and other disease burden.

The use of electronic heath records is contributing to NCD surveillance, patient monitoring and profiling which is otherwise lacking in existing government UPHCs. Considering the increasing disease burden of NCDs and the risk of comorbidities in India, capacities of NCD surveillance must be strengthened to initiate evidence-based decision making and to protect and promote the health of the population. This study suggests that healthcare workers, public health experts and health policy experts should use digital platforms for quality improvement and ease of accessibility of health services.

The existing e-UPHC model can strengthen the health system to provide quality health services, improve accessibility and affordability for the patients. In addition, this study has implications on the acceptance of digital health and scaling up Telemedicine services in primary health centers to bridge the gap of Human resources for Health in India.

Limitations
Data collection was delayed due to onset of Covid-19 during the study. Many patients provided consent for the study during their visit to the e-UPHC but after five days many patients mobile number was not reachable or out of service. Also, in few interviews, patient's spouse and family members answered the questions on behalf of patient.

REFERENCES
1. Aakriti Grover & R. B. Singh. (2019). Health Policy , Programmes. Springer Link. https://doi.org/10.1007/978-981-13-6671-0
2. Agarwal, S. (2011). The state of urban health in India; comparing the poorest quartile to the rest of the urban population in selected states and cities. Environment and Urbanization, 23(1), 13–28. https://doi.org/ 10.1177/0956

247811 398589

3. Anand, S., & Fan, V. (2016). The health workforce in India:Human Resources for Health Observer Series No. 16. World Health Organinzation, 16, 1–98. https://www.who.int/hrh/resources/16058health_workforce_India.pdf

4. Andemeskel, Y. M., Elsholz, T., Gebreyohannes, G., & Tesfamariam, E. H. (2019). Patient satisfaction with peri-operative anesthesia care and associated factors at two National Referral Hospitals: A cross sectional study in Eritrea. BMC Health Services Research, 19(1), 1–8. https://doi.org/10.1186/s12913-019-4499-x

5. Asamrew, N., Endris, A. A., & Tadesse, M. (2020). Level of Patient Satisfaction with Inpatient Services and Its Determinants: A Study of a Specialized Hospital in Ethiopia. Journal of Environmental and Public Health, 2020. https://doi.org/10.1155/2020/2473469

6. Board of Governors - Indian Medical Council. (2020). In supersession of the Medical Council of India Telemedicine Practice Guidelines. Indian Medical Council, March.

7. Constanzo, F., Aracena-Sherck, P., Hidalgo, J. P., Muñoz, M., Vergara, G., & Alvarado, C. (2019). Validation of a patient satisfaction survey of the Teleneurology program in Chile. BMC Research Notes, 12(1), 1–7. https://doi.org/10.1186/s13104-019-4358-1

8. Dandona, L., Dandona, R., Kumar, G. A., Shukla, D. K., Paul, V. K., Balakrishnan, K., Prabhakaran, D., Tandon, N., Salvi, S., Dash, A. P., Nandakumar, A., Patel, V., Agarwal, S. K., Gupta, P. C., Dhaliwal, R. S., Mathur, P., Laxmaiah, A., Dhillon, P. K., Dey, S., … Swaminathan, S. (2017). Nations within a nation: variations in epidemiological transition across the states of India, 1990–2016 in the Global Burden of Disease Study. The Lancet, 390(10111), 2437–2460. https://doi.org/10.1016/S0140-6736(17)32804-0

9. Emami, A., & Safipour, J. (2013). Constructing a questionnaire for assessment of awareness and acceptance of diversity in healthcare institutions. BMC Health Services Research, 13(1). https://doi.org/10.1186/1472-6963-13-145

10. Ganapathy, K., Das, S., Reddy, S., Thaploo, V., Nazneen, A., Kosuru, A., & Shankar Nag, U. (2021). Digital Health Care in Public Private Partnership Mode. Telemedicine Journal and E-Health : The Official Journal of the American Telemedicine Association. https://doi.org/10.1089/tmj.2020.0499

11. George, C. E., Inbaraj, L. R., Rajukutty, S., & De Witte, L. P. (2020). Challenges, experience and coping of health professionals in delivering healthcare in an urban slum in India during the first 40 days of COVID-19 crisis: A mixed method study. BMJ Open, 10(11). https://doi.org/10.1136/bmjopen-2020-042171

12. Health Resources and Service Administration, U. (2021). What is telehealth? | Telehealth.HHS.gov. 1–7. https://telehealth.hhs.gov/patients/understanding-telehealth/

13. Iqbal, M. H. (2020). Telemedicine: An Innovative Twist to Primary Health Care in Rural Bangladesh. Journal of Primary Care and Community Health, 11. https://doi.org/10.1177/2150132720950519

14. Jacobs, J. J. W. M., Ekkelboom, R., Jacobs, J. P. A. M., Van Der Molen, T., & Sanderman, R. (2016). Patient satisfaction with a teleradiology service in general practice. BMC Family Practice, 17(1), 1–8. https://doi.org/ 10.1186/s12875-016-0418-y

15. Kumar, S., Kumar, A., Kumar, M., Kumar, A., Arora, R., & Sehrawat, R. (2020). Feasibility of telemedicine in maintaining follow-up of orthopaedic patients and their satisfaction: A preliminary study. Journal of Clinical Orthopaedics and Trauma, 11, S704–S710. https://doi.org/10.1016/j.jcot.2020.07.026

16. Marcolino, M. S., Oliveira, J. A. Q., D'Agostino, M., Ribeiro, A. L., Alkmim, M. B. M., & Novillo-Ortiz, D. (2018). The Impact of mHealth Interventions: Systematic Review of Systematic Reviews. JMIR MHealth and UHealth, 6(1), e23. https://doi.org/10.2196/mhealth.8873

17. Ministry of Health and Family Welfare (Government of India). (2013a). National Urban Health Mission: Framwork for Implementation. 80. http://nhm.gov.in/images/pdf/NUHM/Implementation_Framework_NUHM.pdf

18. Ministry of Health and Family Welfare (Government of India). (2013b). The Urban Primary Health Center under NUHM: Roles, Responsibilities and Management. 7.

19. Ministry of Health and Family Welfare, G. of I. (2015). Quality standards for Urban Primary Health Centers.

20. Misra, A., Pandey, R. M., Devi, J. R., Sharma, R., Vikram, N. K., & Khanna, N. (2001). High prevalence of diabetes, obesity and dyslipidaemia in urban slum population in northern India. International Journal of Obesity and Related Metabolic Disorders : Journal of the International Association for the Study of Obesity, 25(11), 1722–1729. https://doi.org/10.1038/sj.ijo.0801748

21. MOHFW. (2013). National Urban Health Mission. Implementation framework. 1–23.

22. Policy, N. H., & Nhp-, T. (1983). National health policy. Issued by the Ministry of Health and Family Welfare, Government of India, 1982. The Nursing Journal of India, 74(5), 121–128.

23. Rao, K. D., & Peters, D. H. (2015). Urban health in India: Many challenges, few solutions. The Lancet Global Health, 3(12), e729–e730. https://doi.org/1 0.1016/S2214-109X(15)00210-7

24. Singh, A, Tyagi, N., Purwar, N., & Nagesh, S. (2020). A Cross Sectional Study to Assess the Impact of Telemedicine on Health Care Services in Primary Health Centre , North India. 3(1), 1–8.

25. Singh, Aditya. (2019). Shortage and inequalities in the distribution of specialists across community health centres in Uttar Pradesh, 2002-2012. BMC Health Services Research, 19(1), 1–16. https://doi.org/10.1186/s12913-019-4134-x