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**“Towards Effective use of Information and  
Communication Technology (ICT) Application in  
Healthcare Management: A Descriptive Study of Online  
Appointment System Services of Hospitals in India**



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## Abstract

This research work investigates Online Appointment System Services offered by hospital websites to study the effective use of information and communication technology. Medical appointments allow sufficient time for each patient's medical condition to be examined thoroughly. Among various methods used in booking appointments, online appointment booking is promising. This research work aims to investigate the Online Appointment Service of Hospitals in India, to assess online appointment service process and to build an improved online appointment model. Descriptive research method was employed in the study. There are a few multi-speciality hospitals offering online appointments for consultations, but most hospitals in India are yet to initiate online appointment facility. The proposed new online appointment model which has evolved out of this research work suggests efficient solutions to enable hospitals to provide better healthcare delivery using ICT applications.

**Key Words:** Online Appointment System Services, Information and Communication Technologies, Healthcare Delivery, Inter-networked Healthcare Delivery

## Introduction

### Information and Communication Technology Applications in Healthcare

Information and Communication Technology (ICT) has improved the healthcare delivery mechanisms, like improvements in service efficiency and information dissemination (Peter Idowua Dan et. al, 2008). According to a report by the European Commission (2011), four categories of ICT applications and tools for health was distinguished. (i) Services addressing health prevention, diagnosis, treatment, long-term care, telemedicine. (ii) Support activities like Electronic Patient Record, Picture Archiving and Communication Systems, ePrescriptions, health portals, Hospital Information Systems. (iii) Provision of health knowledge infrastructure, medical education, medical research and clinical trials. (iv) IT infrastructure for physical networks allowing connectivity, interoperability, and regulatory framework related to secure transmission, secure processing and storage. As the health care industry moves toward the advancement of a personalized health experience, methods to improve the access, efficiency, effectiveness and quality of the processes has become important (Tomasi, Facchini and Maia, 2004; Arthur Hylton III and Suresh Sankaranarayanan, 2012).

### Online Healthcare for patients

Information and Communication Technologies such as the Internet, the quality of patient care doesn't end with good bedside manner. The Internet has great potential for increasing patients' access to health information could integrate patient management and health information management into a single, flexible system that is easy to use and maintain (Jodiê Smith, Suresh Sankaranarayanan, 2012).

Initially, the health care industry has been slow in accepting the use of advanced information systems. In most hospital practices, Hospital Information Systems for many years relied on paper based systems, for task like appointment scheduling and in maintaining medical records (Marques et al, 2011). This research investigates the use of one component of ICT tools used in Hospital Information Systems, the Online Medical Appointments through hospitals' website and assess it quality of service.

### Medical Appointments

According to the Medical Dictionary by Farlex, Medical Appointment is a mutually agreed-on time reservation for patient to receive treatment (medicaldictionary.com). From a patient point of view, appointment-making is the time the patient wish to consult a doctor to avoid unnecessary waiting at the hospital.

A medical appointment is most often scheduled over the telephone or in person (Patient Scheduling, 2013). According to Centre for Disease Control and prevention (2004), an appointment is scheduled to define a date, time, location and resource for the clinical encounter to have the order carried out.

### Types and Methods of booking Medical Appointments

There are two types of medical appointments, scheduled appointments and unscheduled appointments. Unscheduled appointments do not require any booking and involves patients' walk-ins to the hospital or clinic. In Scheduled appointments, the patient confirms the availability for the offered appointment time through Phone, SMS, or internet

**Table 1: Unscheduled Method of booking Medical Appointments**

Method	Features	Merits	Demerits
<b>Walk-in</b>	Appointment not scheduled First come, first serve basis Worked in to existing schedule	Appropriate for urgent or emergency cases	Patients kept in queue Unacceptable waiting times Great stress on hospital/clinic staff Exorbitant paper work

**Source:**

Diwakar Gupta and Brian Denton, 2008, Press Ganey Associates, Inc. 2010, Patterson Companies, Inc. 2012, Arthur Hylton III and Suresh Sankaranarayanan, 2012; Patient Scheduling, 2013

**Table 2: Scheduled Method of booking Medical Appointments**

Methods	Features	Merits	Demerits
<b>Phone</b>	Patients call hospital and fix appointment in advance	Overall reduction in time wastage Quick appointments	Overcrowding of hospital telephone lines Unable to be answered at all times Obtaining limited patient information Time- and resource-draining process

<p><b>Interactive Voice Response (IVR) Automated Phone</b></p>	<p>Computer or machine interact with humans through the use of voice and dual-tone multi-frequency signalling (DTMF) keypad inputs</p> <p>Pre-recorded/dynamically generated audio for caller navigation through appointment system</p>	<p>Services high call volumes Reduces cost, and improve the customer experience Convenient to call a dedicated line for appointment Confirmation SMS immediately after fixing appointment</p>	<p>Relatively a year old and the ease of its use is yet to be assessed</p>
<p><b>SMS</b></p>	<p>SMS request to mobile/short coded number Prior registration of user mobile number mandatory Message format given by service provider</p>	<p>Patient data automatically stored in database SMS confirmation after fixing appointment Convenient to fix or cancel appointment Automatic reminder by SMS to Patient, Doctor and Hospital regarding appointment</p>	<p>Success of this system depends largely on the reliability of the mobile service provider</p>
<p><b>Internet</b></p>	<p>Appointments via web-connected device such as a computer, laptop, smartphone or tablet 24/7 virtual medical receptionist Available on web site by hospital/clinic or web portal Appointments online requires a patient or his/her represented family physician reserve consultation time by entering name, family name, mobile phone number and other contact information of patient. Specialist can be chosen by health care institution, family name, speciality and consulting-room or by the set of all these criteria. Customizable date and time slot display (Online Calendar)</p> <p>Notes for each appointment recorded by each Consultant</p> <p>Multiple level of user security &amp; user groups</p>	<p>User-friendly technology, more popular Booking from anywhere, anytime No human assistance and hence, no human errors. Cost-effective Effective optimization of scheduling process Doctors organise best practice sessions, better interaction Avoids waiting time 24 hours convenience Viewing daily weekly and monthly patient schedules made easy Patient view doctors schedule and select convenient dates Automatic confirmation of booking and instant recording</p>	<p>Not an option for most patients Internet access, skill, preferred language required for online activities Privacy maintained but not a guarantee</p>

	<p>Customisable resource (such as room, equipment) management</p> <p>Customisable client customer data fields</p>	<p>Cancellation of appointment is possible</p> <p>Multiple views (such as daily view, weekly view, consultants view) on appointments</p> <p>Recording, updating and accessing patient information is made easy</p> <p>Recurring appointments for multiple patient visits</p> <p>Avoid no-show, missing, overbooking appointments or other conflicts</p> <p>Reduced Paperwork</p> <p>Easy to track insurance coverage</p> <p>Easy to find vacant scheduled time</p> <p>Simplifies cross-scheduling, and the directing of patients to other offices</p>	
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**Source:**

Phone: O. A. Akadiri et.al. 2009, Ryan Field et. al. 2011, Appointment -Plus, 2012  
 Interactive Voice Response (IVR) Automated Phone: Computer Weekly News, 2013, Khaleej Times, 2013  
 SMS: Vilnius, 2008;  
 Internet: Kopach et. al. 2007; Richard Lango, 2009; T. Edwards and S. Suresh, 2009; George Ruth, 2009; Aubrey Andrew, 2010; Gayathri, 2013

**Table 3: Internet based Online Appointment Booking – Web Portal and Hospital/Clinic Website**

Method	Features	Merits	Demerits
<b>Internet (Web Portals)</b>	<p>Creates a single, customizable point of access to any consortium of health care providers registered in the portal</p> <p>Patients make appointments online with various care providers</p>	<p><b>Convenient, 24 hour, self-service options</b></p> <p><b>Patients book appointments at nearest hospital/clinic</b></p> <p>Efficient use of resources and possibility for patients to choose services of specialists from different</p>	<p>Common web portals are not available in all countries</p> <p>Lack of information about common web portals</p>

	<p><b>Two-way communication channel between patients and a consortium of health care providers</b></p> <p>Patients book appointments by logging in and selecting from a menu of choices.</p> <p>Displays available appointments by provider, time slot, clinical session and/or day of the week</p> <p><b>Web portals act like outsourcing appointments</b></p>	<p>health care institutions</p> <p>System helps automate patient reminders, which, again, reduces the time pressures on practice administrative staff</p> <p>Outsourcing appointment patients to call in and schedule appointments in vacant time slots</p>	<p>The success depends upon the common web developers</p>
<p><b>Internet (Hospital/Clinic Website)</b></p>	<p>Provides patients with more specific information on the respective hospital's websites</p> <p>Online appointment system through dedicated web page can be integrated with a hospital/clinic website.</p>	<p>Hospital website are more reliable than web portals</p> <p>Hospitals employ dedicated staff for follow-up</p> <p>Assistance from hospitals is an added assurance</p>	<p>All hospitals/clinics do not have a website</p> <p>Lack of information about the availability of the service to the patients or users</p> <p>Not an option for most patients</p> <p>Internet access, skill, preferred language required for online activities</p>

**Sources:**

Internet (Web portals): Report of the Health ICT Industry Group, 2009; **Elizabeth W. Woodcock, 2011**; ICT News, 2013  
 Internet (hospital/clinic websites): Cao Yin, 2011

### **Literature Review – Application of Online Appointment System Services in hospitals, worldwide.**

The East Tallinn Central Hospital was the first in Estonia to introduce an ePatient portal through the hospital's website and found to be very successful. Access is through the hospital's website, and the portal allows patients to view their medical records, to book medical appointments and pay consultation fees. Patients reported that the system made convenient appointment booking from their homes (European Commission, 2011).

Patient Appointment Reservation System was introduced in 40 different health care institutions in Lithuania to improve the quality of health care services increasing the availability, expedition and the effectiveness of the information of physicians' visits time. Since the beginning of this project in 2008 patients appointment reservations via Internet have been increasing steadily. The system proved to be a great advantage for the patients and primary care physicians and its use have been steadily rising till date (Vilnius University Hospital, 2008).

The public health portal 'Sundhed.dk' in Denmark integrates health-related data from disparate health care systems throughout Denmark. Patients can schedule a medical appointment using the portal's scheduling module. Patients experience more benefits like receiving appointment confirmation via e-mail, and sees as a quick relief of being tied to the phone. (Report of the Health ICT Industry Group, 2009).

Makerere University Hospital, Uganda, introduced an online appointment system to access doctors' schedules and book appointments. A study on this system by Atwine et.al. (2009) found that the administrators used the system to register new users, edit schedules and view pending results. A short messaging system has been interfaced through the system to ensure communication between patients and doctors.

Between 2006 and 2009, a Healthcare Online Programme, an initiative launched by the Spanish government to accelerate Spain's integration into the Information implemented online appointments in all primary care health centres to book appointments with General Practitioners and Paediatricians. A study report of the programme states that by 2006 more than 12 million appointments to see paediatricians and GPs were requested online. Nearly 86% of Spanish citizens registered at the 3,321 primary care Health Centres that offered the Online appointments service. The study also revealed that by the end of 2009 about 37 million citizens benefitted from the online appointment service in the National Health System, which represents a 67% increase over two years (Report of the Healthcare Online programme, 2010).

Extended waiting times for a medical appointment continued to be problematic in China. To address this issue, a web-based appointment system was developed for the Xijing hospital. Cao et al. (2011) studied the efficacy of the system and found that compared to the usual queuing method, the web-based appointment system could significantly increase patient's satisfaction. With online registration, total waiting time was effectively reduced. Lack of information about online appointments was the main reason for most of the patients not using the system.

## **Methodology**

Objectives of the research

- To investigate the Online Appointment Service of hospitals in India
- To assess hospital's Online Appointment service process
- To build an improved online appointment model suitable for hospitals in India

## **Research Method**

Descriptive research design was used for this study. According to Burns and Grove (2003), descriptive research “is designed to provide a picture of a situation as it naturally happens”. It may be used to justify current practice and make judgment and also to develop theories. There are three main types of descriptive research design: observational methods, case-study methods and survey methods. For the purpose of this study, observation method was employed to obtain information used in the hospital's website that provide online appointment service for patients. Observation method is used when no intervention is made (in contrast with an experimental method). Such method provide estimates and examine associations of events in their natural settings without recourse to experimental intervention (C J Mann, 2003).

## **Survey of Online Medical Appointment Application through Hospital websites**

This research studies the application of Online Medical Appointments of hospitals in India and measures its quality of the process and excludes private web portals, as there are no dedicated and authentic web portal for booking appointments approved by any hospitals or government in India.

## **Choice of Sample population and its determination**

India houses many hospitals both public and private. To identify the sample population across the states of India, the authors searched for a list of hospital data what was selected based on a scientific investigation. A rating study by The Week and HANSA on 2011 India's Best Hospitals, published in The Week magazine on December 12, 2012 (The Week-HANSA Research Survey, Full Report, 2012) was chosen.

## **Background of The Week and HANSA Research**

To determine India's Best Hospitals, hospitals with a minimum of 100 beds, which have completed at least 2 years of being operational, and which have received 5 per cent or more of the total nominations from physicians were included in the survey. The survey has taken factual data into account in the rankings. A primary survey was conducted among 917 Experts—328 general physicians, 442 specialists and 147 pathologists/radiologists.

A questionnaire was given to the experts asking them to nominate and rate the top five multi-speciality hospitals in India and within their city. Apart from this, 77 qualitative interviews that went beyond nominations and ratings were also done to get an in-depth understanding of the reasons for the rankings. An advertisement was printed in THE WEEK inviting hospitals to volunteer information. For multi-speciality hospitals in India, ranking was based on a composite score derived by combining the perceptual and factual score of the hospital. (The Week-HANSA Research Survey, 2012).

The Week and HANSA used the following parameters for rankings of the hospitals:

- overall reputation of the hospital,
- competency of doctors,
- infrastructure,
- availability of multiple specialities,
- patient care,
- hospital environment and innovation in treatment

### Sample Selection

All hospitals, excluding pathological, imaging centers from The Week and HANSA were taken for the study. Therefore 144 hospitals' from 18 cities ranked under the city and speciality wise was chosen for the study. The following are the hospitals selected, listed city wise. The figures in brackets refers to the total number of hospitals selected from each city and listed alphabetically.

1. Ahmedabad (Gujarat) (8)
2. Bangalore (Karnataka) (18)
3. Chandigarh (1)
4. Chennai (Tamilnadu) (16)
5. Coimbatore (Tamilnadu) (7)
6. Delhi (15)
7. Hyderabad (Andhra Pradesh) (11)
8. Indore (Madhya Pradesh) (6)
9. Kochi (Kerala) (7)
10. Kolkata (West Bengal) (10)
11. Lucknow (Uttar Pradesh) (5)
12. Ludhiana (Punjab) (4)
13. Madurai (Tamilnadu) (1)
14. Mumbai Maharastra) (12)
15. Nagpur (Maharastra) (5)
16. Pune (Maharastra) (8)
17. Thiruvananthapuram (Kerala) (9)
18. Vellore (Tamilnadu) (1)

### For the list of Hospitals selected for the study, please refer to the Appendix I

The 144 hospitals' website were accessed between July 6<sup>th</sup>, 2013 and July 15<sup>th</sup>, 2013. Each hospital website was navigated to find if the website had the accessibility for online medical appointments for patients. Besides, the input of the hospital's structure was obtained from the website

The structure of the hospital refers to the following criteria:

1. Ownership pattern [Government Hospital (Center/State), Semi-Government, Voluntary Agencies, Charity Hospitals, Private/Corporate)
2. Locality (Urban, Rural, Semi-urban)
3. Speciality (various disciplines of medicine)
4. Objective (General, Speciality, Teaching-cum-research hospital)

**Table 4: Estimated Sample population**

S. No	Category	Items in each category	Number of Hospitals (144)	Total
1	<b>Ownership Pattern</b>	Central Government	7	
		State Government	18	
		Semi-Government	2	
		Voluntary Agencies	5	
		Charity Organisations	13	
		Private/Corporate	99	<b>144</b>
2	<b>Locality</b>	Urban	144	
		Rural	0	
		Semi-urban	0	<b>144</b>
3	<b>Hospitals by Speciality</b>	Multi-Speciality	55	
		Super-Speciality	29	
		General Hospitals	19	
		Multi-Super Speciality	13	
		Single Speciality	28	<b>144</b>
4	<b>Hospitals by Objective</b>	Speciality Services	100	
		General Services	6	
		Teaching-cum-research	38	<b>144</b>
5	<b>Hospitals owing website</b>		141	
	<b>Hospitals without website</b>		3	<b>144</b>
6	<b>Hospitals having online Appointment service</b>		<b>42</b>	
		Central Government	0	
		State Government	0	
		Semi-Government	0	
		Voluntary Agencies	2	
		Charity Hospitals	1	
		Private/Corporate Hospitals	39	<b>144</b>
7	<b>Specialities having Online Appointment Services</b>	Multi-Speciality	20	
		Multi-Super Speciality	6	
		Super-Speciality	5	
		General	3	

		Single-Speciality	8	144
8	<b>Hospitals without online Appointment Service</b>		102	

### **Chosen and Determined Sample Population**

The results of the study revealed that 42 hospitals from different cities have online Appointment system Services. Further it was noted that Apollo Hospitals have one common website for all the branch hospitals in Ahmedabad, Bangalore, Chennai, Delhi, Hyderabad, Indore and Kolkata; Fortis Hospitals have one common website for its branches in Bangalore, Chennai and Delhi; and Global Hospitals have common website for its Bangalore, Chennai and Hyderabad Hospitals. Hence Apollo, Fortis and Global Hospitals were taken as single unit Hospital for the study. 10 branch hospitals of the Apollo, Fortis and Global were consolidated for final analysis. Therefore, the sample hospitals thus taken for further analysis is 32. **(For the list of Hospitals selected for the study, please refer to the Appendix II)**

### **Measuring the quality of Online Appointment Process**

To measure the quality of the Online Appointment System Services for the sample, it was found that several earlier studies dealt with models assessing a website or a portal in terms of information, appearance, usability, and privacy and security (Hsin H Chang and Ching S Chang, 2008) which does not fulfil the objective of the research. In search for a scientific model to assess the Online Appointment System a U.S. Patent No. 20110313806 by Ian Huang published on December 22, 2011 is used in this research to measure the Hospital's Online Appointment System Services. The Patent is published in the website of the US Patent and Trademark Office (Ian Huang, 2011).

### **Background of U.S Patent no. 20110313806 on Online Appointment Booking System**

U.S Patent no. 20110313806 relates to an Online Booking System which can be used for example doctors, dentists and the like. The method explained in the patent has used a model appointments are made is in the medical field where a patient or user needs to book appointment with a family doctor who may then subsequently require the patient to book an appointment with a specialist, hospital, blood lab, X-ray Clinic or other scanning facility.

This patent published in December, 2011 have been an improved method on Online Booking Appointment System developed on the earlier online appointment methods for example U.S Patent No. 6.345, 260 and U.S 2010/0070303. This method claims to have filled the lacunae created by the earlier systems in terms of providing better search and display algorithms to provide a comprehensive booking service for patients, clients, doctors and the like.

### **Assessment of the Sample Population of 32 Hospitals in India providing Online Appointment service by comparing with components proposed by U.S Patent No. 20110313806**

For assessing the sample population of the 32 hospitals in India providing Online Appointment service, the U.S Patent No. 2011030313806 is used. The patent relates to a web based information system that will enable patients (clients) to access doctors' schedules and book appointments online irrespective of the location and time.

The Patent describes the components involved for patients to register information that relates to patient's demographics details, time and date of appointment, health and medical data for completing the online appointment booking process. Each component is listed to identify how patients go through a series of steps to complete the online appointment process by providing individual patient data.

The Sample Population of 32 hospitals in India providing Online Appointment service is compared with each of the 25 components proposed in the patent.

**Table 5: Results of the assessment of the Sample Population of 32 Hospitals with U.S Patent No. 20110313806**

S.No	Components proposed in the Patent No. 20110313806	No. of hospitals having this item (32)
1	Patient Registration ID or Access Code	9
2	Search By Location	12
3	Search By Doctor	23
4	Patient's Name	27
5	Patient's Address	21
6	Patient's Phone Number (Telephone and Cellular Number)	26
7	Patient's email ID	24
8	Date of Birth	18
9	Gender	17
10	Appointment Type	1
11	Patient's Message	16
12	Doctor's email and Phone Number	0
13	Online Calendar for Appointment	23
14	Book Appointment with next available doctor	0
	Preferred date for booking	23
15	Preferred time for booking	12
16	Referral and Consent Letters	2
17	Local Government Health Identification Number	0
18	Health Insurance Company and Policy Number	1
19	Credit Card Number	0
20	Family Dependant Registration	0
21	Approval from Patients for Accepting Messages from Doctors/Hospitals	0
22	Rebooking Appointments	0
23	Cancelling Appointments	1
24	Recall Appointments	0
25	Security Code	12

### **Discussion of evaluation with US Patent No. 20110313806 and Evolution of a new ground truth criteria for evaluation**

It was observed that U.S Patent No. 20110313806 was insufficient to assess the quality of the online appointment services by the sample hospitals, as the hospitals had more significant components than that proposed by the Patent. When the rule becomes insufficient, then the sample population cannot be assessed against the rule and consequently a new rule has to be used for assessment. However, it is noted that there is no other rule other than the Patent to assess an online appointment system of hospitals. Consequently when the ground truth criteria is not available for evaluation, then a ground truth criteria can be evolved out of the entire population for assessment. With regards to online appointment system for hospitals, the entire population gets restricted to the chosen sample population as given in previous paragraphs. Further, the online appointment system of hospitals in the sample population differs substantially except in some areas where there is similarity. Therefore, the ground truth criteria can be evolved out of the sample population itself and can be used to evaluate the same sample population due to reasons of the sample population approximating the entire population and substantial difference between each of the hospitals in the sample population.

Each sample hospital is taken up and the observed components are listed. Similar components are excluded so as to avoid repeating it for more than one time. Whenever a new component is observed it is listed along with the other components. The process is repeated for all the 32 hospitals until all the observed components are fully listed. The components thus arrived at for the new ground truth criteria for evaluating the online appointment system in hospitals is given below.

### **Components of new ground truth criteria for evaluating online appointment system in hospitals (listed alphabetically)**

1. Address of the emergency Contact Person
2. Alternative Choice of Date
3. Appointment Alternative Time choice
4. Appointment Category
5. Appointment Confirmation No
6. Appointment Date
7. Appointment Time
8. Appointment Type
9. Blood Group
10. Cancellation option
11. Captcha Code
12. Date of Birth
13. Doctors Profile
14. Doctors Schedule
15. Emergency Contact Person
16. Father's Name/ Spouse name
17. Gender
18. Health Insurance and Policy Number
19. Hospital Registration No/Access no
20. Insurance Company
21. Marital Status
22. Name of the Employer/Company
23. Nationality

24. Passport No and Date of Expiry of Visa for Foreign Nationals
25. Patient E-mail ID
26. Patient Message/Remarks/details about Symptoms
27. Patient Name
28. Patient Phone/Mobile No
29. Patient's Address
30. Phone No of the emergency Contact Person
31. Print Option
32. Profession
33. Referee Name
34. Relationship of the Patient to the Emergency Contact Person
35. Religion
36. Search by City
37. Search by Doctor
38. Search by Hospital
39. Search by Speciality
40. SMS/Phone/email Confirmation of using Online Booking
41. Upload Medical case
42. Upload Photo
43. User Email ID
44. User Name
45. User Phone/mobile No

**Table 6: Evaluation of Sample Population of 32 Hospitals with Proposed New Ground Truth Criteria for evaluation of online appointment system of hospitals**

- **Not Working** – 7 hospitals having online appointment system service did not function at the time of research.

S.No	Classification Category	Items in each Classification/Category	No. of hospitals having this item
1	<b>Pre-Appointment Booking facilitations</b>		
1.1		Hospital Registration No/Access no (one time access number)	9
1.2		Search by Doctor	23
1.3		Search by City	12
1.4		Search by Hospital	10
1.5		Search by Speciality	25
1.6		Appointment Category (first time or follow-up)	4
1.7		Appointment Type (consultation/diagnosis/health check-up)	1
1.8		Doctors Profile	2
1.9		Doctors Schedule	10
1.10		Appointment Date	23

1.11		Alternative Choice of Date	3
1.12		Appointment Time	12
1.13		Appointment Alternative Time choice	1
2	<b>Patient Demographics</b>		
2.1		User Email ID	2
2.2		User Name	5
2.3		User Phone/mobile No	4
2.4		Patient E-mail ID	24
2.5		Patient Name	27
2.6		Patient Phone/Mobile No	26
2.7		Date of Birth	18
2.8		Nationality	11
2.9		Gender	17
2.10		Father's Name/ Spouse name	3
2.11		Marital Status	3
2.12		Patient's Address	11
2.13		Profession	4
2.14		Name of the Employer/Company	2
2.15		Religion	2
2.16		Upload Photo	1
2.17		Emergency Contact Person	2
2.18		Relationship of the Patient to the Emergency Contact Person	1
2.19		Address of the emergency Contact Person	2
2.20		Phone No of the emergency Contact Person	2
2.21		Passport No and Date of Expiry of Visa	1
2.22		Referee Name	2
3	<b>Clinical Data</b>		
3.1		Blood Group	1
3.2		Upload Medical case	2
3.3		Patient Message/Remarks/details about Symptoms	16
4	<b>Details of Health Insurance</b>		
4.1		Insurance Company and Health Insurance Policy Number	1
5	<b>Post Processing Facilitation (Acknowledgement / Confirmation / Cancellation)</b>		
5.1		Immediate SMS/Phone/email Confirmation of using Online Booking	5

5.2		Appointment Confirmation No	23
5.3		Print Option	2
5.4		Cancellation option	1
6	<b>Online Security Features</b>		
6.1		Captcha Code	12

## Discussion

A current analysis of the sample hospitals, although some features and functionality come standard with some online appointment systems, most of them vary widely among the many hospitals, provided the 45 ground truth criteria for evaluation and thus classified under six major components such as 1. Pre-Appointment Booking Facilitation 2. Patient Demographics 3. Clinical Data 4. Health Insurance 5. Appointment Post Processing 6. Online Security Features.

### Pre-Appointment Booking Facilitations

Items classified under this category facilitates the patients or users to easily navigate the hospital website even without their physical presence. One time registration number or access number if generated to the patients, data access and retrieval becomes easy for the hospital personnel. But it is evident from the findings that most of the hospitals do not provide such facility. Major search facilities like search by doctor and speciality are highly considered by most of the hospitals. Choosing appointment date, which forms the most priority facility in an online appointment system is provided by most hospitals, but some hospitals don't have such facility that ultimately don't serve the purpose of the system. Appointment type, Appointment category, doctor's profile and schedule were also given least priority. Alternative choice of appointment date and time are least considered by the hospitals. This inefficiency on part of the hospital online appointment system will lead to indirect waiting time for the patients.

### Patient Demographics

Information on patient demographics could receive first-hand input which has been ignored by most of the hospitals. The patient demographic information for registration is an integrated patient management system, which captures complete and relevant patient information. Initially, the online appointment system automates the patient administration functions to have better and efficient patient care process. Information on patient email, name, and phone number are highly considered being able to contact you patient is important. Other demographics details as evolved in the ground truth has not been given enough preference. This lack of information will make patients to spend an extra time in disbursing such details that would affect the quality time spent in the hospital outside of doctor's consultation time.

### Clinical Data

In an online appointment booking process, clinical information about the patient will give the doctors time to understand the patient's existing health status before the appointment due that can make face to face interaction more effective. Most of the hospitals are yet to apply this criteria in their online appointment service.

### **Details of Health Insurance**

Majority of the hospitals have not considered this criteria in their online appointment services. Health Insurance details of the patients though used only after hospitalisation, it can serve as a guiding tool for hospitals to check if any such insurance plans are restricted from service to the patients. On patients visit to the hospitals, it can be informed to such patients about any inconveniences present in the health insurance. This eases last minute tension on hospital disbursements. Though the details of the health insurance not an important criteria at the time of booking appointments, it may be helpful for information processing of the patient data quickly.

### **Post Processing facilitation (Acknowledgement / Confirmation / Cancellation)**

Most hospitals render an appointment confirmation number but immediate SMS/phone/email confirmation is processed by very few hospitals. Other post processing facilitation like print option of the entire details of appointment and cancellation option are yet to be recognised as an important criteria by majority of the hospitals. This suggests that most of the hospitals are not backed by a separate IT department to process the incoming online appointment service.

### **Online Security Features**

In compliance with the National Cyber Security Policy of India, 2013, security of online information is mandatory and it also applies to an online booking system. Service providers should incorporate the latest security measures and practices, such as secure server databases, data storage and back-up procedures. For the protection of the patient data, hospitals use a captcha code for patients to enter in the online appointment process. Again, majority of the hospitals do not have such feature.

Overall, patients or users of the online appointment system if facilitated with each of the items classified can obtain easy and less stressful ways to book a doctor appointment. It is noted that most of the hospitals, even among those multi-speciality hospitals that have a high volume of patients walking in offer only a few of the criteria signifying that such hospitals have not updated their online appointment services.

### **New Model for Online Appointment Booking System Service**

The 45 criteria model evolved from the sample hospitals classified under six major components, 1. Pre-Appointment Scheduling Facilitation 2. Patient Demographics 3. Clinical Data 4. Health Insurance 5. Appointment Post Processing 6. Online Security Features will serve as new model and as an entry point to schedule an appointment with the hospital for any types of medical appointment. This proposed model will provide enhanced healthcare by providing timely consultation through instant access to comprehensive patient information.

### **Effectiveness of the model**

A patient centric robust system, this model can be adopted by any hospitals in India and can also be applied to other countries. This model can be used to integrate information across the different department of the hospital for example, data from online appointment services to the Electronic Medical Records (EMRs) for clinical decision making and in computing test results etc. The collection of individual patient information permits the establishment of a longitudinal medical record which is invaluable for improving care of the individual at a lower cost. Application of the model in the hospital's website can enhance patient satisfaction, fewer scheduling errors, reducing no-shows and up-to-date patient information. Effectiveness that can be attained from the perspectives of all the stakeholders are discussed.

### **Hospital's perspective**

The extensive patient information as suggested in the evolved model serves as a reference for hospitals to develop related health care systems and enhance the service quality like adding more resources in terms of staffing for IT and other back end operations. Embracing the new model, even government hospitals can become on par in delivering quality services compared to the majority of private hospitals. The private hospitals offering multi-speciality and super-speciality services can add the quality of the online appointment services by including all the criteria in their services. This model covers all problems that arise out of inefficient booking systems in every hospital like that of finding a suitable match among the available time slots of providers in the clinic, provider prescribed restrictions on how available slots may be filled and patients' preferences for day/time of week. Additionally, linking insurers, healthcare providers, government, and patients has the potential to reduce significantly administrative costs in terms of less paper work. Online services through hospital websites will reach patients more quickly as choice of treatment are most of the times, hospital centric as patients will quickly recall the hospital than a doctor or a speciality. Using this model, hospitals could learn how patients rate their organization's service quality through patients' cognition of technology-based service encounters that can further improve their service standard.

### **Doctor's Perspective**

Doctors are always impacted by the uncertainty in the number of patient appointments on any given day. The proposed model can reduce this uncertainty. From the perspective of individual doctors, this model helps doctors have an opportunity to review the list of upcoming patients and details about their complaints. Further it reduces the complexity time management as it gives an overview of the number of patients booked thus saving direct communication time for the patient. Above all, by allowing patients to book their own appointments online using this exhaustive model, a new channel of communication can be exploited by both the patient and doctor to better manage their relationship. Since most of the information about the patients are given, doctors can study the patient data much before the actual visiting time, thus making the patients feel more involved. Doctors do not waste time waiting for patients who are late or have forgotten about the visit due to unforeseen coincidence or other reasons. Doctors signed to the system can monitor status of visits of his/her patients.

### **Patients' perspective**

With the rise of more informed patients, the model can help patients chose a specialist, location by city or hospital wise or by the set of all these criteria in a hospital. Easy access to a doctor is the first step for patients using health services. When finding a proper specialist patient is able to view all available times of visits and select the most convenient one. One time information input by the patients can lessen the time spent in the hospitals. Through this model, patients are automatically informed about the upcoming visit time by SMS and signed in to the system they can always cancel the visit. Patients receive text messages reminding about upcoming visit time, informing about time or the availability changes of the visit, besides, patients can also cancel the visit and warn specialists about not showing up.

### **Government Perspective**

This proposed model can drive good health care facilities for the citizenry. The aim of the government should be to ease delivery of health care by allowing patient records to be kept in a database and accesses online, which the proposed model will serve as linking tool, especially when the government may want health reports of the people for allocating national

identification health number in future as like that of US and Europe. Further this proposed model can be used to study (a) long term studies on health patterns, healthcare trends, lifestyle diseases, chronic illnesses, drug usage (b) short term studies on disease/epidemic outbreaks, control of epidemics, patient response to epidemic control, etc. (c) framing/evolving of new/improved healthcare policies as information about the patients can be made assessable to benefit the entire population.

## Conclusion

This research work investigated the Online Appointment System Services of hospital websites in India and assessed the quality of the process. The assessment yielded valuable insight into the structure and build-up of the current online appointment systems in hospitals in India. U.S Patent no. 20110313806 on Online Appointment Booking System offered a comprehensive set of suggestive modules in setting up of good online appointment systems in hospitals. The same patent was used as a benchmark to evaluate the existing online appointment models of hospitals in India. The results of this evaluation inspired the evolution of a new exhaustive, comprehensive, efficient online appointment model for hospitals in India, which will serve to provide efficient ICT based healthcare delivery. The proposed new model provides an efficient communication tool that facilitates provisioning of comprehensive healthcare delivery through its various modules. Implementation of this new model will also help to facilitate healthcare delivery through inter-networked hospitals as an outcome of the strengths of the new model.

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## **Appendix I**

### **List of Hospitals chosen for the study (arranged in order of City, alphabetically)**

#### **I. Ahmedabad (Gujarat)**

1. The Gujarat Cancer and Research Institute
2. Sterling Hospitals
3. Apollo Hospitals
4. SAL Hospital
5. Shalby Hospitals
6. Care Institute of Medical Sciences
7. HCG Medi-surge Hospital
8. B.J Medical College

#### **II. Bangalore (Karnataka)**

1. Narayana Nethralaya
2. M S Ramaiah Memorial
3. Fortis Hospital
4. Columbia Asia Referral Hospital
5. Apollo Hospital
6. St. John's Medical College
7. BGS Global Hospitals
8. Bowring & Lady Curzon Hospital
9. Mallya Hospital
10. National Institute of Mental Health and Neuro Sciences
11. Nethradhama Superspeciality Eye Hospital
12. Narayana Hrudayalaya
13. Sri Jaya Deva Institute of Cardiovascular Sciences and Research
14. Manipal Hospital
15. Kidwai Memorial Institute of Oncology
16. Healthcare Global Enterprises
17. Hosmat Hospital
18. Sparsh Hospital

#### **III. Chandigarh (1)**

1. Post Graduate Institute of Medical Education & Research

#### **IV. Chennai (Tamilnadu)**

1. Apollo Hospital
2. Billroth Hospital
3. Cancer Institute, Adyar
4. Chetnad Health City
5. Dr. Mehta's Hospital
6. Dr. Mohan's Diabetes Specialities Centre
7. Fortis Malar Hospital
8. Global Hospitals & Health City
9. Government General Hospital
10. M.V. Hospital for Diabetes

11. Madras Mission Hospital
12. MIOT Hospitals
13. Sankara Nethralaya
14. Sri Ramachandra Medical Centre
15. Vasan Eye Care
16. Vijaya Hospital

**V. Coimbatore (Tamilnadu)**

1. Aravind Eye Hospital
2. G. Kuppusamy Naidu Memorial Hospital
3. Ganga Hospital
4. KG Hospital
5. Kovai Medical Center and Hospital
6. PSG Hospitals
7. Sri Ramakrishna Hospital

**VI. Delhi**

1. All India Institute of Medical Sciences
2. Batra Hospital & Medical Research Centre
3. BLK Super Speciality Hospital
4. Dr. R.P. Centre for Ophthalmic Sciences (AIIMS)
5. Dr. Ram Manohar Lohia Hospital
6. Dr. Sharoff's Charity Eye Hospital
7. Fortis Escorts Heart Institute & Research Centre
8. GB Pant Hospital
9. Indian Spine Injuries Centre
10. Indraprastha Apollo Hospital
11. Max Super Speciality Hospitals
12. Medanta-The Medicity
13. Rajiv Gandhi Cancer Institute & Research Center
14. Sir Ganga Ram Hospital
15. Vidyasagar Institute of Mental Health & Neuro Sciences

**VII. Hyderabad (Andhra Pradesh)**

1. Apollo Hospitals
2. CARE Hospitals
3. Global Hospitals
4. Kamineni Hospital
5. Krishna Institute of Medical Sciences
6. LV Prasad Eye Institute
7. Medwin Hospitals
8. Nizam's Institute of Medical Sciences
9. Osmania Hospital
10. Rainbow Children's Hospital
11. Yashoda Hospital

**VIII. Indore (Madhya Pradesh)**

1. Bombay Hospital
2. CHL-Apollo Hospitals
3. Choithram Hospital & Research Centre
4. Gokuldas Hospital
5. Maharaja Yashwantrao Hospital
6. Sri Aurobindo Institute of Medical Sciences & Hospital

**IX. Kochi (Kerala)**

1. Amrita Institute of Medical Sciences
2. Ernakulam Medical centre
3. Lakeshore Hospital & Research Centre
4. Lisie Hospital
5. Lourdes Hospital
6. Medical Trust Hospital
7. PVS Memorial Hospital

**X. Kolkata (West Bengal)**

1. Advanced Medicare and Research Institute (AMRI) Hospital
2. Apollo Gleneagles Hospital
3. Belle Vue Clinic
4. Calcutta Medical Research Institute
5. DESUN Hospital & Heart Institute
6. Institute of Post Graduate Medical Education and Research
7. Medical College and Hospital
8. Nil Ratan Sircar Medical College & Hospital
9. Peerless Hospital & B.K. Roy Research Centre
10. Rabindranath Tagore International Institute of Cardiac Sciences

**XI. Lucknow (Uttar Pradesh)**

1. Mayo Hospital
2. Ram Manohar Lohia Combined Hospital
3. Sahara Hospital
4. Sanjay Gandhi Post graduate Institute of Medical Sciences
5. Vivekanand Hospital

**XII. Ludhiana (Punjab)**

1. Christian Medical College
2. Dayanand Medical College & Hospital
3. Ludhiana Medicity
4. Satguru Prathap Singh Apollo Hospitals

**XIII. Madurai (Tamilnadu)**

1. Aravind Eye Hospital

**XIV. Mumbai (Maharashtra)**

2. Asian Heart Hospital
3. Bombay Hospital & Medical Research Centre
4. Breach Candy Hospital
5. Dr. Balabhai Nanavati Hospital
6. Hinduja Hospital (P.D. Hinduja National Hospital & Medical Research Centre)
7. Jaslok Hospital
8. King Edward Memorial Hospital
9. Kokilaben Dhirubhai Ambani Hospital & Medical Research Institute
10. Lilavati Hospital & Research Centre
11. Lokmanya Tilak Municipal General Hospital
12. Sir J.J Group of Hospital
13. Tata Memorial Hospital

**XV. Nagpur (Maharashtra)**

1. CARE Hospital
2. Central India Institute of Medical Sciences
3. Government Medical College and Hospital

4. Orange City Hospital & research Institute
5. Wockhardt Super Speciality Hospital

**XVI. Pune (Maharashtra)**

1. Aditya Birla Memorial Hospital
2. Deenanath Mangeshkar Hospital
3. Jehangir Hospital
4. KEM Hospital
5. Poona Hospital & Research Centre
6. Ruby Hall Clinic
7. Sahyadri Hospital
8. Sancheti Institute for Orthopaedics

**XVII. Thiruvananthapuram (Kerala)**

1. Ananthapuri Hospitals & Research Institute
2. Cosmopolitan Hospital
3. Government Medical College
4. Kerala Institute of Medical Sciences
5. NIMS Medicity
6. PRS Hospital
7. Regional Cancer Centre
8. Sree Chitra Tirunal Institute for Medical Sciences and Technology
9. Sree Uthradom Thirunal Hospital

**XVIII. Vellore (Tamilnadu)**

1. Christian Medical College

**Appendix II**

**Determined Sample Population (arranged in alphabetical order)**

1. Amrita Institute of Medical Sciences
2. Ananthapuri Hospitals and Research Institute
3. Apollo Hospitals
4. Asian Heart Hospital
5. BLK Hospital
6. Christian Medical College
7. Columbia Hospital
8. Ernakulam Medical centre
9. Fortis Hospitals
10. Global Hospitals
11. Hinduja Hospital
12. Kamineni Hospitals
13. Kerala Institute of Medical Sciences
14. Kokilaben Hospital
15. Krishna Institute of Medical Sciences
16. Lilavati Hospital and Research Centre
17. M.V. Hospital for Diabetes
18. Manipal Hospitals
19. Max Hospitals
20. Mayo Health Center
21. Mehta Hospitals
22. Narayana Hrudalaya Hospitals
23. Nethradhama Hospitals



24. Peerless Hospital
25. Rabindranath Tagore Institute of Cardiac Sciences
26. Sahyadri Hospitals
27. Sancheti Hospital
28. Sankara Nethralaya
29. Shalby Hospitals
30. Sparsh Hospitals
31. The Madras Medical Mission Hospital
32. Yasodha Hospitals