

# Editorial

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## Medical Research at Crossroads

Medical education and research in India is in a state of metamorphosis wherein there is a paradigm shift from conventional rigid methodology to need-based issues. The present state of medical research in India is in quagmire owing to some being industry-driven, some for academic accomplishments, with very few actually addressing the felt needs of our country. The health of any country is unique and customized research can only address plethora of challenges arising in our ecosystem. Medical education presently is focusing on developing healthcare resources where primary stress is on superspecialization. This has to be revisited and the old concept of family physicians be ushered in, which will ease the load from the superspecialists, and health care can permeate to deep interiors of our society. While graduates generally possess reasonably sound knowledge of medical science, they are generally found deficient in performance of clinical skills and clinical competence. The application of evidence-based medicine has taken a backseat, because of constraints of basic research outcomes.

While technological advances appear stupendous and attractive, one must not forget that their roots are deeply embedded in knowledge gained through basic research carried out by passionate people whose only objectives were to unravel mysteries of nature. It is imperative that basic research should focus on more of wellness of society than innovating for costly equipments. The aim should be to gain affordable and integrative health care.

The National Health Research policy states several examples of Indian research providing the evidence for the formulation of strategies, policies, and programs (Vitamin A prophylaxis, National Vector Borne Diseases Control Programme, National Immunization Days, the use of bivalent vaccine for poliomyelitis, DOTS regimen for the treatment of Tuberculosis in the Revised National Tuberculosis Control Programme, new regimens for leprosy and kala azar, which are likely to lead to elimination). The challenge is that there is no long-term planning.

Continuity of research is also not maintained so that scholars while satiating their academic quest work on different topics rather than extending a topic of common interest. Various research projects which are undertaken lead to silos of knowledge and the continuity is lost. As a result, the research output remains rather disappointing and the enormous advantages offered by the human resource, on the one hand, and the diversity of Indian population, on the other, are almost completely lost. We continue to rely, for diagnosis as well as prognosis, on data generated in other countries with very different genetic and physiological backgrounds.

The support to healthcare research in our country is from multiple sources. The government is doing its bit by trying to promote through very robust institutes, such as the Indian Council of Medical Research (ICMR) and the National Health System Resource Centre (NHSRC). But a lot desires to be changed. For academic analysis, the total Twelfth Plan outlay (2012–13 to 2016–17) earmarked for the Department of Health Research (including the ICMR) was Rs. 10,029.00 crore. The actual expenditure was Rs. 3,180.99 crore for the entire Twelfth Plan period (up to February 2017). So, there was a huge mismatch to the tune of Rs. 6,762.50 crore between outlay and expenditure. The Parliamentary Committee, chaired by Prof Ram Gopal Yadav, observed that though it is always possible to generate more value for the funds allocated, it would be unrealistic to expect to achieve key goals of health research or to make spectacular breakthrough in the newly emerging frontier areas of health research with only 32% of the approved outlays. Honorable Prime Minister of India has also expressed his concern over the current status of medical research in our country which has led to spiraling cost of drugs and increased dependency on foreign countries. We are increasingly dealing with trade-related intellectual property rights (TRIPS) issues and challenges of intellectual property right.

To reboot, the conditions as are existent today in various healthcare institutes need to be deliberated. The Government on its part has launched three ambitious programs, namely “Make in India” for indigenization, “Start-up India” for innovation, and *Aayushman Bharat* for health coverage. The scenario for routine research is still deficient in basic requirements, such as proper financing, remuneration to researchers, and their social well-being. In healthcare institutes, the formal teaching load of a typical medical college faculty is usually not as high as those teaching in basic science departments in a university or college, although in most of the clinical disciplines, teaching continues in outpatient departments (OPDs), wards, and on the operation table as well, somewhat parallel to “teaching” that goes on in basic research labs. A common explanation for the rather limited novel research output from medical institutions is that the medical college faculty members have patient load amidst meager infrastructure which leaves

them with little time and energy to think about any serious research. However, the medical faculty in eminent medical institutions may not be engaged with OPDs/surgeries or wards on every working day and, therefore, the average per-week workload may not be exceptionally or unduly high.

In India, academic positions are largely given out in a time-bound fashion irrespective of any real output or any real contribution. There are no explicit incentives of being a researcher. Let us accept the fact that research in itself is not an independent specialty and is always the domain of respective sciences. This in turn pegs it at a lower stratum in the pecking order of professional needs of most scholars. Research also needs infrastructure and money. In Western societies, this money comes from various sources, such as Government and charity. Charities are busy promoting their own goals and most universities do not have dedicated funds.

In the present scenario, affordable health care is the cornerstone for our populace, but public sector hospitals struggle to provide treatment. The country has long battled infectious diseases, such as tuberculosis, malaria and dengue and is now facing rising numbers of noncommunicable illnesses, including diabetes and coronary heart disease. A 2014 report from the World Economic Forum and Harvard School of Public Health estimates that noncommunicable diseases and mental illness could cost India \$4.58 trillion by 2030. In the biotech sector, India has gone a long way to create a thriving enterprise in developing new drugs. The country's success in the generic industry relies on a different set of skills: reverse-engineering pharmaceuticals created elsewhere by breaking them into their components and remaking them through cheaper routes.

The way ahead for facilitating medical research can be achieved by providing dedicated infrastructure, earmarked budget, and incentivizing scholars. Centers of Excellence for health research can be an integral zone in all institutes. Separate budget should be earmarked for the same. Encouragement and incentives as marks and money should be available. Private organizations can be roped in for funding, albeit considering ethical issues. It is time that the government steps in for providing adequate financial benefit, stability of tenure, and career growth to scholars involved in research activities. Accommodation near place of work will augment their productive hours and will help them achieve better results.

Undoubtedly, the government and private sector are doing their bit by providing infrastructure and financial support to start-ups. It is time that private players step up and augment the academic resources by contributing financially as well as providing fertile ground for medical research as a career.

At the institute level, responsive and responsible governance and management structure needs to be developed in every research institution. These bodies should be empowered as well as accountable with strict timelines for deliverables.

At the government level, stewardship, quality assurance, administrative and financial support should be provided to ensure research productivity and evidence-based care to the community. This is the time when interventions, if applied in right proportion, would cascade our academic resources to zeniths of excellence.

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# Guest Editorial

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## The Deoxyribonucleic Acid of Health care Delivery Institutions

I have an admiration for hospitals, particularly through a lens of administration. In fact, my fascination with health care delivery institutions started as a student in medical technology in 1986. Over the years, the feeling grew stronger when my interactions with hospitals took place in different capacities. Upon graduation, I became an employee, years later a supplier of medical devices and research systems, then a patient, and a family or friend of a patient who was visiting, and finally, as an economic development official to facilitate greater adoption of innovation (from the private sector or academia) into hospitals. These exposures have taken place in different countries, on different continents, in both public and private sectors and also in civilian and army hospitals.



I found that hospitals share similarities and differences. I am going to focus on similarities, as it offers a greater context. Health care professionals are well aware of the deoxyribonucleic acid (DNA) to be the building block of all living organisms—a double helix with four bases known as A (Adenine), C (Cytosine), G (Guanine), and T (Thymine). Metaphorically speaking, one might view hospitals to have their own DNA. Let's assume one string is health care professionals delivering required care to patients and the other string is the management who is looking after the many investments and operations in the hospital.

While this might come across as a simple idea, in reality, each string would differ in many characteristics from the other one. For example, health care is deeply rooted in natural sciences, while management is somehow a social science. The differences in these two disciplines would impact how experiments, theories, and knowledge are developed, interpreted, and utilized. While management-trained professionals don't (and can't) engage in direct health care service delivery to patients, it is not unusual to see that health care-trained professionals engage in various management functions. As such, different personal and professional views, experiences, biases, expectations, misinterpretations, and miscommunications are likely to challenge an optimized bonding of the two strings (i.e., health care and management professionals) in a hospital. The managerial and leadership issues will surface even more when conflicts of priorities, values, and resource allocation are among the dividing factors.

Reflecting on some of my past experiences and observation (while not a formal study with academic rigor), I have noted that many issues could have been avoided, reduced, and more efficiently resolved in many cases if one side had a better understanding of the other. So, let's see what could ideally be the equivalent of A, C, G, and T as key building blocks of a hospital DNA through the lens of management:

- A (Administration): Henry Mintzberg (a Canadian scholar) described management as a science, art, and craft in one of his bestselling books. While the science can be learned, the art and craft of management require certain capabilities and experience to master. Like a good wine, it often comes with time. The relevance of this item is mainly for cross-disciplinary functions, suggesting that workers in each string require a good understanding of the other side to achieve an optimized operation. In practical terms, both sides of health care delivery and management would need to be mindful and have mechanisms in place to ensure proper training and mentoring to gain the right context.

From a management and logistics perspective, hospitals are a marvel of administration. There are likely thousands of daily tasks (if not more in larger hospitals) when it comes to scheduling, staffing, sourcing of goods, facility maintenance, materials handling and operations, reporting, monitoring, and security, to name a few. Not many other operations are open 24/7/365 (all year long), while providing lifesaving or life-enhancing services with a certain portion of activities to be highly unpredictable. And yet, there is a need to be prepared for almost any scenario. Any mistakes could carry significant losses and liabilities in hospitals. I believe that onboarding new administration from either side is key. We should also give them the right tools. This brings us to our next building block on enablers.

- T (Technology): Many hospitals have seen an increased share of technology adoption over the past 30 years. Recent issues of this journal have covered certain topics, such as Artificial Intelligence and Robotics very well. Technology acquisition on the health care delivery side often draws on many skills and resources from the

administration to engage in planning, budgeting, procurement, training, and maintenance to ensure proper operation. However, with increased demand on hospitals and often with limited resources, technology can also come to the rescue on the administration side. Digitization of certain processes, records keeping, digital tools (e.g., analytics, cybersecurity, supply chain management, integrated building technologies, etc.) could all play a role to enhance cost and performance efficiencies.

For residents in the Toronto area (Canada), they often hear about the fairly new Humber River Hospital as the first fully digital hospital in North America ([www.hrh.ca](http://www.hrh.ca)). A quick search on the internet would bring up many articles or videos for interested readers to check and learn about the many digital innovations, which are integrated into this facility. Beside all robots and automated systems in the delivery of health care, one could see humanoids to interact with patients and visitors, autonomous material handling to carry goods, and even smart windows that would tint automatically to control how much sun could enter the building (read as energy management for cooling/heating applications in a climate like Toronto that could range from +30°C in summer to -30°C in winter).

Why am I so excited about automated material handling in a hospital? Back in the days, I did my fair share of walking from our lab to the emergency room to pick up blood samples (and in some massive army hospitals, it was quite a journey). That time could have been better spent sitting behind my microscope! Now a robot could do that on own at a push of a button tirelessly with health care workers to do what they are best trained to do—serving patients. Such use of technology could also bring cost efficiencies to the administration. Technology adoption of this nature can be a good decision, when the facility size and information technology infrastructure would support such solutions. But how do we know that we are not spending money on fancy gadgets when the business case won't justify it? I hope the next building block of our hospital DNA to address this concern.

- G (Governance): Health care practitioners are professionally trained and are obligated to perform duties under an oath and abide by a professional code of conduct/ethics. When it comes to the administration side, it is usually the governance or oversight that aims to uphold accountability. After all, hospitals are social institutions engaged in serving people (with medical needs), which, in my opinion, would necessitate upholding operations to high standards. So, how do we ensure that the administration is engaged in doing the right thing? There are frameworks, models, and experts to consult on this and that is beyond the scope of this editorial.

At a minimum, I have found that those in the management or leadership positions could ask four value-rational questions as suggested by Bent Flyvbjerg (a Danish scholar). This practice would help them view social implications with more clarity:

- Where are we going with this decision? What do we want to achieve?
- Who gains, who loses, and by which mechanism of power (e.g., force *vs* consensus)?
- Is this desirable? Why?
- What needs to be done? How?

I believe we are at a point in time that societies will have greater social sensitivities to technology adoptions, infrastructure development priorities, and health care expenditures, to name a few. At the same time, I think there are blind spots and biases in management decisions made in both the public and private sectors. That is why better governance frameworks and asking deeper questions could result in better accountability and greater transparency in any leadership team. So, in light of the above considerations, can hospitals do and achieve everything on their own? This brings us to the next building block of a hospital DNA on working with others.

- C (Collaboration): Hospitals are large and complex social institutions. Not only it is a necessity for the health-care delivery and administration sides to collaborate internally, there is even a greater need for external collaboration. For example, many hospitals would engage with external stakeholders to raise funds for building new infrastructure and acquire more modern technology; to advance medical research in academia; to inspire and train future workforce; to source goods and services; to discover and develop better medications in clinical trials; and to learn/innovate continuously.

For management scholars, hospitals are a fertile ground to examine many of the management and organizational theories. While (public) hospitals often have close ties with the research community in health care, I'd wonder how often they look into other disciplines to learn transferable knowledge that would relate to their operation. Peter Drucker (an American management scholar) has been quoted to say that thinking is very hard work and management fashions are a wonderful substitute for thinking. As mentioned earlier, there are many assumptions, biases, and half-truths in the management, and being a social science won't help it much as experiments are hard to duplicate for greater validation. This should remind us the integrity and rigor of the management advice that

administration might receive from others. Many of us could relate to Drucker's quote for an advice we received from a mentor to find that it did not help much. The issue could either be differences in the context or the lack of evidence to prove that was true. Can management researchers observe operations, gather data, analyze, and share new insight with hospitals? I am confident that they can.

Health care administrators play a vital role in the effective and efficient delivery of services to patients. They are often a different kind of heroes in the background. It is only natural to assume that the two strings of health-care delivery and administration in the DNA of every hospital would need to bond to enable an optimized function (or failing that, to expect anomalies). After all, as the saying goes in different cultures, one hand does not clap or it takes two to tango!

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# Improving Scan Reporting Time using Lean and Six Sigma

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## ABSTRACT

Hospitals are always looking for ways to improve their processes and systems to provide benefits for all the stakeholders. Radiology department is one of the revenue-generating areas in the hospital where short waiting times and positive experience represent important drivers of patient satisfaction. Quality of care has been given a major focus by hospital and health care organizations across the country. Computed tomography (CT) and magnetic resonance imaging (MRI) are the two important modalities contributing to the revenues through radiology. Since the scan time being low, the significance for more revenue by increasing the patient load will add more value to the services. Certain non-value activities may lead to improper functioning of the department. Lean and Six Sigma tools have been used in this study to identify such activities. This led to reversal of negative performance indicators, streamlining the processes, and regaining the patient satisfaction in this hospital.

**Objectives:** Streamline mapping of workflow to implement Lean and Six Sigma and to improve the present performance of Radiology Department.

**Materials and methods:** Prospective study with direct observation of workflow. A total of 120 patients were observed for a period of 1 month, to identify the time taken. Failure mode effect analysis (FMEA) was used to identify potential steps for failure, and their effects.

**Results:** Number 490 is the maximum risk priority number (RPN) for report approval and preparation; 920 minutes was the average time taken for CT scan approval and 834 minutes was the time for MRI scan approval.

**Conclusion:** The radiologists were pointing that lesser number of monitors were available for report preparation.

**Keywords:** Customers process mapping, Inputs, Lean and Six Sigma in healthcare, Outputs, Process, Radiology services, Supplier, Total quality management.

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## INTRODUCTION

Radiology services is one of the major sources of revenue generation in a tertiary care level. In the Indian scenario, as many outpatient diagnostic centers, stand-alone radiology scan centers are being built, with a huge competition in domestic market.

This leads to patients getting attracted to any center for reasons like quick processing time of scans, turnaround times, accurate reporting, better customer care services in the lounges, and competitive pricing. Hence, radiology department in tertiary care hospitals faces stiff competition and administrators face stiff challenges with workflow and patient flow, if the department does not operate smoothly. Delays can be common and there is rarely a single common cause delaying the system or adversely impacting the patient throughput.

Diminished capacity and diminished productivity will lead to a variety of problems for diagnostic modalities like delay in diagnosis and treatment, increased length of stays, patient dissatisfaction, and referring physician dissatisfaction. Lean and Six Sigma are two approaches that are in use for systematically analyzing and improving process flow and efficiency within industries.

Other approaches are Business Process Modeling, Business Process Reengineering, Workflow Mapping, as well as total quality management (TQM) and continuous quality improvement (CQI)-oriented techniques, such as management accounting systems, Kaizen, and Shewhart cycles. Health care organizations started adopting industrial quality management methods in the late 1980s, including TQM and CQI approaches.<sup>1</sup> The selection of any one process of approach depends upon the specific circumstances and needs, existing in working environment, including the type of processes, the improvement objectives and the skills, knowledge, and resources available in that setting. Where there is optimizing changes among process steps (Lean) or if there are many steps where statistical analysis of defects can be done (Six Sigma), these approaches can be used.

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Radiology services in a hospital will aptly suit with both the above situations; hence, we used Lean and Six Sigma tools to reduce the reporting time. Early applications primarily focused on setting up of programs and infrastructure to measure quality and enhancing organizational culture around quality-related problems.<sup>2</sup> Few hospitals used TQM methods toward implementing process improvements and redesigning both supportive and clinical workflows.<sup>3</sup> The phrase “lean transformation” is used by many businesses to characterize a company moving from an old way of thinking to lean thinking. It requires a complete transformation on how a company conducts business. This requires long-term perspective and perseverance. The term was first used by Jim Womack and his team at Toyota and coined by John Krafcik<sup>4</sup> in a 1988 article, “Triumph of the Lean Production System.” Six Sigma’s core philosophy focuses mainly on reducing variability.

Output variability is reduced by implementing tightly controlled processes. This is done through a methodology that uses five basic processes: Defining, Measuring, Analyzing, Improving, and Controlling (DMAIC). Problem which is identified, data collected, and statistical methods are used to determine sources of variation and opportunities to improve.

Processes are then adjusted to remedy the problem, data collected, and analyzed several times to check for improvement in error rates.<sup>5</sup> Lean philosophy encourages an accentuated continuous improvement strategy supporting creating a simple and direct pathway and eliminating loops in a system. Being of a similar process to Six Sigma, Lean quality improvement methodology identifies an inefficient process, establishes waste within the process by distinguishing value-added and nonvalue-added activities, improves the process by creating standardized work, and uses standardized metrics to guide the work. Like Six Sigma, Lean requires cultural change to result in performance improvement.<sup>6</sup> The purpose of our study was to utilize these methods in understanding the characteristics of the current radiology processes that are limiting the ability of the department to ensure the referral base for the CT and MRI services. Untimely reporting of results is impacting negatively the referrals to hospital, resulting in reduced customer satisfaction, limiting the revenue opportunities.

## MATERIALS AND METHODS

An exploratory research was conducted at a 2000-bed tertiary care hospital's radiology department.

### Primary Data

During the Measure phase, overall performance of business process is calculated. A plan for data collection is

prepared to collect the required data, and what type of data, sources of data, and the specific reason to collect data are identified and measured. A sample of 60 cases undergoing CT scan and 60 cases undergoing MRI scan were observed during a 30-day duration.

## RESULTS

The goal of the project is to improve the workflow of department, improve timely reporting process to physicians, and improve patient and physician satisfaction.

Under the Define phase, the Project Charter was prepared and a Supplier, Inputs, Process, Outputs, Customers (SIPOC) process mapping was done. These processes were modified and improved through the remaining phases of DMAIC (Table 1). The department works on all days from 8 am till 5 pm.

It is well equipped and staffed with organization hierarchy showing all cadres of consultants available. There are 12 radiologists, 20 nurses, 34 radiographers, 6 MRI technicians, and 8 CT technicians. During the Measure phase, the researcher observed the time taken for each patient to get serviced in CT scan area and MRI area as identified by the Time study. The findings are as below.

The two factors that became prominent as performance indicators having a direct relationship with patient and physician satisfaction were identified after noting the time taken as in Table 2. These two factors were: (1) Patient waiting time in the lounge is high (>30 minutes) and (2) reporting of results after approval of senior consultant (around 24 hours).

The nonvalue-added activities that lead to dissatisfaction among patients were identified, where the Lean philosophy can be applied. These activities were: (1) Patients waiting at the lounge, (2) time taken to review the film by junior doctor, and (3) time taken to approve the report. In the CT scan area, a staff nurse was deployed to take consent, whereas in the MRI scan area, it was the MRI technician work, so this has been identified as nonvalue-added activity to staff nurses in the CT scan area.

Value-added activities are the steps where customers are willing to pay, as they perceive a better service or better product due to that step. During the Analyze phase, FMEA was used. This process includes rating possible defects, or failures in three ways: The likelihood that something will go wrong, the ability to detect a defect, and the level of severity of the defect. This is done to identify and understand potential failure modes and their causes, the effect of failures on the systems or end users, to assess the risks associated with identified failure modes, effects and causes, and to prioritize issues for corrective actions. It includes analysis of the following: (1) Steps in the process,

**Table 1:** Project charter for radiology: Lean and Six Sigma project

<i>Improving the workflow of radiology department using Lean and Six Sigma principles</i>			
<i>Project title</i>	<i>Improving the workflow of radiology department using Lean and Six Sigma principles</i>		
Problem statement	To improve the workflow of the department, thereby increasing patient satisfaction		
Business case	Describe how the problem for the project affects	Kano status: Wow/expected/ must have/unspoken	Attribute type: Lesser the better/nominal/greater the better
Customers	Customer is affected by prolonged waiting time	Expected	Lesser the better
Staff	Staff will be keen to adhere to the set timelines for each step	Expected	Nominal
Business	Reduce the average length of stay and the current waiting list will come down	Expected	Lesser the better
<i>Stakeholders affected</i>			
Department 1	Doctors	Increase in number of patients will increase the revenue	
Department 2	Staff nurses	Resistance due to increased workload	
Department 3	Housekeeping staff	Resistance due to increased workload	
Department 4	Billing personnel	Resistance due to increased workload	
Department 5	Management	Increase in patient satisfaction and revenue of the hospital	

**Table 2:** Time taken by patients in CT scan and MRI areas

	Average	Minimum time (in minutes)	Maximum time (in minutes)
<i>Name of the step in CT scan procedures</i>			
Patient reaching reception with request and appointment is allotted and entered in HIS	2.01	1.19	2.36
Receptionist explains the cost, bill preparation, and bill payment	2.71	1.88	3.54
Radiology nurse takes the consent from patient	0.14	0.06	0.21
Time taken for patient to change into gown/remove ornaments	3.28	1.81	4.76
Patient waits at the lounge for his turn	93.87	67.47	120.26
Time taken to review the film by junior resident	13.09	11.69	14.49
Time taken to verify and approve the report	920	701	1138
Reports dispatched to radiology reception/PACS	0.05	0.05	0.05
Total time taken	1041.39	788.11	1294.66
<i>Name of the step in MRI procedures</i>			
Patient reaching the MRI room with request and MRI technician giving an appointment and entered in HIS	2.1	1.98	2.23
Receptionist registers with bill preparation and bill payment	2.21	1.86	2.56
Radiology nurse takes the consent from patient	0.56	0.41	1.52
Time taken for patient to change into gown/remove ornaments	3.18	2.81	5.01
Patient waits at the lounge for his turn	23.82	11.9	35.7
Time taken to perform an MRI procedure	25.55	21.99	29.1
Time taken by a patient to leave the MRI room	2.28	1.92	2.64
Time taken to review the film by junior resident	19.49	9.84	29.14
Time taken to verify and approve the report	834.55	690	978.17
Total time taken	913.74	742.71	1086.07

(2) failure modes (what can go wrong?), (3) failure causes (why can the failure happen?), and (4) failure effects (what could be the consequences of the failure?).

For each failure mode, a numeric value is assigned as RPN for the likelihood of occurrence of detection and severity. Failure modes with high RPNs are the most important parts of the process on which to focus improvement efforts. Modes with low RPNs are not likely to

affect the overall process. The findings for the Radiology Department are shown in Table 3.

From the calculation of RPN, it can be seen that following potential failure modes lead to potential failure effects from highest to lowest:

- Report turnover time.
- Machine breakdown leading to cancelation of appointments.



**Table 3:** Failure mode effect analysis of workflow of radiology

Process step	Potential failure mode	Potential failure effects	Severity	Potential causes	Occurrence	Current process controls	Detection	RPN	Actions recommended
What is the step?	In what ways can the step go wrong?	What is the impact on the customer if the failure mode is not prevented or corrected?	10	What causes the step to go wrong? (i.e., How could the failure mode occur?)	10	What are the existing controls that either prevent the failure mode from occurring or detect it before it should occur?	10	1,000	What are the actions for reducing the occurrences?
Appointment is allotted and entered in HIS	Inaccurate patient information	Billing denials, increased waiting time	5	Increased workload on reception staff	8	Cross-checking the patient details once entry is made	3	120	Training clerical staff on data entry
Bill preparation by receptionist	Wrong billing using wrong codes	Inaccurate bill payment by the patient	4	Increased patient number and negligence by receptionist	3	Entering procedure code generating bill slip	1	12	Performing chart audit
Technician performs the procedure	Performing incorrect procedure and low-quality images	Patient dissatisfaction and loss of time	6	Handling incorrect case sheets of patients	6	Staff nurse cross-checking the patient case sheet and transferring to technician	6	216	Confirming the patient name and procedure
	Machine breakdown	Cancelations of appointments, delayed procedure time, increased ALOS	7, 5, 4	Inappropriate maintenance of equipment	6, 8, 8	Immediate repair of the machine by engineers	7, 7, 7	294, 280, 224	1) Daily maintenance of the equipment, 2) Provide idle time between procedures
	Reviewing and approving of report by senior radiologists	Report turnover rate is high	Patient dissatisfaction and increased ALOS	7	1) Computer monitors less in number, 2) doctors saying busy, 3) procedures more in number	10	Simultaneous viewing and reporting to happen immediately	490	1) Increasing the number of monitors, 2) report must be viewed immediately after procedure

HIS: Hospital Information System; ALOS: Average length of stay

- Machine breakdown leading to delayed procedure time.
- Machine breakdown leading to increased average length of stay.
- Incorrect procedure performed and low-quality images.
- Inaccurate patient information being captured.
- Wrong billing using wrong billing codes, leading to inaccurate bill payment.

During the Improve phase, the potential failure modes thus identified have got reduced or eliminated due to the actions recommended. This resulted in the reduction of scan reporting time by 42%.

## DISCUSSION

Each section of the department developed interventions to improve its report turnaround time, as per one study by Seltzer et al.<sup>7</sup> In this study, they determined whether TQM techniques were successful in expediting the report turnaround time in Radiology of a teaching hospital. Cancellation of appointment due to machine breakdown and air-conditioning problem has been rectified by daily checking working status of machines by in-house team and periodic maintenance by the outsourced company specialists. And scheduled idle time for machines between the procedures was advised. High turnaround time for the report being approved and signed has been rectified by rearranging the shifts for senior radiologists. At present, the reports were viewed only till 5 pm in the evening, which got extended till 7 pm, so that each day, procedures are reported on the same day. More number of computer monitors were recommended to this department with bigger size and better resolutions. To optimize the process of reporting and uploading radiological examinations, Six Sigma was adopted as a methodical approach, and rigorous statistical analysis to analyze and improve processes was done by Cavagna et al.<sup>8</sup> They succeeded in bringing the turnaround times 62% lesser in a 6-month duration.

## CONCLUSION

As executing Six Sigma programs involve changing human behavior, it is critical to include a carefully built communication plan that identifies and takes care of human issues. Any transformation of any magnitude across health care organization requires discussions with physicians, nurses, managers, and other key stakeholders. Having the right people in the right roles is critical to the success of a Six Sigma initiative. Radiology services along with operation theater services is one of the major areas where Six Sigma projects can bring in maximum benefits to the management of hospitals.

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# Study of Stress among Health Care Professionals: A Systemic Review

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## ABSTRACT

Stress is any action that places special physical or psychological demands upon a person, anything that can unbalance his individual equilibrium. Work-related stress is a potential cause of concern in health care workers and is associated with decreased job satisfaction, days off work, anxiety, depression, sleeplessness, medical errors, and near misses. To compare stress levels in different groups of health care worker and identify causes of stress, we conducted a survey-based study at a super-specialty public sector hospital at Delhi NCR.

**Keywords:** Health status, Medical practitioners, Stress, Stress management, Work stress.

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## INTRODUCTION

Stress is any action that places special psychological or physical demands upon a person, anything that can unbalance his or her individual equilibrium.<sup>1,2</sup> Decreased job satisfaction inevitably results in negative results and in negative attitudes toward one's work, family, and ultimately, self.<sup>3-5</sup>

Chronic overstress often state as burnout.<sup>6</sup> Emotional illnesses can lead to anxiety disorders, addictions, depression, eating disorders, and suicide.<sup>7,8</sup>

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A recent study conducted at Mayo Clinic revealed that 60% of American physicians at times suffer symptoms of fatigue and depression, otherwise known as "burnout."<sup>9,10</sup>

Despite the high prevalence of stress in doctors, and a myriad of physical and mental health consequences, doctors are notoriously reluctant to seek help for themselves.<sup>11</sup> Doctors are also "poor" patients due to maladaptive health behaviors.<sup>12,13</sup>

## AIMS AND OBJECTIVES

### Aim

The aim of the study is to assess the stress levels among health care professionals and finding its correlation with work, health status, and allied factors.

### Objectives

- To assess the stress level among various work groups of health care professionals
- To explore the relation between work stress and health
- To compare the stress levels among men and women
- To explore the relation between work stress and years of work experience
- To explore marital status' influence on stress condition
- To identify the age groups which are most susceptible to work stress

## MATERIALS AND METHODS

### Study Setting

We conducted an anonymous survey of doctors working in various departments and in hospital administration over 6 weeks using the validated questionnaire developed by the Indian Council of Medical Research (ICMR). The study was conducted on 600 participants who included health care professionals.

### Study Design

The study was a questionnaire-based analytical study incorporating two questionnaire-based tools. First questionnaire was used to assess work stress and second for general health status evaluation. The responses were statistically analyzed by Statistical Package for the Social Sciences which was used for both data analysis and tabular presentation. Descriptive statistical measures were used

for quantitative variables. Analytic measures were done by Mann–Whitney test and Spearman correlation coefficient. The level of significance for this study was  $p \leq 0.05$ .

### Study Questionnaire

The study was done using two questionnaire-based tools which were given to 600 participants.

The first questionnaire, the work stress questionnaire (Annexure A), has been developed by ICMR, having 32 questions to be scored on 1/2/3/4 criteria, Never—1, Sometimes—2, Frequently—3, and Always—4. The scores were interpreted as:

- Scores 32 to 64: You manage your stress levels very well. Too little stress can reduce stimulation, so strive to achieve the balance between negative and positive stress.
- Scores 65 to 95: You have a reasonably safe level of stress, but certain areas need improvement.
- Scores 96 to 128: Your level of stress is too high. You need to develop new strategies to improve it.

The second questionnaire which assesses commonly experienced stress symptoms (Annexure B) was developed by ICMR. The questionnaire has 30 questions which were specific to general health. Each question had symptoms needed to be scored 0/1/2 on the criteria Never—0, Sometimes—1, and Always—2. The scores were interpreted as, score less than 30 meaning health is not effected, and score more than 30 meaning commonly experienced stress symptoms have effect on individuals' health.

### Response Rate

The questionnaire was distributed to 600 participants out of whom 329 responded. Respondents included doctors,

engineers, health care administrators, students pursuing degrees in hospital administration, and other professionals. The satisfactory response rate probably reflects both the suitability of the study design and the health care professionals' interest in the topic.

## OBSERVATION AND DISCUSSION

### Work-related Stress

Of the study population, 59% (193) scored 65 to 95, i.e., having moderate stress which needs better stress management; 41% of the study population (136) scored 32 to 64, i.e., they have safe levels of stress and they manage stress levels very well (Table 1 and Graph 1).

### Health Status

Of the study population, 62% (205) showed a stress-associated symptom; 38% of the study population (124) showed good health status (Table 2 and Graph 2).

### Impact of Stress on Health

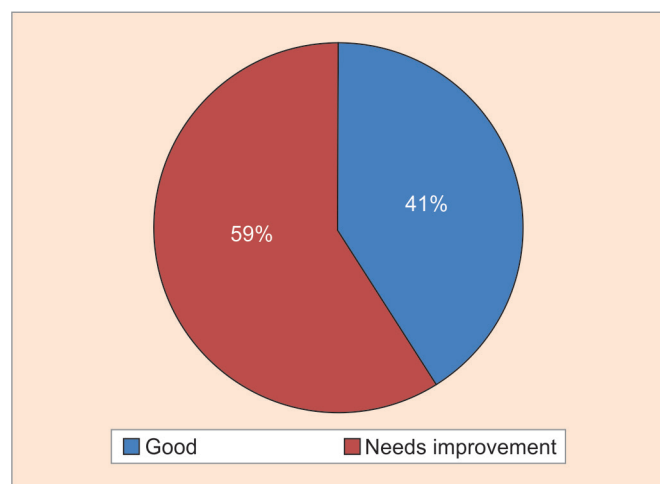
Refer to observation 1. Out of the population that managed work stress well (136), only 46% showed symptoms, whereas out of the population that did not show good stress management (193), 74% showed symptoms. Thus, it proves that better stress management decreases the chance of having health symptoms related to stress. This result is statistically significant and the difference between two population is  $74\% - 46\% = 28\%$  (Table 3 and Graph 3).

### Job Profile and Stress

From the total population ( $n = 329$ ), to find the correlation of stress in health care professionals vs other

**Table 1:** Work stress

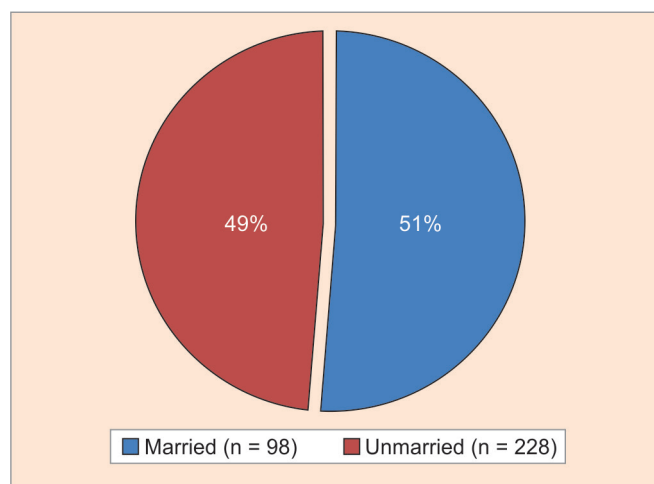
Good	41%
Needs improvement	59%



**Graph 1:** Work stress

**Table 2:** Health status

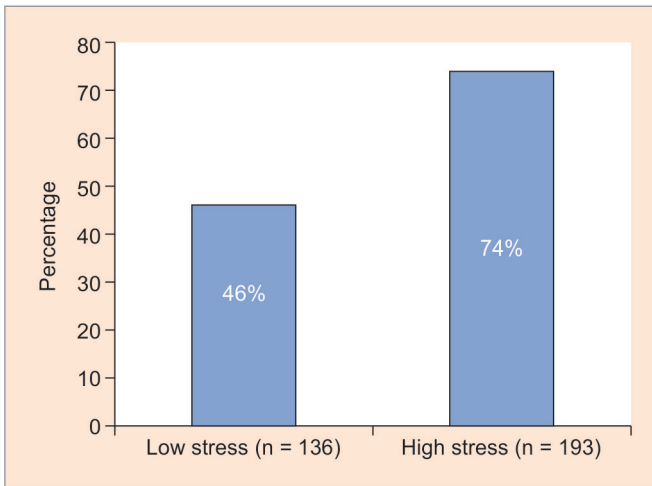
Affecting health	62%
Not affecting health	38%



**Graph 2:** Health status

**Table 3: Impact of stress on health**

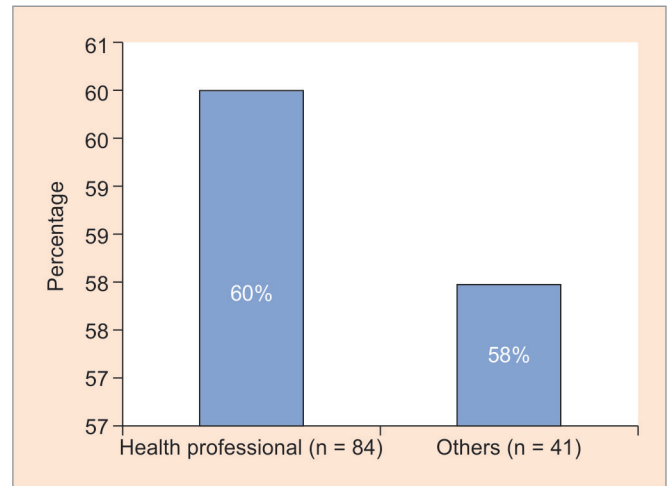
Low stress (n = 136)	46%
High stress (n = 193)	74%



**Graph 3: Impact of stress on health**

**Table 4: Job profile and stress**

Health professional involved in clinical area (n = 84)	60%
Health professional working in administrative area (n = 41)	58%



**Graph 4: Job profile and stress**

professionals, student/nonworking category of sample size was excluded. The working professionals of all categories had a sample size of 125; 84 out of 125 were health care professionals and 60% of these health care professionals showed stress; 41 out of 125 were nonhealth care professionals and 58% of these nonhealthcare professionals showed stress. This shows that stress level in health care professionals was marginally higher (2%) than in nonhealthcare professionals. This result was statistically not significant (Table 4 and Graph 4).

**Work Experience and Stress**

The sample population was divided into three groups:

1. People having 0 to 10 years of work experience—stress in 65% of population.
2. People having 10 to 20 years of work experience—stress in 55% of population.
3. People having more than 20 years of work experience—stress in 51% of population

It is observed that as number of years of experience increase, stress management skills improve and the person copes with stress in a better way. This may not mean that stress reduces with the number of years of work, but only shows that a person handles stress in a more matured way (Table 5 and Graph 5).

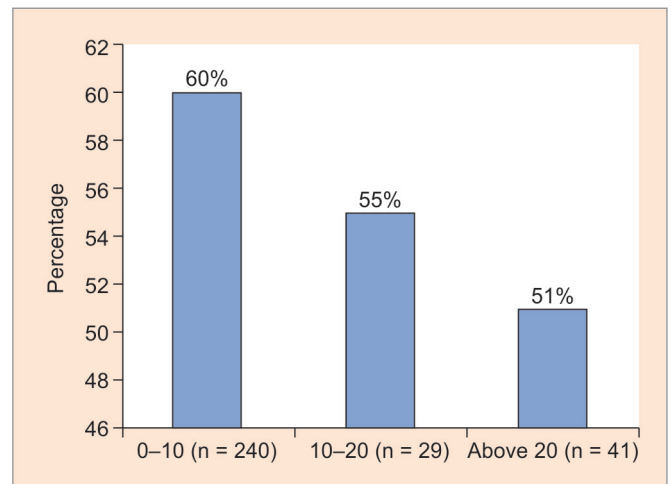
**Age and Stress**

The population was classified into three groups:

1. People aged 20 to 30 years [n = 226, standard deviation (SD) 0.39]—58% of this population showed stress.

**Table 5: Work experience and stress**

0–10 (n = 240)	60%
10–20 (n = 29)	55%
Above 20 (n = 41)	51%



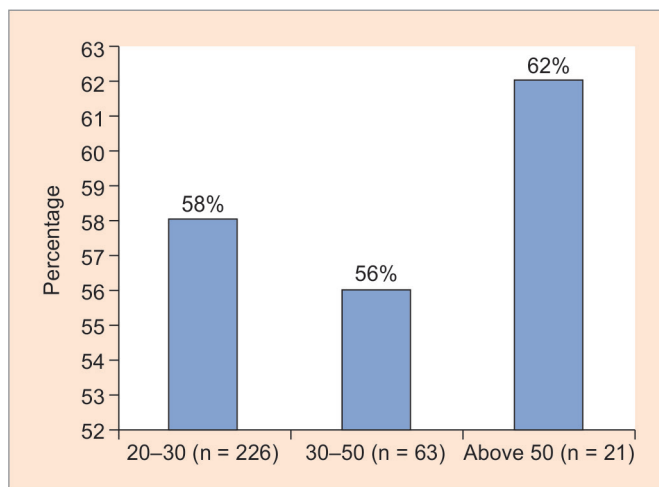
**Graph 5: Work experience and stress**

2. People aged 30 to 50 years (n = 63, SD 0.41)—56% of this population showed stress.
3. People aged 50 years and above (n = 21, SD 0.44)—62% of this population showed stress (Table 6 and Graph 6).

Spearman correlation revealed that there is significant negative correlation between age and total number of stress sources (r = -0.188), work experience and stress (r = -0.189), and job profile and stress (r = -0.212). Total

**Table 6: Age and stress**

20–30 years (n = 226, SD 0.39)	58%
30–50 years (n = 63, SD 0.41)	56%
Above 50 years (n = 21, SD 0.41)	62%

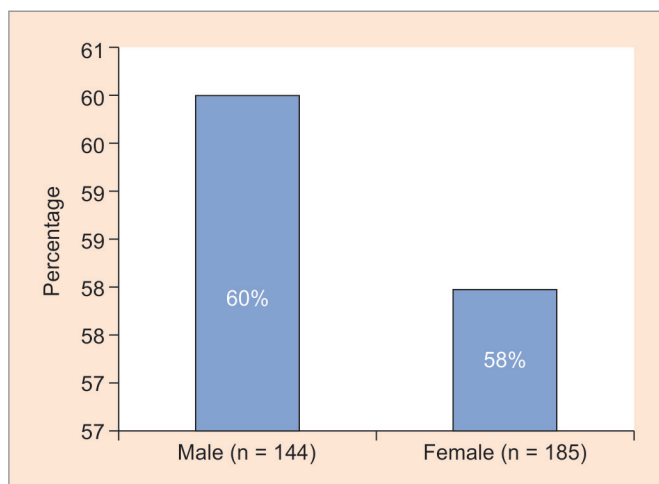


**Graph 6: Age and stress**

working years as a health care professional significantly negatively correlated with sources of stress ( $r = -0.176$ ), work experience and stress ( $r = -0.189$ ), and job profile and stress ( $r = -0.196$ ).

**Table 7: Gender and stress management**

Male (n = 144)	60%
Female (n = 185)	58%



**Graph 7: Gender and stress management**

**Gender and Stress Management**

Males (n = 144), 60% of the population had stress. Females (n = 185), 58% of the population had stress (Table 7 and Graph 7). Gentlemen have marginally more stress (2%) than ladies!!!

**Marital Status and Stress**

Married (n = 98), 60% of the population had stress. Unmarried (n = 228), 57% of the population had stress. Married people have marginally higher stress (3%) than unmarried people (Table 8 and Graph 8).

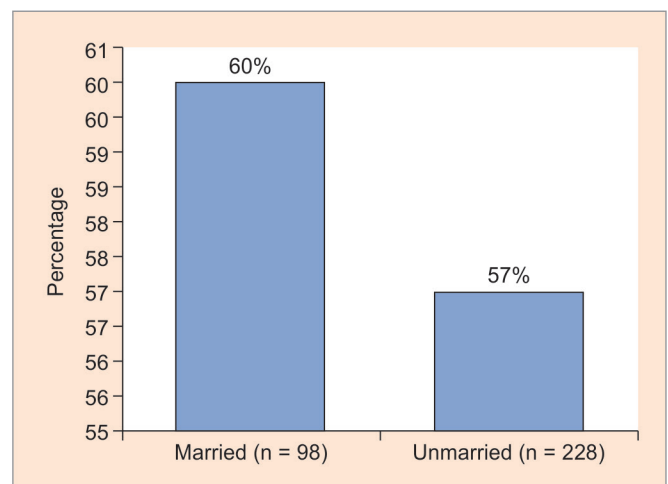
**CONCLUSION**

From the study, it is apparent that correlation exists between work stress and poor health. Poor health in turn, reduces human efficiency due to lack of alertness, focus, absenteeism, and other similar problems. There was no significant difference in stress levels between different grades of doctors and administrative staff. All workers in health care profession are equally stressed.

Effective stress-free environment is possible in any organization when both employees and employers cooperate and develop mutual understanding for each other’s needs.<sup>14</sup> Thus, it is essential for each of them to do their bit, to promote a wholesome atmosphere of peace, joy, and good health.

**Table 8: Marital status and stress**

Married (n = 98)	60%
Unmarried (n = 228)	57%



**Graph 8: Marital status and stress**

**ANNEXURE A**

**Work Stress Questionnaire Id No. ....**

**Personal Information**

Name (Optional) \_\_\_\_\_

Age \_\_\_\_\_

Sex  Male  Female

Marital status  Married  Single

Education  Nongraduate  Graduate  
 Postgraduate  Higher Education

Job profile  Student  Doctor (Clinician)  
 Hospital Administrator  Entrepreneur  
 Engineer/Architect  Other Professionals

Work experience  0–10 yrs  
 10–20 yrs  
 above 20 yrs

**WORK STRESS**

**Part I: Instructions**

When answering this questionnaire be as honest as possible. If your answer is “NEVER” mark 1, 2—“Sometimes,” 3—“Frequently,” “ALWAYS” mark 4, and so on.

I blame myself when things go wrong	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I bottle up my problems, then feel like I want to explode	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I concentrate on work to forget about my personal problems	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I take out anger and frustration on those nearest to me	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I notice negative changes in my behavioral patterns when I am under pressure	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I focus on the negative rather than the positive aspects of my life	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I feel comfortable when experiencing new situations	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I feel that the role I play within my organization is worthless	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I arrive late for work or important meetings	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I respond negatively to personal criticism	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I feel guilty if I sit down or do nothing for an hour	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I feel rushed even if I am not under pressure	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I have insufficient time to read as often as I would like	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I demand attention or service immediately	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I avoid expressing my true emotions at work	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I undertake more tasks than I can handle at once	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I resist taking advice from colleagues and superiors	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I ignore my own professional or physical limitations	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I miss out on my hobbies and interests because my work takes up all my time	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I tackle situations before thinking them through thoroughly	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I am too busy to have lunch with my friends and colleagues during the week	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I put off confronting and resolving difficult situations when they arise	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
People take advantage of me when I do not act assertively	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I am embarrassed to say when I feel overloaded with work	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I avoid delegating tasks to others	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I deal with tasks before prioritizing my workload	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I find it difficult to say no to requests and demands	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I feel I have to finish all outstanding work each day	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I think I will not be able to cope with my workload	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
My fear of failure stops me from taking action	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
My work life tends to take priority over my family and home life	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always
I become impatient if something does not happen at once	<input type="checkbox"/> 1-Never	<input type="checkbox"/> 2-Sometimes	<input type="checkbox"/> 3-Frequently	<input type="checkbox"/> 4-Always



## ANNEXURE B

## Part II: Instructions

Given below is a list of commonly experienced problems. If you do not have the problem mark 0; sometimes mark 1, always have problem mark 2.

Blurred vision	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Asthma	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Excessive sweating	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Pain in the chest	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Palpitation (fast heart beat)	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Difficulty in breathing	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Cold hands and feet	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Stomach upset/pain	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Indigestion/constipation	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Nausea/vomiting	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Loss of appetite	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Increased appetite	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Pain in joint/back/legs	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Itching in some parts of the body	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Headache	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Panting	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Biting nails	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Feeling tired	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Weight loss/gain	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Sleep disturbances	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Losing temper	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Restlessness	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Aggressive/fighting	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Bad dreams	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Difficulty in deciding	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Crying spells	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Forgetful	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Feels rejected	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Lack of confidence	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always
Difficulty in concentrating	<input type="checkbox"/> 0-Never	<input type="checkbox"/> 1-Sometimes	<input type="checkbox"/> 2-Always

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# A Study on Utilization of Blood Culture Reports in the Emergency Department at a Tertiary Care Teaching Hospital in North India

<sup>1</sup>Sujeet K Sinha, <sup>2</sup>Anil K Gupta, <sup>3</sup>Ray Pallab, <sup>4</sup>Madaan Nirupam

## ABSTRACT

**Introduction:** It is invariably observed that blood cultures are more often ordered because the patient has fever or the admitting physician wants them for any expectation of clinical impact. As a result of such practice, unnecessary blood culture is being ordered with negative financial impact on hospital as well as the patients. The indication for obtaining blood cultures from patients in the Emergency Department (ED) is even less clear. This study was done to study the utilization of blood report in the emergency department of a tertiary care teaching hospital in north India.

**Need of the study:** It was a common perception among the emergency medicine physician that they did not get blood culture reports on time from the Microbiology Department. The reports are either misplaced or received late as desired by the physician. A pilot study was done to check the hypothesis. Totally seventy blood culture samples were sent from the medical emergency ward and surgical emergency ward over a 3-week period. It was observed that 25% of total blood culture reports did not reach the physician.

**Aim and objective:** (1) To study the utilization of blood culture report in emergency, (2) to design an intervention for timely availability of blood culture reports, and (3) to Study the impact of the intervention on the utilization of blood culture reports.

**Materials and methods:** The study was cross-sectional, record-based prospective study, supplemented with interview of treating doctors. All patients admitted in the emergency ward (one each from medical and surgical) were followed up for 3 months. An Intervention was done personally by the researcher to ensure that all the test reports reach the patient file within 6 hours of its generation.

**Observation:** Out of total 104 blood culture reports sent in preintervention, change in treatment according to culture report was done only in 7.6%. In postintervention, it increased to 9.9%. It was found that the clinician did not narrow down treatment even when the cultures are positive. About 77.1% of positive blood culture reports get wasted in preintervention and 54.5% in postintervention.

**Conclusion:** There was ample loss of hospital resources in respect of money as well as manpower if even a single blood culture report is not utilized.

**Keywords:** Blood culture, Emergency department, Intervention, Utilization.

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**Conflict of interest:** None

## INTRODUCTION

Bloodstream infections cause significant morbidity and mortality worldwide and are among the most common healthcare-associated infections. Blood culture is a laboratory test to check for bacteria or other microorganisms in a blood sample. It is done when a person has symptoms of a blood infection, also called bacteremia. Blood is drawn from the person one or more times and is tested in a laboratory to find and identify any microorganism present and growing in the blood. If a microorganism is found, more testing is done to determine the antibiotics that will be effective in treating the infection.

Bloodstream infections are now ranked as the 10th leading cause of death in the United States.<sup>1,2</sup> For this reason, many ED physicians routinely order blood cultures before starting empiric antibiotic therapy in patients they suspect to be bacteremia. However, blood cultures also represent a significant expenditure of resources for hospitals and EDs with no evidence of clinical benefit to admitted patients.

According to the current literature, as many as 90% of all blood cultures grow no organisms, and of the 10% that do grow organisms, only about half represent true bacteremia (i.e., true positives), whereas the other half

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are considered contaminants (i.e., false positives).<sup>3,4</sup> It is the false positives that are known to increase both the cost and the duration of care.<sup>5</sup> In addition, 22.4% of physicians tend to continue the empiric antibiotic therapy despite the availability of the culture data.<sup>6</sup> Endimiani et al<sup>7</sup> investigated this apparent aversion to the narrowing antibiotic coverage once culture data were noted. They found that only 67.9% of their study subjects (521 patients over a 2-year period) received the appropriate antibiotic treatment despite the availability of susceptibility results.

A large number of patients with febrile illness are evaluated in the ED. The indications for obtaining blood cultures from patients in the ED are even less clear. There are no impact data specific to the ED practice setting, and attempts to encourage informed clinical use of this test are few. It is invariably observed that blood cultures are more often ordered "because the patient has a fever" or "the admitting Registrar will want them" than for any expectation of clinical impact.

## MATERIALS AND METHODS

This is a cross-sectional, record-based prospective study of admitted patients of Emergency department in a tertiary care teaching hospital. One ward from each medical (ward 22) and surgical (ward 1) emergency services was taken for the study. The data were collected for a period of 3 months from April 15 to July 15, 2012.

### Study Design

The data were collected for a total period of 12 weeks in two phases, 6 weeks apart, in preintervention and postintervention respectively. All patients admitted in the above-said wards under study were followed up for a period of 3 months to find out: (1) Whether any blood cultures have been requisitioned, (2) whether he/she was on antibiotics prior to requisitioned, (3) date of requisitioned blood culture, (4) date of receipt of reports, (5) response time, and (6) impact of culture reports on treatment.

An intervention was done personally by the researcher to ensure that all test reports reach the file of the patients within 6 hours of its generation. For this purpose, one hospital attendant round the clock was deputed to carry blood culture reports twice in his shift at predetermined interval from the Medical Microbiology Department to the respective files of the patients. Subsequently, the methodology as listed above was repeated for the patients in the study area for another 6 weeks (postintervention). Data were collected concerning patients' indication for culture, blood culture outcome, and change of treatment.

## Data Analysis Methods

The data collected were analyzed to find out:

- No. of cultures that have been requisitioned before and after starting antibiotic therapy.
- No. of reports received (this included any test, received telephonically by the treating doctors, in addition to the report filled in the patient case sheet).
- No. of times treatment was started or changed in response to reports received.
- Percentage of utilization of blood culture was calculated based on the formula:

$$\frac{\text{No. of cultures for which Rx which was changed}}{\text{Total no. of culture report sent}} \times 100$$

## Statistical Analysis

This was conducted to find out the effect of the intervention on outcome in terms of the utilization coefficient specialty wise and age wise for all patients under study. Discrete data were calculated as n (%) and continuous data (hospital stay) were presented as mean  $\pm$  standard deviation. Categorical data were compared using Pearson chi-square test or Fisher's exact test as appropriate.

All analyses were conducted using Statistical Package for the Social Sciences for Windows (version 15.0; SPSS Inc., Chicago, Illinois, USA). All statistical tests were two-sided and performed at a significance level of  $\alpha = 0.05$ .

## RESULTS

A total of 104 blood cultures were sent for 71 patients over a period of 6 weeks in the preintervention phase. Out of the total 104 blood culture reports, 67 reports were sent before starting the antibiotics of the patients, and 37 blood culture reports were sent after the starting of antibiotics. Totally 131 blood culture reports were received after the process from the Microbiology Department. Out of total 131 reports received, no action was taken against 119 reports, 4 reports were received contaminated, and the change in treatment was done only in 8 reports.

In the postintervention phase, 70 patients were followed up over the period of 6 weeks. Totally 102 blood culture reports were sent in the Department of Microbiology. Out of 102 blood cultures, 61 blood samples were sent before the starting of the antibiotics and the 40 samples after the antibiotics. Totally 156 blood culture reports were received after the process from the Microbiology Department. Out of total 156 reports received, no action was taken against 140 reports, 6 reports received were contaminated and the change in treatment was done only in 10 reports.

Table 1 shows that out of total 71 patients admitted in the emergency wards, 36.6% (n = 26) patients were already

**Table 1:** Patients who were on antibiotics before coming to hospital

	Preintervention		Postintervention	
	No.	%	No.	%
Yes	26	36.6	27	38.6
No	45	63.4	43	61.4
Total	71	100	70	100

**Table 3:** Change in treatment of patients in response to blood culture report received

	Preintervention		Postintervention	
	No.	%	No.	%
Yes	7	9.9	15	21.5
No	64	90.1	55	78.6
Total	71	100	70	100

on some form of antibiotics in the preintervention stage. In postintervention, this number was 28.6% (n = 27).

Table 2 shows that out of a total of 131 blood culture reports received in the preintervention stage, 26.6% were positive, 70.2% were sterile, and 3.1% were contaminated. In postintervention, 14.1% were positive, 82.2% were sterile, and 3.8% reports were contaminated.

Table 3 shows that out of total 71 patients enrolled in the preintervention stage, the change in treatment after receiving blood culture was done in 7 (9.9%) patients. This number increased to 15 (21.4%) in case of postintervention.

Table 4 shows that out of total 104 blood culture samples that were sent in preintervention, 35 (33.3%) blood culture reports returned positive and the change of treatment was done only in 8 (7.6%) of culture reports. Similarly, in postintervention, total of 101 blood culture samples were sent, and 22 returned positive and change of treatment was done in 10 (9.9%) reports. There

**Table 2:** Result of blood culture reports

	Preintervention		Postintervention	
	No.	%	No.	%
Positive	35	26.7	22	14.1
Sterile	92	70.2	128	82.1
Contaminated	4	3.10	6	3.80
Total	131	100	156	100

was a marginal increase in change of treatment after intervention.

Table 5 shows that the utilization coefficient of blood culture was 12.1% in preintervention as compared with postintervention where it was 12.5%. There was a marginal increase in utilization in surgery after the intervention. The utilization coefficient increased from 5.5 to 9.41% after intervention. The utilization coefficient in medicine was significant (p < 0.05) and well utilized as compared with surgery.

Table 6 shows that in surgical patients, of the age group 16 to 60, the utilization coefficient increased from 12 to 14.5% after intervention. In the age group of >60 years, the utilization coefficient decreased marginally from 16.7 to 14%. In medicine, the utilization coefficient in both age groups increased after intervention, especially in the age group of <60 years, this number was 8.70%.

**DISCUSSION**

Blood cultures are a commonly ordered test in ED. In recent years, a small number of papers have been published looking at the clinical utility of blood cultures as a test. These, however, are difficult to extrapolate to the ED setting, as they have either focused on hospital inpatients, patients in intensive care settings, or have “worked backward” from discharge diagnosis.

**Table 4:** Change in treatment according to the specific blood culture reports

	Preintervention			Postintervention		
	Yes	No	Total	Yes	No	Total
	No. (%)	No. (%)		No. (%)	No. (%)	
Positive	8 (7.6)	27 (26)	35 (33.3)	10 (9.9)	12 (11.8)	22 (21)
Sterile	2 (1.9%)	63 (60.5)	65	14 (13.8)	59 (57.1)	73
Contaminated	0	4 (3.9)	4	0	6 (5.8)	6
Total	10	94	104	24	77	101

**Table 5:** Specialty-wise utilization coefficient of blood culture

Specialty	Preintervention (%)	Postintervention (%)	p-value
Surgery	12.1	12.5	1
Medicine	5.5	9.41	0.038 (<0.05)

**Table 6:** Specialty and age-wise utilization coefficient of blood cultures

Specialty	Age group	Preintervention	Postintervention	p-value
		No.	No.	
Surgery	16–60	12.0	14.5	0.75
	>60	16.7	14.0	0.70
Medicine	16–60	3.40	8.70	0.24 (<0.05)
	>60	13.3	16.7	0.30 (<0.05)



Blood cultures are routinely sent by treating physician as other common investigations are sent. There are a number of reasons for this behavior. Habit is a major factor. Hospital-based training reinforces the almost Pavlovian response that if a patient has fever, a blood culture should be taken. Also, there is a perception among ED staff that blood cultures should be taken because the inpatient unit will require them. The underlying assumptions that the inpatient unit is always right and that the blood cultures will alter management have yet to be proved. Studies have shown that in the presence of known major bacterial infection, blood cultures are only positive in up to 20% of cases. In most of these studies, multiple blood cultures have been taken, so the sensitivity of an individual test is likely to be lower than this. The pathology of the disease and thus the likelihood of bacteremia must also be considered. An additional factor is the prevalent fallacy that if blood cultures are not performed initially, "the boat has been missed."

In the present study, whether patients had taken antibiotics before coming to ED was assessed. It was found that out of total 71 patients, 26 (36.6%) were already on some form of antibiotic in preintervention and 27 (38.6%) patients out of total 70 patients in postintervention stage. Totally 37 blood cultures were sent for 26 patients and 40 blood culture for 27 patients in pre- and postintervention respectively, in spite of patients being already on antibiotics. Totally 18 and 15% of blood culture turned positive in pre- and postintervention respectively, in postantibiotic culture. But surprisingly, the change in treatment was not significant. So, sending blood culture after taking antibiotics has hardly any relevance in current clinical practice in ED.

A similar study was done by the Christopher J Grace et al<sup>8</sup> about usefulness of blood culture of those who were receiving antibiotic therapy. They did not find any organism in 60% of the patients. The blood culture reports were either negative or contaminated. In 40% of the patients, there were some pathogens identified. But one condition was that the cultures were obtained during the first 72 hours of antibiotic therapy. Patients were excluded from the study if they had taken antibiotics during the 72 hours prior to the admission. If we compare with our study, it will be very difficult to get patients' history about the course of antibiotics therapy. This might be the reason for relatively high positivity rates in postantibiotic cultures.

Another study conducted by Murty and Gyaneshwari,<sup>9</sup> from the Department of Microbiology, SV Medical College, Tirupati, Andhra Pradesh, found that administration of empirical antibiotics was already initiated by the time of collection of sample for culture in 71 (66.35%) of the cases. Of these, only 6 (8.45%) had positive cultures.

In the present study, out of the total 104 blood cultures that were sent for 71 patients in preintervention, 35 blood cultures returned positive and in postintervention, it was 22 blood culture reports. Normally, positivity rate is around 10 to 15%. In our study, the reason for higher positivity might be due to inclusion of both true positive and false positive and also due to inclusion of coagulase-negative species, which is normally considered as contaminated. Only 7.6% of blood cultures taken in ED impact on management of the patient. This number increased to about 10% in the postintervention stage. It shows that there was a slight impact on treatment by providing blood culture reports within 6 hours of generation from the Microbiology Department. However, it was not very much significant. One more interesting result came in our study; in 2 (1.9%) sterile blood cultures in preintervention stage and 14 (13.8%) in postintervention, the physician changed the treatment of the patient. This might be due to the clinical judgment of the clinician or due to the deterioration of the patients.

The results of this study show that blood cultures obtained in the ED rarely yield a result that impacts on patient management. We found that the patient's clinical condition had a far stronger influence on change of antibiotic therapy than the result of blood culture.

Dr Birnbaumer's Centres for Medicare, Seattle, in his study about community-acquired pneumonia population,<sup>10-13</sup> found that even when blood cultures are positive, they rarely have effect on clinical management. In 58% of patients with positive cultures, the empirical antibiotic course is continued despite culture results indicating that management can be changed. For majority of cases in which antibiotic coverage is changed, it is by clinical response, regardless of culture result.

Corbo et al,<sup>14</sup> in their research paper on limited usefulness of initial blood cultures in community-acquired pneumonia found that in total, of 355 study participants, the management of only 18 cases (5%) was changed by blood culture results. There were 151 patients (43%) who had their antibiotic management changed by clinical improvement, and 23 patients (6%) who had their antibiotic management changed by clinical deterioration.

In surgery, the utilization coefficient of blood culture was 12.1 in preintervention as compared with postintervention where it was 12.50. There was a marginal increase in utilization. The utilization coefficient of blood cultures for the Medicine Department increased significantly in the postintervention phase. Although utilization was more in the Surgery Department, there was no effect of intervention. In medicine, there was significant impact of intervention.

## Limitations of the Study

As the study was confined to only two wards of the ED, generalization of opinion cannot be made about the other emergency wards and even normal inpatient wards. False positives were not excluded in the study, which, if done, would further increase the wastage due to test results.

## Future Study

- Costing of blood culture reports through the unit cost method using the ABC technique.
- Physician and surgeon behavior toward utilization of blood culture reports.
- Study of correlation between blood culture positivity and average length of stay of patients.

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# A One-year Observational Study on Hand Hygiene Practices in an Open Intensive Care Unit of a Large Teaching Hospital in India

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## ABSTRACT

Health care-associated infection (HCAI) is the commonest complication affecting hospitalized patients. The infection sources in a hospital are personnel, hospital's inanimate environment, and self-infection. Direct transmission accounts to 70% of infection transfer. Bacteria, fungi, and viruses have been reported as causative agents in HCAIs, and many infections are polymicrobial. Effective safety management in the 21st century involves keeping an eye on human factors and highly reliable organizations can identify and capture potential hazards before they show themselves as accidents. One method of achieving this is by measuring the level of safety through "leading" indicators. An active surveillance to measure the adherence to hygiene of hands of employees is conducted by the infection control nurses randomly in the critical areas in this hospital. Hand Hygiene Moment Observation Form taken from the original World Health Organization (WHO) 5 Moments "Observation Form" is used for observation. The compliance among nurses is greater compared with doctors in the intensive care unit (ICU), 64.44 to 60.74%. During the said period, the number of infections incidence in ICU compared with overall hospital's infections was 62.98%. The nurses had 7 opportunities and doctors had 10 opportunities to wash hands during 1-hour period, and the average time spent for washing was 8 seconds by doctors and 14 seconds by nurses.

**Keywords:** Hand hygiene of health care workers, Health care-associated infections, Infection control nurse, Patient safety, World Health Organization observation form study.

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## INTRODUCTION

Modern medicine has been thorough, wonderful, and genuine, but modern medicine too has the potential for considerable harm, perhaps even greater harm than in the past.<sup>1</sup> The health sector when compared with other sectors is a high-risk area as the adverse events arising from treatment rather than disease can lead to death, complications, and further sufferings. Though many hospitals have procedures in place to ensure patient safety, the health care sector lags behind other industries and services that have introduced systematic safety processes, famous being airline industry and health care industry comparison in all scientific gatherings and presentations.

Patient safety can be defined as: "The avoidance, prevention and amelioration of adverse outcomes or injuries stemming from the process of health care," as per Vincent.<sup>1</sup>

Health sector-induced harm to patients imposes a heavy burden on society. Investment in patient safety, therefore, has the potential to generate savings in expenditure coupled with an obvious benefit to patients. If a hospital focuses on patient safety, it leads to savings in treating patients manifesting adverse events and subsequent improved use of financial resources of the community as such. Supplementing this, savings are achieved in litigation costs associated with grievances and applications for compensation related to adverse events. Of utmost important, patient safety bestows better quality of life. In order to achieve these measures, the culture of safety can be improved significantly in various ways.

It is said that we cannot manage what we cannot measure. The purpose of evaluating patient safety is that it helps to effectively monitor safety and quality or assess the impact of any initiatives or programs that are implemented. The systematic reporting and tracking of safety problems is an important approach to quality improvement.

Nosocomial infection, or HCAI, is the commonest complication affecting hospitalized patients. Currently, 5 to 10% of patients admitted to hospital in Britain and in the US acquire one or more infections; millions of people each year are affected.<sup>1</sup> In a massive survey of over 75,000 patients in 2006, a prevalence rate of 7.59%

in the UK was found.<sup>2</sup> The sources of infection are personnel, hospital's inanimate environment, and self-infection. Bacteria, fungi, and viruses have been reported as causative agents in HCAs, and many infections are polymicrobial. The most common causative agents are *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli*, *Enterococci*, *Candida albicans*, and *Klebsiella* species.<sup>3</sup> In the wards, hospital infections may manifest in the form of bacteremia, respiratory infection, gastroenteritis, urinary tract infection (UTI), meningitis, and skin infections. Surgical wound infections are found after surgery. Four types account for about 80% of nosocomial infections: UTIs often associated with catheter use; bloodstream infections, often due to intravascular devices, surgical site infection (SSI), and pneumonia. Each of these four types may arise in more than one way and may be due to one or more different bacterial species. Intravenous lines are a particular potent source of infection, and if the chance of infection is increased, the longer the line remains in place.<sup>1</sup> Nowadays, infection control covers a wide range of processes within a hospital. It needs epidemiological expertise and attention to medical devices (e.g., intravascular and enteral devices, ventilators, diagnostic equipment); the physical environment (e.g., ventilation ducts, physical surfaces); surgical wound management; and carrying by health care employees and supportive health professionals.<sup>4</sup>

Diabetic patients, dialysis patients of chronic renal failure, and with chronic dermatitis are most likely to have areas of intact skin that are colonized with Gram-positive bacteria.<sup>5-12</sup> Skin flakes containing microorganisms are shed daily from normal skin and are 100 in number approximately.<sup>13</sup> The patient gowns and fomites in the patient's immediate environment can be easily contaminated with patient flora.<sup>14,15</sup> During patient care activities like lifting a patient, taking patient's pulse reading, oral temperatures, and blood pressure, which involves patient touching, can contaminate nurses' hands with 100 to 1,000 colony forming units of *Klebsiella* spp.<sup>16</sup>

In health care situation, the health care providers if called as "donors" and patients as "recipients," the transmission of organisms from donor fabrics to clean recipient fabrics through hand contact has also been studied. The results explicablely showed the number of organisms transmitted was greater if the donor fabric or the hands were wet during contact process.<sup>17</sup>

Hospital-acquired pneumonia (HAP) is one of the most common infections occurring in patients getting care in an ICU and accounts for almost 25% of all nosocomial infections in ICU patients, with incidence rates ranging from 6% up to 52%. Prevention and control of HAP include: Staff education and their involvement in

preventing infections, prevention of infection transmission; sterilization or disinfection and maintenance of equipment, devices, mechanical ventilators; prevention of person-to-person transmission of organisms; standard precautions, such as hand hygiene, glove, and gown usage; care of patients with tracheostomy; suctioning of respiratory tract secretions.<sup>18</sup>

Few steps in the prevention of central line-associated blood stream infections (CLABSI) include education, training and staffing, appropriate selection of catheters and sites, hand hygiene and aseptic techniques, maximal sterile barrier precautions, following catheter site dressing regimens, etc. that comply with current Centers for Disease Control and Prevention (CDC) hand hygiene guidelines.<sup>19</sup> Effective patient safety management in the 21st century includes paying attention to human factors, physical factors, and environmental factors. By paying attention to human factors, highly reliable organizations can identify and capture potential hazards before they exhibit as accidents. One method of achieving this is by measuring the state of safety through indicators, such as safety culture or climate. These are seen as different from indicators of safety, such as incidents as they provide knowledge into the state of safety without the need for retrospective analyses.<sup>20</sup> World Health Organization provides a set of quality indicators to be captured; most of the indicators are aimed at patient safety. We studied the indicators that have a bearing on hand hygiene of the health care personnel that would lead to increased infection rates.

## MATERIALS AND METHODS

An observational study was conducted for a period of 1 year, January 2016 to December 2016, in the multidisciplinary ICU of this tertiary care teaching hospital. This is an Open ICU with admission and discharges done by respective specialty consultants. The tool used for observation was WHO 5 Hand Moments Observation tool. Informed consent was taken from the doctors and nurses prior to the start of study, and repeated once every quarter. All personnel entering this Open ICU were included in the study.

## RESULTS AND DISCUSSION

The study was carried out in multidisciplinary 24-bed ICU at a tertiary care teaching hospital. The hospital has emerged as a premier health care institution providing quality tertiary care to patients. It was started as a 150-bedded teaching hospital in 1961. It has grown since its inception to 2,032-bedded superspecialty tertiary care teaching hospital. The hospital received 608,788 outpatient and 73,308 inpatient admissions in a year. The hospital is

committed to patient safety. The hospital follows patient safety practices through various measures undertaken. This study relates to hospital-acquired infection, safety, and sentinel events. Infection control is an important component of patient safety having direct bearing on the prevention of HCAs and the transmission of infectious agents among patients and health care providers. Infection control manual is prepared and periodically reviewed by the Hospital Infection Control Committee, at this hospital. The infection control policies include:

- Hand hygiene policy.
- Standard precautions for health care workers.
- Guidelines for hospital waste management, and sharps disposal policy.
- Antibiotic policy.

### Hand Hygiene Policy

The hospital hand hygiene policy promotes hand hygiene and provides a comprehensive indication for hand washing, which include before touching a patient, before a procedure, after a body fluid exposure risk, after touching a patient, and after touching a patient's surroundings. Hand hygiene policy is followed as per WHO guidelines.<sup>21</sup>

### Definition

Hand washing is the vigorous rubbing together of lathered hands for at least 15 to 20 seconds, followed by thorough rinsing under a stream of clean water.

### Purpose

- To remove transient microbial contamination that has been acquired by recent contact with infected or colonized patients or environmental sources.
- To prevent the transmission of potentially pathogenic organisms.

The policy provides standard duration of hand hygiene practice:

- Two minutes at the beginning of duty.
- Two minutes before high-risk procedures: Intravenous handling, catheter care.
- Two minutes after heavy contamination: Dressing changes.
- Fifteen to 30 seconds for other routine hand washing with alcohol hand rub.
- Six-minute scrubs are required for preoperative hand washing.

The products for hand washing include soap solution, hand rub solution (alcohol-based), and products containing antiseptic preparations: Topical antimicrobials are used to disable, inactivate, or kill microorganism and reduce total skin bacterial count.

Hand washing facilities are provided in all the patient care areas. Hand rub solution is provided at each patient bed in critical areas like ICUs, postoperative wards, at the entrance of each ward, and at all nursing counters.

Techniques for hand hygiene depends on:<sup>22,23</sup>

- Amount of solution
- Duration of washing procedure
- Selection of hand hygiene agents
  - Alcohol-based hand rubs are the best agents for reducing the number of bacteria on the hands; antiseptic soaps and detergents are the next most effective; and nonantimicrobial soaps are the least effective.
  - Water and soap are recommended for clearly soiled hands.
  - Alcohol-based rubs are recommended for decontamination of hands for all patient-related situations (except when hands are visibly soiled) and as one of the options for surgical hygiene.

An active surveillance to measure the adherence to hand hygiene is conducted by the infection control nurses randomly in the critical areas. Hand Hygiene Moment Observation Form adapted from the original WHO 5 Moments "Observation Form" is used for observation (Annexure 1). The infection control nurse observes the doctors, nursing staff, paramedical staff, and student nurses for adherence to Hand Hygiene. The 5 Moments for Hand Hygiene are:

1. Before touching a patient.
2. Before clean/aseptic procedure.
3. After body fluid exposure risk.
4. After touching a patient.
5. After touching patient surroundings.

Compliance rate is measured using the formula →

$$\text{Compliance (\%)} = \frac{\text{Actions}}{\text{Opportunities} \times 100} \rightarrow$$

The highest hand hygiene compliance was seen among student nurses (71.81%) and paramedical staff (70.94%), followed by nursing staff (64.44%) and the least was among doctors (60.74%). The compliance among nurses is greater compared with doctors. This has been observed in other studies also. The compliance rate in the national hand hygiene audit conducted in Australia showed compliance rates of 64.6% among doctors, 82.4% among nurses, 77% among paramedical staff, and 76.9% student nurse.<sup>24</sup> In a similar study the hospital's compliance rate was 50.3%, and its distribution among doctors was 49.1%, nurses 52.2%, and technicians 42.8%.<sup>25</sup>

During the same period, the number of HCAs observed in the hospital was 543, out of which 342 (62.98%) were observed in ICUs and 201 (37.02%) outside the ICUs. The total patient days was 529,718 days in a year. The overall HCAI rate was 1.025 per 1,000 patient days



or 0.74 per 100 admissions (0.74%). The HCAI rate in the ICUs was 1.98% as compared with 0.36% in the wards. The observed HCAI rate is below that estimated by CDC. The CDC estimated the burden of US HCAs in 2002 as 1.7 million infections in hospitals (9.3 infections per 1,000 patient days or 4.5 per 100 admissions).<sup>26</sup> The WHO study shows a hospital-wide prevalence of HCAI varies from 5.7 to 19.1%, with pooled prevalence of 10.1%.<sup>27</sup>

The nurses had seven opportunities to wash their hands during 1 hour in ICU, and an average period the washing was performed was 12 seconds. Whereas, the doctors had 10 opportunities to wash their hands during 1 hour, and an average period the washing performed was 8 seconds. The duration of hand washing or hygienic hand wash episodes by health care workers has averaged 6.6 to 24.0 seconds in various observational studies.

The most common site of HCAI was HAP 47.7%, out of which ventilator-associated pneumonia (21.18% of HCAI) accounts for 44.4% of HAP. The second most common infection was catheter-associated UTI (24.49%), followed by SSI (16.21%), infected burns wound (6.26%), and CLABSI (5.34%).

In the USA, the most frequent type of infection hospital-wide is UTI (36%), followed by SSI (20%), bloodstream infection, and pneumonia (both 11%).<sup>28</sup> A study in European acute care hospitals reports pneumonia (37.3%) to be the most common HCAI site followed by BSI (18.6%), SSI (11.9%), and UTI (3.4%).<sup>29</sup>

The most common organism causing HCAI overall was *Acinetobacter* species (19.19%) followed by *E. coli* (13.18%), *P. aeruginosa* (13.18%), and *K. pneumoniae* (12.79%). Methicillin-resistant *S. aureus* was seen in 4.65% of HCAI. The study in European acute care hospitals reports the most common causative organism was Enterobacteriaceae (34%), out of which *E. coli* was the most common. *Candida* species were the second most frequently detected pathogens (17%), followed by *Enterococci* (15%), *S. aureus* isolates (6%), and *P. aeruginosa* isolates (6%).<sup>29</sup>

Responsibilities of patient care managers/administrators are:

- Statements can be displayed about the value and adherence to hand hygiene practices.
- Role models demonstrating adherence to recommended hand hygiene practices.<sup>30</sup>

## Glove

Gloves should be worn while handling blood/infected body fluids, handling of items on surfaces soiled with blood or body fluids, for all invasive procedures, venipuncture, and other vascular procedures. Gloves should be changed between patient-to-patient contact. Gloves

should be used while handling visibly soiled linen. Wearing gloves does not replace the need for hand hygiene.<sup>31</sup> After providing care for a patient if gloves are not changed, it may lead to transmission of microorganisms from one patient to the other.<sup>32</sup>

By November 2017, this hospital got certified by Guinness Book of Records for the hand hygiene awareness drive, for clearing a world record in highest number of congregation of hand washing done in a day's time. The Department of Hospital Administration and we, as members of the department of the hospital, overlooked the conducting of event. The hospital has started promoting physicians and surgeons as brand ambassadors of hand hygiene in the premises of the hospital. The hoardings are displayed in the outpatient area, operation theatre complex, and intensive care areas.

## CONCLUSION

This study relates the proportion of hospital-acquired infections with hand hygiene practices by health care professionals in a hospital setting. Infection control is an important component of patient safety concerned with the prevention of HCAs and the transmission of infectious agents among patients and health care workers. Among the published literature search on reasons for poor adherence with hand hygiene recommendations, all are clearly associated either with institution or system or people. Visible safety programs across the hospital should be the norm of quality policy. An awareness program among workers, encouraging workers to report, a tolerant and supportive attitude toward reported problems, and belief in the efficacy will reap better dividends for hospitals in the long run.

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# Level of Satisfaction in Patients attending Government Health Facilities of AIIMS, New Delhi, Outreach Outpatient Department, Badsa, Jhajjar, Haryana, India

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## ABSTRACT

Customer satisfaction is an individual feeling of pleasure or disappointment resulting from comparing a product/service's perceived performance or outcome in relation to his or her expectations. Outpatient department (OPD) in any hospital is considered to be a shop window of the hospitals. Our study aims to extract patient's satisfaction through structured questionnaire covering all dimensions like interpersonal manner of health service providers, accessibility, physical environment, and quality of medical care. It was a cross-sectional questionnaire-based study conducted at the All India Institute of Medical Sciences (AIIMS), New Delhi, outreach OPD, over 2 years from November 2014 to February 2016 and included 402 participants. The satisfactions divided into low, medium, and high were found in 17.91, 67.66, and 14.42% respectively. Medium satisfaction was similar in almost all qualification and occupation groups, which could be a subject of perception. Income-wise, upper class had highest level of satisfaction. Among the five divisions of questionnaire, accessibility to health care facility raised some concern from patient point of view, probably this being an outreach OPD. Other four factors like availability of medical resources, interpersonal manner, behavior of health care personnel, and physical environment of health care facility drew similar attention from the participants. The AIIMS outreach OPD can be taken as one of the steps in improving the outreach facility.

**Keywords:** Outreach outpatient department, Patient satisfaction, Questionnaire.

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## INTRODUCTION

Customer satisfaction is an individual feeling of pleasure or disappointment resulting from comparing a product or service's perceived performance and outcome in relation to his or her expectations. The role of government in ensuring that the country's health care system provides optimal services for its population has been greatly emphasized upon.<sup>1</sup> All health care providers and programs in our country have an overwhelming emphasis on quantitative aspect of services delivered, which means that, in a quest to chase runaway targets, we often neglect the concept of quality of care, which is also a right of patients.<sup>2</sup> Outpatient department in any hospital is considered to be a shop window of the hospitals. Nowadays, patients are looking for hassle-free and quick services. This demand is only possible with optimum utility of the resources through multitasking in a single-window system of the OPD.<sup>3</sup> Monitoring patient satisfaction has some advantages over other clinical outcome indicators. Patient satisfaction indicators remain stable over time as opposed to clinical indicators, which will be changed with technology and pace of medical progress.<sup>4</sup> Patient satisfaction is determined by the cultural setting of the people served. Medical care that fulfills the social and emotional needs of the patients is highly accepted. It is determined by the interplay of two factors, i.e., patient's or client's expectations and the real services provided. If the performance falls short of expectations, the customer is dissatisfied and if the performance matches the expectations, he is satisfied. In case the performance exceeds expectations, the client is highly satisfied or delighted.

Patient's satisfaction means patient's attitudes and perceptions toward health care services. Being

intangible and subjective phenomenon, it is not easy to define. Patient satisfaction is "The degree to which the individual regards the health care as useful, effective and beneficial."<sup>5</sup> Patient satisfaction has been defined as an evaluation and reaction based on the fulfillment of expectations.<sup>5,6</sup> "It is the reflection of experiences of the customers for their expectations and needs."<sup>7</sup> People's use of health services is influenced by a range of psychological, social, cultural, economic, and political forces.<sup>8</sup> Health care includes several services; therefore, there are several factors of patient's satisfaction from doctors, nurses, treatment, general environment, and management. An attempt to evaluate the level of patient's satisfaction is related to different parameters of quality health care at the health facilities. This provides the existing medical system certain parameters that need improvement in the quality of the service provided.<sup>9</sup> Almost all the research on user perceptions includes questions about the personality, expertise, behavior, and interpersonal skills of the doctors. Patients have high expectations from the doctors in terms of showing care for the patient, extending consultation and support. The study of doctor-patient relationship is critical in customizing the doctors' attitude according to the user requirements.<sup>10,11</sup>

### Asian Data

The patient satisfaction data from Asian studies from Sharma et al,<sup>12</sup> Prasanna et al,<sup>8</sup> and Verma and Sharma<sup>13</sup> have varied from around 50 to 80%. Factors like registration procedure, doctor behavior, waiting times, transportation, and doctor skill have been independently explored in these studies.<sup>14-16</sup> However, due to lack of a structured questionnaire covering all domains of patient satisfaction and lack of internal consistency and reproducibility, these surveys give only partial information. Our study hence, aims to fulfill this lacuna by covering all patient satisfaction dimensions like interpersonal manner of health service providers, accessibility, physical environment, and availability and quality of medical care.<sup>17</sup>

Therefore, a study was conducted to investigate the level of satisfaction in patients attending government health facilities at the AIIMS, New Delhi outreach OPD Jhajjar, Badsa, Haryana, around 46 km away from the main campus.

## MATERIALS AND METHODS

### Study Design

It was a cross-sectional questionnaire-based study conducted at the outreach clinic, Jhajjar. The target population of this study included all patients who utilized health services at the OPD clinic of AIIMS Jhajjar. Parents or

guardians were the respondents of patients of age less than 14 years. Jhajjar outreach clinic was selected as the study site. The health facility catered to the population of the Jhajjar district and the nearby villages with the total of 956,907 population (source 2011 census).<sup>18</sup> This is an outreach OPD facility center having various departments (lab facility, radiodiagnosis, medicine, surgery, orthopedics, obstetrics and gynecology, pediatrics, ear, nose and throat facility, and ophthalmology) run by AIIMS, New Delhi. The study was carried out over nearly two years from November 2014 to February 2016 with sampling done mainly in winter season (2014-2015 and 2015-2016) between December and January. Similar weather was chosen to maintain coherence in satisfaction related to environmental conditions.

### Sample Size Determination

Sample size was calculated using the formula, sample size  $(n) = z^2 p (1-p)/d^2$  assuming a beta error = 0.2, corresponding power of 80%, and  $Z = Z$ -score when 95% confidence interval for estimating client satisfaction  $Z$  was equal to 2.58, When alpha error = 5%, corresponding to 99% confidence interval, where  $p$  = prevalence of patient satisfaction,  $d$  = allowable error 6.5%. As we presumed maximum variability, hence,  $p = 0.5$ ; sample size thus yielded was 393. Adding a figure of 10% for incomplete interviews, the total number came out to be 430 which was rounded off and 450 patients were interviewed. Selecting only the completed, fully legible, and completed pro formas, 402 of them were finally analyzed.

### Sampling Technique

Systematic random sampling was applied to draw the patients in order to get information about the aspects of health services. The sampling data collection was done once a week on different days to cover heterogeneity in patient population across days. Patients were selected within a  $k$  interval. The  $k$  interval is calculated by using this formula:  $k = a/n \times d$ , where  $k$  = sampling interval,  $a$  = actual number of patients who consumed services at the OPD clinic per day ( $a = 225$ ),  $d = 8$  (equivalent to 8 weeks, thus spread over 2 months in one season),  $n$  = required number of patients who consumed services at the OPD clinic ( $n = 450$ ).

Thus, by this formula  $k = 4$ .

### Research Instrument

The research instrument was a structured questionnaire (Annexure 1) which was adapted and modified from well-validated questionnaire for primary health care satisfaction in Thailand.<sup>19</sup> The questionnaire was translated into Hindi language which is used locally in the study area.

**Annexure 1:** Questionnaire used in the study (modified version of Net et al<sup>19</sup> questionnaire of satisfaction) which was scored on a 1 to 5 scale developed by Ware, Snyder, and Wright, 1976 = Excellent Satisfaction (81–100%), 4 = Good Satisfaction (61–80%), 3 = Satisfied (41–60%), 2 = Dissatisfied (21–40%), 1 = Poor satisfaction (<20%); and some was also stratified on Likert's system as "strongly agree," "agree," "neither agree nor disagree," "disagree," and "strongly disagree."

No.	Statements	Satisfaction level				
		1	2	3	4	5
<i>Interpersonal manner of health service providers</i>						
1	Physicians examine and treat me in a very friendly and courteous manner					
2	Physicians and their staff who treat me should give me more respect about my wishes					
3	When I am receiving medical care, physicians and their staff should pay more attention to my privacy					
4	I feel free to complain about my health problem when I am with my physicians					
<i>Accessibility</i>						
5	Staffs at the reception ease me to obtain all information I need about health services here					
6	There are enough seats at the waiting area					
7	I do not have to wait too long for getting medical care at this OPD					
8	I find it hard to get an appointment for medical care right away at this OPD					
9	Places where I get medical care are very conveniently located					
<i>Physical environment</i>						
10	The location of services is clean and has enough space to use					
11	I feel the atmosphere of this OPD is good					
12	There are clear signs and directions to indicate where to go in the service area of this OPD					
13	Facilities and equipment at the OPD are tidy					
<i>Availability of medical resources</i>						
14	Physicians and their health staffs are available whenever I need during my visit					
15	I think my physician's office has adequate medical instruments and equipment needed to provide complete medical care					
<i>Quality of care</i>						
16	Physicians are careful to check everything when examining and treating me					
17	Medical instruments and equipment that physicians use when examining and treating me are very clean					
18	The ability of physicians, pharmacists who give me medical care services is perfect					
19	My physicians and their staff are very competent and have experiences with my medical problem					
20	Medications I receive are good and well-packed					
21	Registration procedure					
22	Time given by doctor					
23	Overall patient global satisfaction					

A pretest of 23 questionnaires was conducted in the OPD clinic prior to the actual data collection for its reliability and feasibility. In the pretest, the values of "Cronbach's alpha" coefficient satisfaction parts were determined. We proceeded with the study only if "Cronbach alpha" value of greater than 0.7 was found and the questionnaire was easily understandable for our patients and data collectors in our resource-limited setting. Socioeconomic status was classified according to "BG Prasad classification"<sup>20</sup> system based on precipitate income updated according to May 2014 (Annexure 2).

## RESULTS

In our study, data of 402 patients were analyzed. The mean age of our study group was 38.19 years [standard deviation (SD) 16.18%], the majority of them being females

**Annexure 2:** BG Prasad classification system of socioeconomic status used in the study

Socioeconomic classification	Value in INR (last reference May 2014)
I (Upper)	1. 5571 INR per capita and above
II (Upper middle)	2. 2786–5570 INR
III (Middle)	3. 1670–2786 INR
IV (Lower middle)	4. 836–1670 INR
V (Lower)	5. Upto 836 INR

[315 (53.5%)] and education wise, number and percentage of illiterate, primary school (up to 5th standard), high school (up to 10th standard), senior secondary (plus two), graduate, and postgraduate were 68 (16.9%), 27 (6.7%), 11 (2.7%), 123 (30.6%), 100 (24.9%), 62 (15.4%), and 11 (2.7%) respectively (Table 1). Occupation wise, the number and percentage of housewives and unemployed

**Table 1:** Demographic and socioeconomic profile of population under study

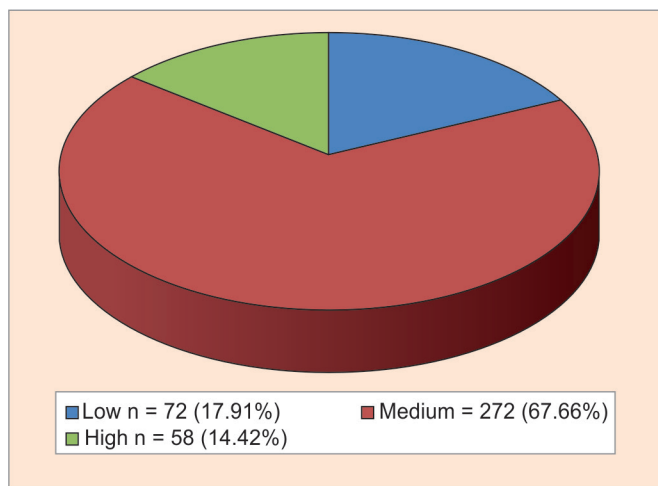
Profile of the participants	Number of patients (n)
Demography	402
Age, mean (SD)	38.19 (16.18)
Sex = M (%)	187 (46.5)
<b>Education</b>	
• Illiterate	68 (16.9)
• Up to 5th standard	27 (6.7)
• 6 to 7th standard	11 (2.7)
• 8 to 10th standard	123 (30.6)
• Senior secondary	100 (24.9)
• Graduate	62 (15.4)
• Postgraduate	11 (2.7)
<b>Occupation</b>	
• Housewife/unemployed	194 (48.3)
• Farmer	54 (13.4)
• Student	26 (6.5)
• Government job	40 (10.0)
• Private job	80 (19.9)
• Business	8 (2.0)
<b>Income</b>	
• 5571 INR per capita and above	299 (74.4)
• 2786–5570 INR	58 (14.4)
• 1670–2786 INR	15 (3.7)
• 836–1670 INR	12 (3.0)
• Up to 836 INR	18 (4.5)

males together constituted around 194 out of total 402 which constituted the majority 48.3%. Farmers, students, government employees, private firm employees, and businesspersons were 54 (13.4%), 26 (6.5%), 40 (10%), 80 (9.9%), and 8 (2.0%) respectively. Socioeconomic status on BG Prasad classification consisted of 299 out of 402 over 5,571/month INR, 58 patients (14.4%) had income less than 5,571, but more than 2,786 INR, 15 (3.7%), 12 (30%), and 18 (45%) patients had income that ranged from 1,670 to 2,786, 836 to 1,670, and up to 836 INR respectively.

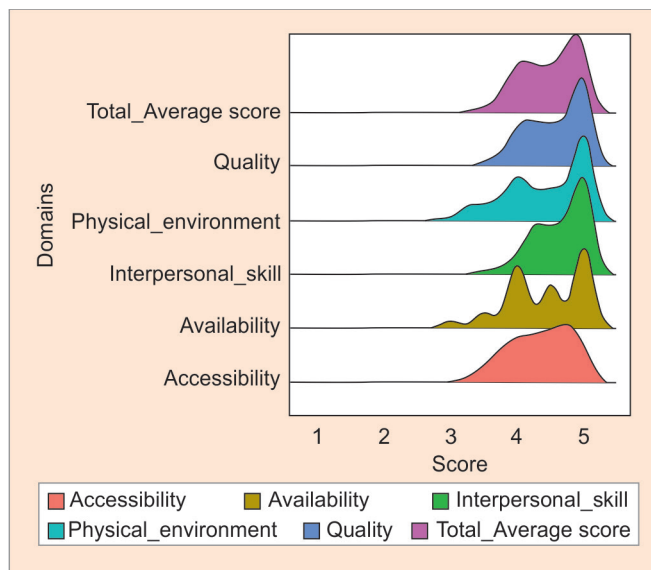
The questionnaire (Annexure 1) grossly dealt with issues under five major subheadings that were: Accessibility to health care facility, availability of medical resources, interpersonal manner and behavior of health care personal, physical environment of health care facility, and quality of health care. The overall satisfaction was classified into three by dividing the average of all the scores (Table 2) into lower third (low satisfaction), middle third (medium satisfaction), and upper third percentile (high satisfaction). As shown in Graph 1, the global satisfaction of the patients (patients') toward health services at the outreach OPD clinic of AIIMS, New Delhi, was found to be low, medium, and high satisfaction as in 17.91, 67.66 and 14.42% respectively.

**Table 2:** Characteristics of patients in the study divided into low, medium, and high level of satisfaction groups

	Low	Medium	High	p-value
n	72	272	58	
Age [mean (SD)]	40.40 (17.74)	38.15 (16.26)	35.62 (13.43)	0.246
Sex = M (%)	38 (52.8)	115 (42.3)	34 (58.6)	0.039
<b>Education (%)</b>				<0.001
• Illiterate	18 (25.0)	49 (18.0)	1 (1.7)	
• Up to 5 <sup>th</sup> standard	6 (8.3)	17 (6.2)	4 (6.9)	
• 6 to 7 <sup>th</sup> standard	5 (6.9)	6 (2.2)	0 (0.0)	
• 8 to 10 <sup>th</sup> standard	16 (22.2)	102 (37.5)	5 (8.6)	
• Senior secondary	16 (22.2)	60 (22.1)	24 (41.4)	
• Graduate	8 (11.1)	36 (13.2)	18 (31.0)	
• Postgraduate	3 (4.2)	2 (0.7)	6 (10.3)	
<b>Occupation (%)</b>				0.026
• Housewife/unemployed	35 (48.6)	140 (51.5)	19 (32.8)	
• Farmer	17 (23.6)	27 (9.9)	10 (17.2)	
• Student	6 (8.3)	17 (6.2)	3 (5.2)	
• Govt. job	5 (6.9)	28 (10.3)	7 (12.1)	
• Private job	9 (12.5)	54 (19.9)	17 (29.3)	
• Business	0 (0.0)	6 (2.2)	2 (3.4)	
<b>Income (%)</b>				<0.001
• 5571 INR per capita and above (upper)	59 (81.9)	213 (78.3)	27 (46.6)	
• 2786–5570 INR (upper middle)	5 (6.9)	43 (15.8)	10 (17.2)	
• 1670–2786 INR (middle)	0 (0.0)	8 (2.9)	7 (12.1)	
• 836–1670 INR (lower middle)	0 (0.0)	4 (1.5)	8 (13.8)	
• Up to 836 INR (lower)	8 (11.1)	4 (1.5)	6 (10.3)	
Accessibility [mean (SD)]	3.66 (0.57)	4.34 (0.39)	4.91 (0.10)	<0.001
Availability [mean (SD)]	3.56 (0.73)	4.45 (0.48)	5.00 (0.00)	<0.001
Interpersonal [mean (SD)]	4.05 (0.63)	4.68 (0.33)	5.00 (0.00)	<0.001
Physical environment [mean (SD)]	3.52 (0.50)	4.51 (0.46)	5.00 (0.00)	<0.001
Quality [mean (SD)]	3.85 (0.57)	4.62 (0.34)	5.00 (0.02)	<0.001



**Graph 1:** Overall satisfaction of the patients attending the government facility at AIIMS outreach OPD, Badsa, Jhajjar, Haryana



**Graph 2:** Distribution of various scores and their predominance among various parameters the scores having highest peak in almost all the groups of around 4 to 5, where 5 was the maximum score given

**Distribution of Scores**

Visualization at distribution of scores (Graph 2, Violin plot) suggests that score for most questions has bimodal peak of 4 (satisfied) and 5 (very satisfied) respectively in all five domains. In interpersonal and quality domains, most items had greater than 50% of very satisfied (5) responses, while in the accessibility domain, greater than 10% cases had a less than 4 (neutral or dissatisfied) response.

quality and interpersonal skills domains have significant higher scores than other domains like availability, accessibility, and physical environment, though there is no statistically significant difference between quality and interpersonal Skills (Annexure 3).

**Comparison of Scores across Domains**

We did an analysis of variance (ANOVA) of scores across domains. The ANOVA was significant (F-value = 21, p < 0.0001). Tukey’s *post hoc* analysis suggests that while

**Confirmatory Factor Analysis**

A confirmatory factor analysis was conducted on the 23 items with orthogonal rotation which assumes that items are correlated. The Kaiser–Meyer–Olkin (KMO)

**Annexure 3:** Tukey’s *post hoc* analysis of difference between domain scores post one-way ANOVA

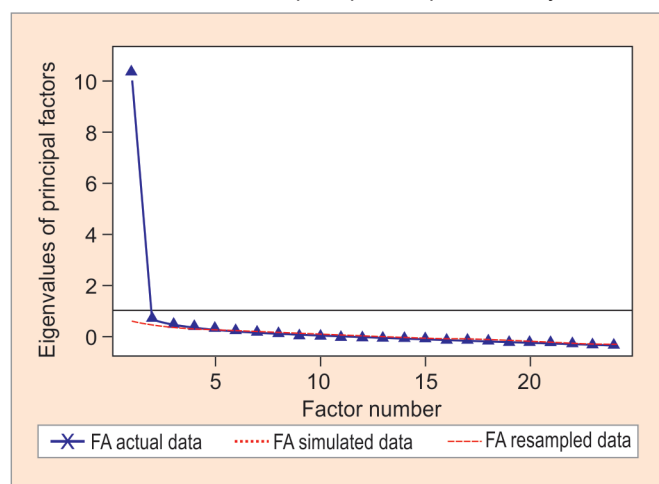
\$Domains	diff	lwr	upr
Availability–Accessibility	0.07014925	-0.038178796	0.17847730
Interpersonal–Accessibility	0.31579602	0.207467971	0.42412407
Physical_Environment–Accessibility	0.10435323	-0.003974815	0.21268128
Quality–Accessibility	0.23899254	0.130664488	0.34732059
Interpersonal–Availability	0.24564677	0.137318717	0.35397482
Physical_Environment–Availability	0.03420398	-0.074124069	0.14253203
Quality–Availability	0.16884328	0.060515234	0.27717133
Physical_Environment–Interpersonal	-0.21144279	-0.319770835	-0.10311474
Quality–Interpersonal	-0.07680348	-0.185131532	0.03152457
Quality–Physical_Environment	0.13463930	0.026311254	0.24296735
	p adj		
Availability–Accessibility	0.3926757		
Interpersonal–Accessibility	0.0000000		
Physical_Environment–Accessibility	0.0653889		
Quality–Accessibility	0.0000000		
Interpersonal–Availability	0.0000000		
Physical_Environment–Availability	0.9106676		
Quality–Availability	0.0002115		
Physical_Environment–Interpersonal	0.0000011		
Quality–Interpersonal	0.2986533		
Quality–Physical_Environment	0.0063212		

**Annexure 4:** Cronbach alpha representing internal consistency of domains of score

Domains	Test_retest_reliability	Cronbach_alpha
Interpersonal	0.74	0.79
Accessibility	0.60	0.68
Physical_Environment	0.78	0.81
Availability	0.58	0.66
Quality	0.82	0.91

(Annexure 4) measure verified the sampling adequacy for the analysis  $KMO = 0.93$ , and all  $KMO$  values for individual items were  $>0.77$ , which is well above the acceptable limit of 0.5. Bartlett's test of sphericity,  $\chi^2 (253) = 19.334$ ,  $p < 0.001$ , indicated that correlations between items were sufficiently large. An initial analysis was run to obtain eigenvalues for each component in the data. While five components had eigenvalues over Kaiser's criterion of 1 and in combination explained 64% of the variance, component 1 (made up of majority of questions of quality of care domain, 16 to 23) accounted for 23% of variance, component 2 (made of majority of questions in accessibility domain, 6 to 9) accounted for 20% of variance. Component 3 accounted for 9% of variance (had 2 out of 4 questions from environment domains). Components 4 and 5 together accounted for 11% of variance and had component not specific to predefined domains in questionnaire and varying amounts of cross-talk.

The scree plot (Annexure 5) was slightly ambiguous and showed inflexions that would justify retaining anywhere between two and three components. Given the large sample size, and the convergence of the scree plot and meeting Kaiser's criterion on five components, five components were retained in the final analysis. However, it is clear from the analysis that component 1 (quality of care) and component 2 (accessibility) capture maximum amount of variance.

**Annexure 5:** Scree plot showing eigenvalue variation with number of factors in principal component analysis

## Internal Consistency

The internal consistency of subscales (domains) varied from 0.91 (quality of care) to 0.66 (availability). The accessibility and availability domains had lower than recommended value of 0.7, indicating that questions in these domains need to be worded more appropriately for more internal consistency. Test-retest reliability (testing the same questionnaire on the same patients after a duration of thirty minutes) also followed a similar trend like Cronbach alpha.

## Multivariate Analysis

We carried out a multiple linear regression with average score as dependent variable and other predictor domain scores as independent variables. The model had significant goodness of fit. ( $R$  square = 0.98). The coefficient of regression estimates shows that one-point improvement in quality will lead to 0.29-point improvement in mean score while controlling for other variables. Corresponding values for other domains are 0.22 for physical environment, 0.20 for accessibility, 0.08 for availability, and 0.12 for interpersonal skills; other variables are nonsignificant. It implies that quality and physical environment play a major role in affecting average score in our study. The forest plot of regression coefficients is shown in Annexure 6.

## Predictor Factors

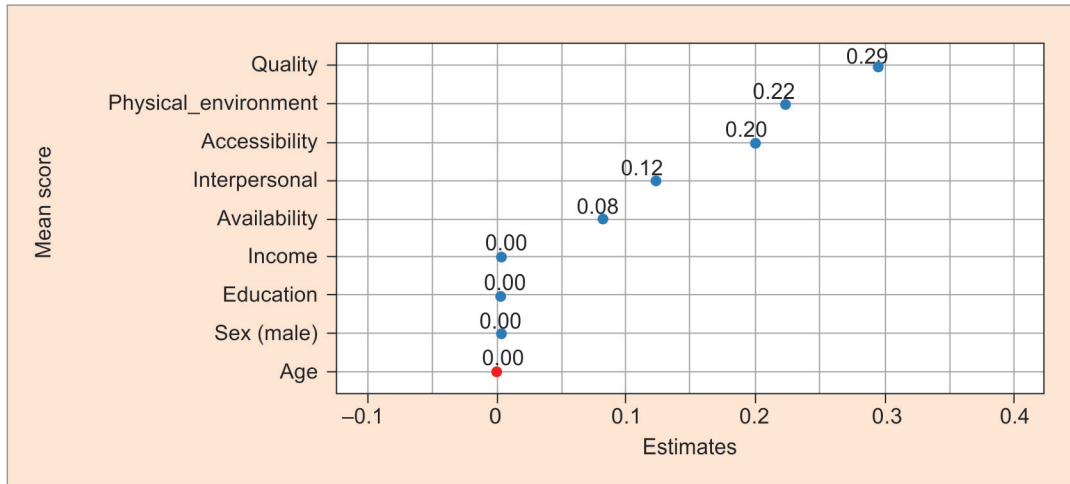
On correlation matrix of age with domain scores, we see that higher age is negatively correlated with all domains, while higher income and better occupation status are associated with better scores on all domains (Annexure 7).

While age has been seen to have a negative correlation in other studies as well, income and occupation are negatively correlated in other studies, but positively correlated in our study.

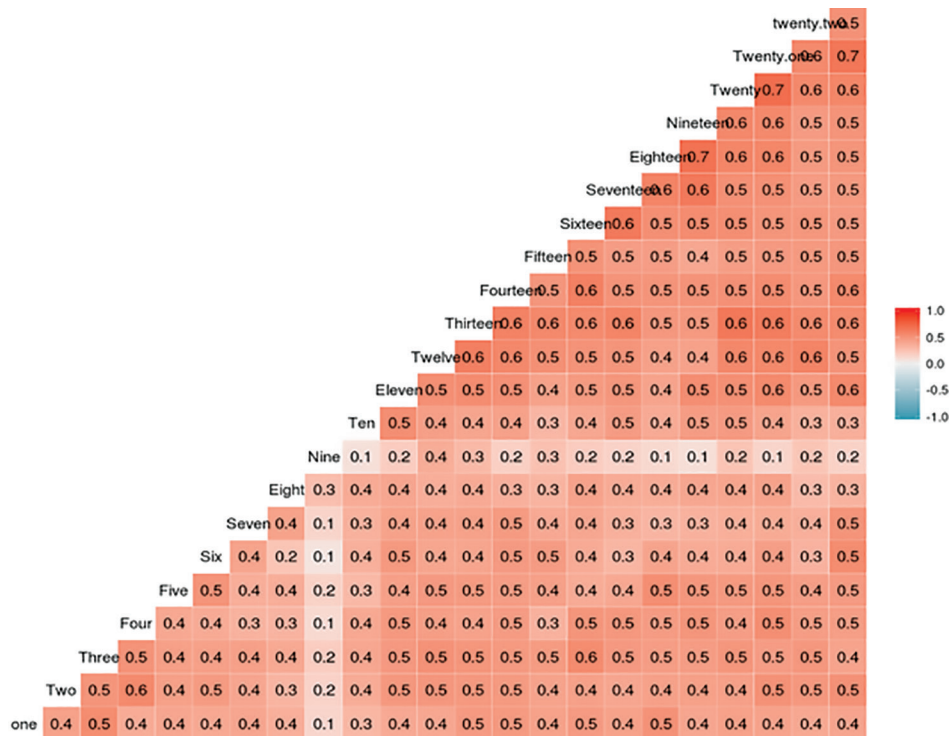
The results show that medium satisfaction was more in almost all qualification group and the same also holds true with different occupation groups with  $p$ -value being significant for both  $<0.001$  and  $<0.026$  respectively. Income wise, in upper class, most of them has medium satisfaction, followed by low satisfaction, and least had high satisfaction, while upper middle and middle had mostly medium satisfaction, followed by high satisfaction and least had low level of satisfaction. Lower middle had highest satisfaction, followed by medium-level satisfaction while lower class, most of them had low level of satisfaction, followed by high level of satisfaction, and then least had medium level of satisfaction. Among the five major subheadings of the complete questionnaire, most of them ( $n = 272$ ) had medium level of satisfaction



**Annexure 6:** Forest plot showing coefficients of effect of domains on mean score



**Annexure 7:** Correlogram showing correlation between various items in our questionnaire



with average score given about 4 out of 5, followed by low level of satisfaction (n = 72) with score of 3 given out of 5 and high level of satisfaction (n = 58) in which most of them marked maximum 5 out of 5. The findings can be correlated with the distribution of scores in various groups shown in the figure.

**DISCUSSION**

The proportion of medium satisfaction was higher and the proportion of lower satisfaction was lower than other similar study by Net et al.<sup>19</sup> However, in gross, it could be observed that in this unique kind of a pilot outreach

OPD by an apex government health center in India, the distribution of scores suggests that we need to keep up our performance in quality and interpersonal domain, while we need to improve in accessibility domain. Gross satisfaction level was quite positive, with a combined medium and high level of satisfaction constituting 330 out of 402 (82.08%). At the same time, generally felt and quoted issues by most of the staffs working at the center that none of the patient availing this facility would be unsatisfied was disproved by the fact that 72 out of 402 (17.91) were low satisfied. Distribution of scores suggests that we need to keep up our performance in quality and

interpersonal domain, while we need to improve in accessibility domain. Gender wise, the center catered a proportionally more female (54.65%) against the sex ratio of 862 (46.29%) of the Jhajjar district according to 2011 census. That is a remarkable note in a country like India, where women empowerment is being focused upon. The mean age of the population attending the clinic was 38 years (with standard deviation of 16 years), so mostly it was distributed around young population and the representation of the geriatric age group was lacking. The higher age group around mean of 40 years and lower age group of mean 35 years (in comparison with mean of total, i.e., 38 years) had low and high level of satisfaction respectively. While 83.1% of the population attending the facility were literate, given that the total literacy rate of the district is around 80% according to 2011 census. The majority of the subjects (52%) of the population were educated up to secondary and senior secondary level. Irrespective of the education profile, almost in all such groups majority had medium level of satisfaction while illiterate and low education profile people had slightly higher proportion of low satisfaction level. Against the anticipation, the farmers constituted 13.4% of the total number of patients attending the health care facility at Jhajjar, while the total fraction of cultivators according to the 2011 census were 34.5%. This may be explained by the geographical location of the Jhajjar health care facility. Other major observation was made that housewives and unemployed constituted around 48.3% of total patients under study. But almost in all occupation group, majority had medium satisfaction level. According to BG Prasad classification of socioeconomic status, most of the patients were belonging to upper to middle to upper class. High to lower middle class of people had medium to high level of satisfaction compared with lower socioeconomic class people where the majority of them had low level of satisfaction.

## CONCLUSION

An outreach OPD attached to a full-fledged tertiary center having multispecialty facility is very much welcomed by the people. This kind of setting gives the consumers a specialized, hassle-free, smooth, and quality health care. This also de-loads the work burden of the main apex/tertiary center side by side and provides a quick and timely referral for the patient in remote areas. The Jhajjar outreach OPD by AIIMS, New Delhi, is an excellent example of the same. As shown in the study, this model sets a good example for the existing outreach OPD in India. These kinds of new centers across our nation are the need of the hour where AIIMS outreach OPD sets the ways to improve and reach high level of satisfaction.

## ACKNOWLEDGMENT

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# A Study on After effects of Holi: Color Injury, Ocular Trauma, and Assault at a Tertiary Care Ophthalmic Center in North India

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## ABSTRACT

**Introduction:** India is known for its diverse culture and religions which are indeed famous for their variety of festivals. The presented study deals with one such festival called Holi and its hazardous ocular effects at Tertiary Care Ophthalmic Center In North India.

**Aim:** To study the demographic and clinical profile of patients visiting ophthalmologic emergency tertiary care ophthalmic center during Holi in New Delhi.

### Objectives:

- To study the pattern of normal patient flow in the emergency department of RPC.
- To study the demographic and clinical profile of patients visiting Emergency Department during Holi.
- To study the trend of Holi cases over the years.

**Materials and methods:** The data were collected by conducting direct interviews with patients and from medical records of the patients visiting the Emergency Department of RPC from March 1 to 5, 2018 (i.e., 5 days). These 5 days were chosen so that it could cover the pre-Holi day, Holi day and post-Holi day. Data of total 210 patients who visited the Emergency department of RPC, AIIMS, New Delhi, were taken. Statistical data were analyzed using Microsoft Excel.

**Results and discussion:** An increase in awareness among people shows a substantial decline in number of color injury, complications, traumatic eye injuries, and assault cases from the year 2016. Men (20) were more affected than women (9), with most common being among the youth (21 years  $\pm$  10). No change in routine cases was recorded in normal patient flow to the casualty, but a sudden spike in cases of color injury (29) was observed during the study period. Sooner the patient reported, better was the prognosis.

**Keywords:** Chemical injury, Emergency, Holi, Ocular injury, Ocular trauma, Substance abuse.

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**Conflict of interest:** None

## INTRODUCTION

India is one of the most diverse countries in the world harboring people belonging to different religions and caste. Every religion has its own cultural and traditional festivals which are celebrated in unique ways. The major religious festivals are Holi, Raksha-Bandhan, Diwali, Janamastami, Durga-Puja, Dussehra, Eid, Christmas, etc.<sup>1</sup>

Holi is a traditional Hindu festival originated in India. People celebrate it by playing with Gulal, a special colored powder, at each other. This Holi color/Gulal powder is manufactured by different companies. The quality and the amount of information given on the outer packaging about the ingredients of the particular Holi color are mostly very poor.

Ophthalmology is a branch of medicine which deals with diagnosis, treatment, and prophylaxis of diseases in the eye and visual pathway.<sup>2</sup>

Every year during the festive period, there is a sudden spike in cases of chemical injury, assault, and trauma cases in the eye. Hence, this study was chosen in order to look for the trend and its variation for the year 2018.

The severity of injury related to colors depends on composition, amount, concentration, time since exposure, and duration of reporting to a hospital from the time of incident.<sup>3</sup> The immediate symptoms can be blurred vision/blindness, inflammatory condition, allergic reaction, epiphora, and dermatitis. Balloon injury is the most common type of ocular trauma. They are being hit randomly by strangers from heights as a part of prank and fun which can cause blunt eye injuries. There can be hyphema, lens subluxation, macular edema, or retinal detachment, leading to loss of vision, rupture of blood vessels, diminished vision, fracture, and bruising.<sup>4</sup> Another common example of ocular trauma is conflict

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related. Cases of physical assaults and road accidents are recorded mainly under the influence of substance abuse like hallucinogens more commonly being “bhaang,” “charas,” marijuana, cocaine, and alcohol. Bhang is exclusively sold during Holi which is a hallucinogen under whose influence the person forgets about the time, events that have occurred during that interval.<sup>5</sup> Blindness resulting under such circumstances is classified as preventable blindness. It is defined as a blindness which could be either treated or prevented before the occurrence of permanent damage.<sup>6</sup>

## REVIEW OF LITERATURE

A study was conducted by Bossmann et al<sup>7</sup> on composition of Holi colors, who interpreted that an aerodynamic diameter smaller than 10 µm, so-called PM10 particles, can induce proinflammatory response and an oxidative leukocyte burst, after analyzing four different Holi colors regarding their particle size.

A review study conducted by Susman<sup>8</sup> on water balloon slingshots concluded that the balloons can be thrown at a speed up to 94 miles per hour which can cause rupture of blood vessels in eyes, diminished vision, hemorrhage, or fracture of the orbital bone surrounding the eye.

Another study by Velpandian et al<sup>9</sup> analyzed about ocular hazards caused by malachite green in Holi colors and evaluated the corneal penetration of malachite green using goat cornea in perfusion chamber and concluded that malachite green was extensively used in our festival of Holi and has caused severe ocular irritation with epithelial defect upon exposure.

A study by Ghose et al<sup>3</sup> carried out a prospective study on ocular chemical injury, which suggested that out of 50 cases of acute chemical burns, 86% of them were men with a mean age of 25 years who were most affected.

## MATERIALS AND METHODS

A descriptive cross-sectional observational study was conducted at the RPC in New Delhi in the Casualty Department of Ophthalmology for a period of 5 days to assess the patient flow during the festive period of Holi.

### Inclusion Criterion

Patients reporting to the Emergency Department during the duration of the festival, i.e., from March 1 to 5, 2018.

### Exclusion Criterion

Patients who reported before March 1 and after March 5, 2018.

## Study Period

It was divided into three phases:

1. Phase I
2. Phase II
3. Phase III

Phase I (March 1, 2018) dealt with all the pre-Holi cases (43), phase II (March 2, 2018) included cases which happened on the day of Holi (45), and phase III (March 3–5, 2018) dealt with the post-Holi cases (122), i.e., after the day of Holi for 3 days.

Direct open interviews were conducted with the patients and their relatives to record the significant demographic data. Patients' records were also reviewed for additional information. The data collected were analyzed using Microsoft Excel.

## OBSERVATIONS

Ophthalmic casualty hosts a variety of patients everyday viz., trauma, glaucoma, foreign body penetration, cataract, etc.

The patients' record is maintained by the nurses in three shifts: from 12 am to 1 pm, from 1 pm to 7 pm, and from 7 pm to 12 am. In normal routine days, the patients in need of immediate care directly report to the doctor, and in case of delay, they are asked to report to the nurse, where the history is recorded and any preliminary treatment is provided. Minor operation theater is used for suturing or for administration of anesthesia next to the casualty, whereas minor procedures like intravitreal injections, measurement of intraocular pressure (IOP), and saline wash, and are done on bedside within the casualty.

During Holi, the department is pre-prepared for patients (Fig. 1), with full-time availability of emergency drugs, additional staff on station and special eye drops



Fig. 1: Casualty scenario on Holi

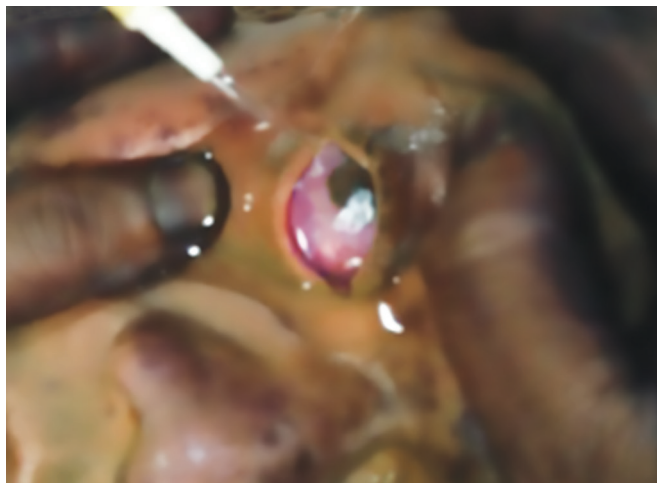


Fig. 2: Saline wash



Fig. 3: Color injury

for patients with color injury. Two doctors and two nurses were posted in the casualty for 24 hours. Holi injured patients were examined by the doctors on slit lamp, ophthalmoscope, and visual acuity/ultrasonography was done. Patients reporting with trauma were admitted.

In cases of color injury, saline wash (Figs 2 and 3) was given thoroughly to remove the foreign particles with prescription of sodium citrate (thimerosal, aqua, sodium citrate) and artificial tears (aqua, glycerol, sodium chloride, and thimerosal) eye drops which are exclusively manufactured the center for Diwali and Holi festival. They were further given prescription containing other medicines as per their requirements.

### Open Interview with Patients

The patients were asked about their demographic details, such as name, age, residence, occupation, and clinical details, such as history of exposure to the harmful chemical, status of vision, duration of exposure, time of first consultation, soundness of mind, and history of referral from other institutions, history of first aid (if any), and outcome of treatment. In phase I, a patient of color injury presented with complaints of burning sensation and blurred vision after exposure to Holi color. In phase II, 25 patients reported to Ophthalmology Casualty in RPC, AIIMS, after 2:00 pm in a disturbed condition after Holi celebration. Patients with color injury had similar complaints as mentioned in phase I. Out of three cases of trauma, two cases were accidentally hit by a balloon and an egg directly in the eye, while another case of trauma was reported where a man had been hit by a cow in an intoxicated state (Fig. 4). There was one case of assault where a man was beaten up in a crowd where Holi was being celebrated on the ground of personal grudge (Table 1).

In phase III, two cases reported for color injury after 2 days of Holi celebration; they were referred from other



Fig. 4: A case of trauma under substance abuse

hospitals after receiving preliminary care. These patients were interviewed to assess the reason for delay in reporting to AIIMS casualty. On interviewing, it was found that the delay was determined by two factors: Distance and ignorance of patients.

### Record Review

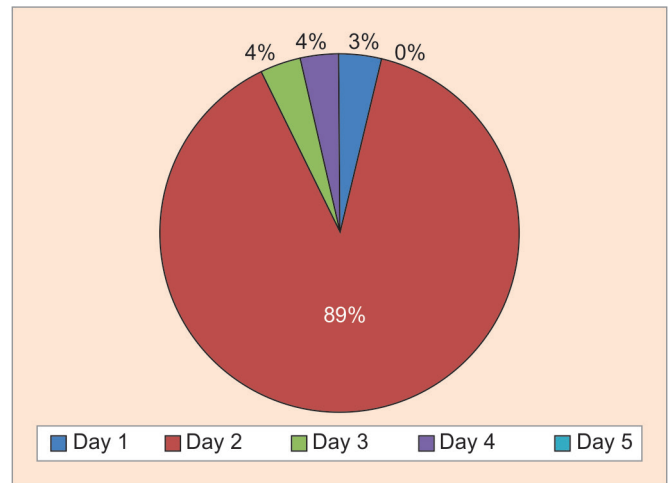
The data were recorded by interviewing the patients coming to the casualty between 8 am and 10 pm and from the records maintained in the record files and computerized data entries.

### RESULTS AND OBSERVATION

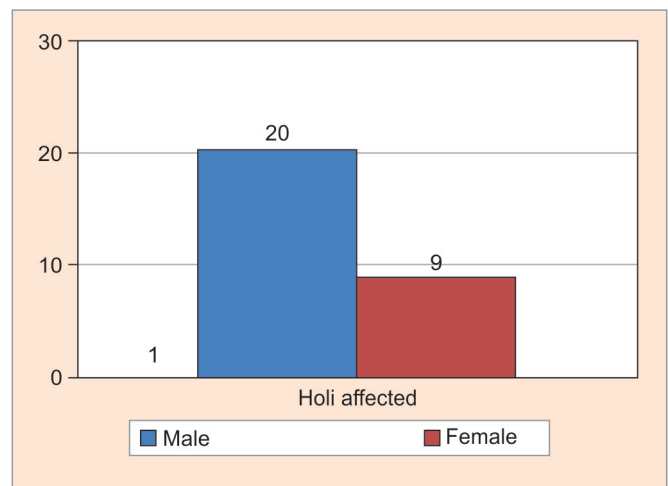
A total of 210 patients visited the ophthalmology casualty during the period of study (5 days) out of which 29 (13.81%) were affected from the events related to Holi. The data of number of patients visiting ophthalmology casualty are depicted in Graph 1. It was observed that there was a sudden increase in cases due to chemical injury during the period of Holi as shown in Graph 2.

**Table 1:** Demographic and clinical profile of patients

Demographic profile		
Gender	Male	20
	Female	9
Residence	Within Delhi	22
	NCR region	7
Age group (years)	5–20	20
	20–60	9
	Above 60	–
Occupation	Student	15
	Working class	10
	Housewife	3
	Retired	1
Clinical findings		
Cause of injury	Color injury from excessive playing	26
	Assault	1
	Balloon injury	1
	Trauma	1
Status of subject	Intoxicated	1
	Sound	28
Referred cases	Family physician	7
	Chemist	3
	Trauma center	3
First aid	None	18
	Eye drops (in color injury)	12
Time of reporting	Within hours	27
	Next day	1
	After 2 days	1
Outcome of treatment	Improved	27
	Admitted	2
Status of vision	Blurred vision	23
	Temporary blindness	6
	Permanent blindness	–
First aid	Premedicated	12
	Nonmedicated	17



**Graph 2:** On day 5, out of 55, there were no Holi affected cases

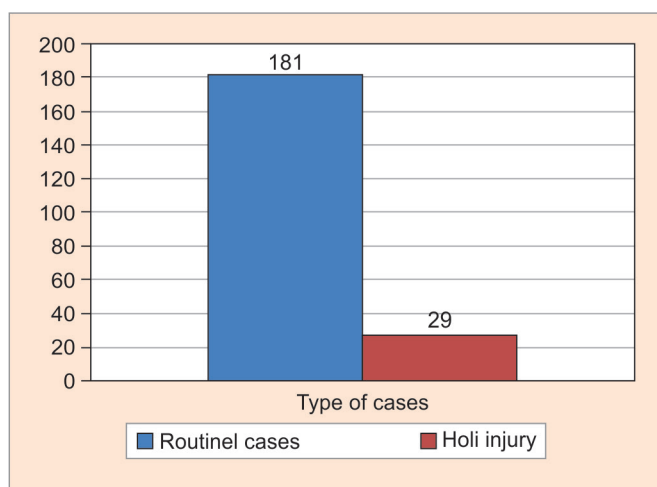


**Graph 3:** Gender distribution

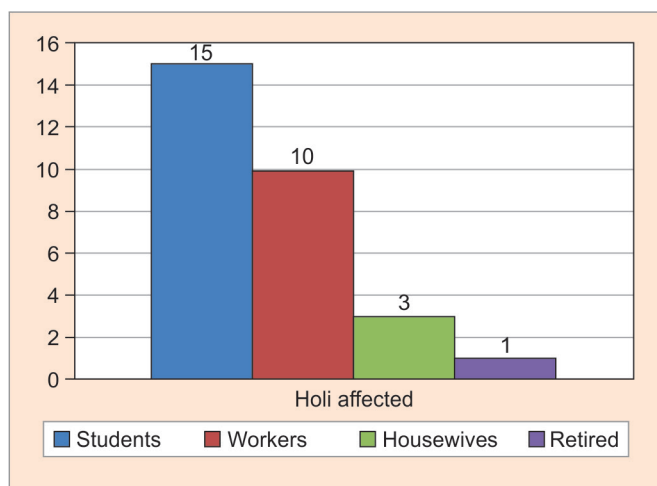
It shows that maximum cases were reported on day 2, where out of 45 patients, 26 (57.78%) were cases affected due to Holi followed by day 1 where out of 43, there was 1 (0.23%) case of color injury. On days 3 and 4, out of 44 and 22 patients respectively, one case of color injury in each was reported, constituting 0.23 and 0.45% respectively. Out of 210 cases reported to ophthalmology casualty during the study period, 129 cases (68.97%) were males and 81 cases (31.03%) were females. This is depicted in Graph 3.

Graph 4 deals with occupation of patients showing that 51.72% of cases affected by color injury were students, followed by 34.48% from service class, 10.34% cases were housewives, and 3.45% were retired personnel. The data show that out of 29 Holi affected cases, 86.21% were affected from color injury, 3.45% from assault, 6.9% trauma cases, and 3.45% from balloon injury as depicted in Graph 5.

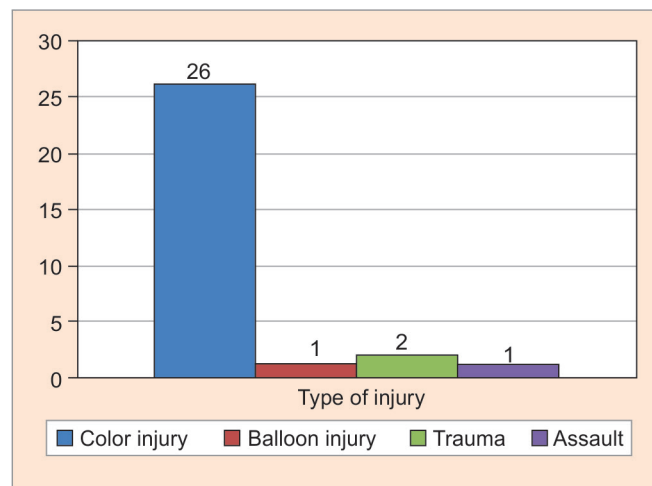
By interview of patients, it was found that the average duration from the time of exposure till the time of



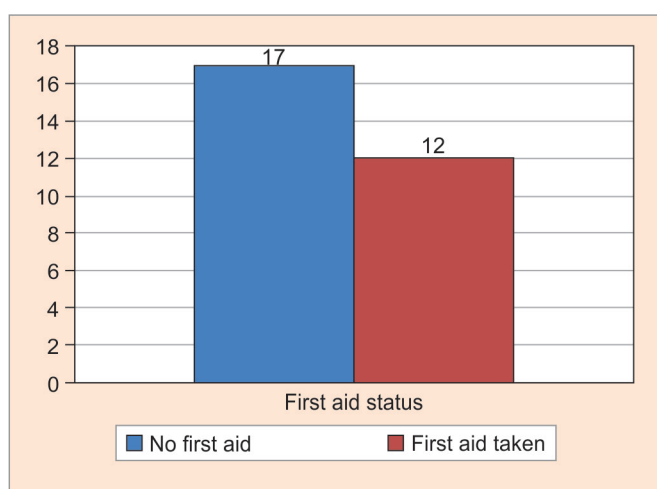
**Graph 1:** Type of cases reported during Holi



Graph 4: Occupation-based comparison



Graph 5: Types of injuries



Graph 6: Pretreated and nontreated patients

examination by doctors was found to be 7.9 hours, with minimum time being 1.5 hours and maximum being 48 hours from the time of occurrence of incident.

By analysis of the data, it was found that most incidents of ocular injury during Holi occurred at around 1 pm. Earliest exposure was observed at 9 am to as late as 7 pm. Average time of reporting to the hospital by the patients was at 4 pm who were examined within 5 minutes. A maximum delay of 60 minutes was observed because of an emergency trauma case which was reported in between.

Thirteen patients were referred from other centers out of which 3 (10.34%) were referred from the associated trauma center of AIIMS, 7 (24.17%) from family doctors, and 3 (10.34%) others were from nearby chemists as shown in Graph 5.

In all, 41.48% of patients (12) who reported had already been treated with some unnamed eye drops. Out of 29 patients treated at the ophthalmic casualty, 93% improved while 3% were admitted; 94% patients complained of blurred vision and 6% suffered from temporary blindness without any serious complication.

Over the years, the trend of color-related injury has declined from 41 cases in the year 2016 to 28 in 2017, to 25 in 2018 as seen in Graph 6.

## DISCUSSION

Annually, general outpatient department patient load is 3,63,445 and in casualty, it is about 56,059, which suggests that in routine days, number of patients in casualty is approximately 4,671 per month. In the current study period of 5 days, the patient load in the casualty department was 210, which included cases affected due to Holi along with other routine cases like glaucoma, increased IOP, foreign body, orbital cellulitis, and corneal ulcer with sudden rise in cases of chemical injury.

A case study conducted by Susman on water balloon slingshots showed that 17 cases were affected from ocular injury due to water balloon slingshots; in this study, there was one patient who had suffered similarly. Another case study conducted by Ghose et al<sup>3</sup> on ocular chemical injuries stated that out of 50 cases of chemical injury, 28% were due to Holi color and 8% due to trauma, having 86% males with a mean age of 25.4 years  $\pm$  12.2. In the current study, similar results were obtained where majority of color injury cases were seen in young men (68%) of same mean age (21.4 years  $\pm$  10).

Another study conducted by Chauhan et al<sup>10</sup> on bilateral periorbital necrotizing fasciitis following exposure to Holi color presented a case of a 57-year-old patient suffering from complications after being exposed to Holi color; however, in this study, no complications were observed.

At other hospitals (Delhi, Uttar Pradesh, Haryana), the number of cases reporting to emergency departments on the day of Holi was above 770, which included all the cases of road accidents, murders, and assault, although 2018 has marked lowest road deaths on Holi





**Graph 7:** Comparison with data of previous years

in Delhi over 7 years. On the day of Holi, over 9,300 people in Delhi were booked for traffic violations out of which 1,300 cases were caught by Delhi police for drunken driving.

## CONCLUSION AND RECOMMENDATIONS

It is concluded that

- Routine patient flow during Holi and other days in casualty has remained static with a sudden increase in cases of chemical injury.
- There has been a decline in the number of color injury cases over the past 3 years (Graph 7).
- A significant decrease in cases of trauma and assault cases, implying better enforcement of laws.
- There has been minimal extent of damage to eyes because of immediate reporting time, which implies an increase in the number of more informed and learned public.
- Holi is a joyous festival and should be played with utmost precautions by using herbal colors, protective glasses, oiling of hair and skin, and if a harmful

exposure occurs, nearby hospital should be sought for treatment without delay.

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# Importance of Medical Leadership Development: A Global Perspective with Special Reference to the Indian Healthcare System

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## ABSTRACT

Medical leadership has in the last decade assumed great importance globally. The reason for this is the proven link between effectiveness of leadership and improved clinical outcomes. With increasing demands for delivering high quality patient care at lower cost, physicians are expected to embrace leadership roles. Traditionally, medical schools do not teach leadership either at undergraduate or postgraduate levels. Also efforts to develop leadership skills among 'in service' professionals are minuscule and not very effective due to lack of structured leadership development programmes. This causes a significant "leadership gap" in medicine across a wide range of organizations. In order to bridge this gap, many countries viz. UK, USA, Canada etc. have designed specific leadership models and are conducting leadership development programs at various career stages of doctors to address the needs of the changing healthcare systems. However, not much work has been done in India in this direction. It is high time that medical schools and organizations in India begin to formalize leadership training at all stages of medical education and career. It will be prudent to design a leadership development programme targeting the needs of Indian doctors with special reference to the rapidly expanding Indian healthcare sector. This will help to create more doctors who are not only skilled as "competent physicians" but also as "competent physician-leaders". This article analyzes the leadership competencies critical for medical doctors and methods to develop them as well as reviews the important medical leadership models and programmes available globally.

**Keywords:** Canmeds, Competencies, Leadership, Leadership models/frameworks, Management, National Health Service, The Health Care Leadership Alliance, Training and development, UK-Faculty of Medical Leadership and Management.

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## INTRODUCTION

Leadership competencies and management abilities play a pivotal role in health care organizations for delivery of high-quality cost-efficient care. Effective clinical leadership improves hospital governance as well as patient care, patient safety, service quality, and hence, clinical outcomes. It also enables innovation with continuous development of newer health technology designs, methods, and skills. Further, cost containment with utilization of the available resources efficiently and ethically is another important outcome of effective leadership. Hence, in the last decade, medical leadership and management have received a lot of attention in many countries, especially because of modern challenges in quality, safety, and cost of health care. A lot of global efforts are being made to develop leadership competencies and management skills of medical professionals across their careers.<sup>1-3</sup>

## LEADERSHIP vs MANAGEMENT

American College of Health Care Executives defines leadership as "ability to inspire individual and organizational excellence, create a shared vision, and successfully manage change to attain the organization's strategic ends and successful performance." John Kotter of Harvard Business School defines leadership "by what leaders really do: They cope with change, they set direction, they align people to participate in that new direction, and they motivate people."<sup>4</sup> Leadership essentially involves vision, strategic thinking, defining purpose, setting a mission or goal, and motivating others through passion and team work to achieve the goal. It also involves strategic insights, innovation, creativity, planning change, taking calculated risks, and facing up to challenges in order to ensure organizational development. Leadership requires talented people but talent must be accompanied by passion, attitude, relationship skills, right work ethics, work skills, and strong peer networks.

Medical leadership is essentially “a physician’s ability to serve both as a manager and a leader of diverse teams in pursuit of maximally effective patient care.”<sup>5</sup> However, the concept still remains ill-defined and it means different things to different people in different scenarios. Thus, some experts consider medical leadership to be the formal management and administrative roles performed by physicians, while others refer to it as a part and parcel of the daily work of all medical professionals, which include organization of their clinical work, interdepartmental coordination, and delivery of high-quality patient care services.<sup>1,6</sup>

In contrast to leadership roles, management actions involve execution and implementation of the vision, policy, and plans of the organization to achieve specific goals. The main job of a manager is monitoring and controlling organizational activities, processes, and systems on a day-to-day basis, thus maintaining organizational stability and delivering results.<sup>1-3</sup> However, the distinction between leadership and management still remains a grey area. They are often referred to as being mutually exclusive but actually they are complimentary and synergistic. Both components are essential for the accomplishment of the strategic objectives of all organizations, and separation of the two will actually affect the success of any organization.<sup>1</sup> Collins-Nakai<sup>7</sup> and Noren and Kinding<sup>8</sup> best define the two terms as follows: “Leadership is not charisma, nor is it the same as management, though both may contribute to leadership practice. Management and leadership have two distinct roles and both are essential to the success of any enterprise. Management means coping with complex organizations and ensuring that things run well, that everyday problems are dealt with, and that there is a steady and continuous performance of the whole. Leadership, on the contrary, involves visioning and motivating others to achieve a preferred vision. It requires dealing with change, often unanticipated, unplanned change—whether it comes from external forces, such as government, or from internal forces, such as new medical technologies and the resultant but unanticipated ethical dilemmas.”

Classical teaching mentions that “Management is about coping with complexity,” while “Leadership is about coping with change.”<sup>2</sup> It describes management as an attribute of the mind and a matter of accurate calculations; however, its practice is science. Whereas leadership is a combination of personality and vision, its practice is an art. “Leadership styles can be considered to be ‘transformational’ while managerial actions are largely ‘transactional.’”

## TYPES OF LEADERS

Three different types of leaders have been reported in health care sector.<sup>2</sup>

1. Institutional leaders—CEOs, Directors, etc.
2. Service leader—Heads of Departments, Chiefs of centers.

3. Frontline leader—Primarily caters patient care services.

Berghout et al<sup>6</sup> identified medical leaders of two types:

1. Type I leaders represent doctors who work as physician managers responsible for management and/or executive functions in hospitals. The nature of the management position is either (a) Full time—the physician to carry out clinical tasks or (b) part time—where management roles are performed in addition to clinical practice. Thus, type I leaders represent doctors working in formal leadership roles which are akin to institutional and service leaders.
2. Type II leaders in contrast include doctors working in informal leadership roles, e.g., doctors working as leaders in their clinical practice. They are akin to the frontline leaders described by Blumenthal et al.<sup>2</sup>

Though in any organization, “institutional or service leaders” perform an important role in managing and planning the mechanisms of health care delivery, it is the frontline leaders who are largely responsible for the clinical outcome and the organizational performance because of their direct patient interaction.

## COMPETENCIES NEEDED TO BE AN EFFECTIVE MEDICAL LEADER

Leadership competencies are mainly described as “the technical and behavioral characteristics that leaders must possess to be successful in positions of leadership across the health professions – administrative, medical and nursing.”

An effective medical leader should possess the following competencies<sup>2,6,9</sup>:

- *Innovativeness*—should have creativity to plan, change, and enhance efficiency of health care delivery and increase financial viability.
- *Creditability*—related to clinical excellence and commitment leading to respect and trust by peers. This puts a person in a strong position as a leader and is critical for getting things done to improve organizational performance.
- *Knowledge of health care systems*—healthcare insurance, medico-legal issues, accreditation, quality control, quality assurance, right to information, consumer protection act, public/private partnership, etc.
- *Technical knowledge*—operations, finance, information technology, systems, human resources, strategies, legal and policy making in health care, etc.
- *Technical skills*—communication skills, administration, skills, collaborative skills, strategic skills, team skills, skills to resolve conflicts and negotiating, networking, and ability to carry out a vision.

- *Problem-solving ability*—organizational strategy and project management.
- *Risk tolerance*—to try new and novel approaches and innovations.
- *Ethical*—adherence to high ethical values central to health care.
- *Personal attitude or traits/emotional intelligence*—motivation, assertiveness, integrity, result driven, honest, innovative, team player, self-confident, quality driver, forward thinking.
- *Experience*—people who lack experience feel insecure when they get leadership roles.

## LEADERSHIP GAP IN MEDICINE

Though there are adequate evidence that supports a positive link between leadership and improved clinical outcomes, still a significant “leadership gap” exists in health care across a wide range of organizations at different geographical settings. Reasons for these are many<sup>2</sup>:

- A physician-leader worries that his/her primary responsibility to provide patient care will be affected if he/she indulges in administrative commitments. These responsibilities, being overly time-consuming, will prevent him/her from the opportunity to improve his/her clinical expertise and achieve better clinical outcomes.
- Secondly, in most health care organizations, individual accomplishments related to academic achievements are generally rewarded and recognized rather than joint successes, leadership capabilities, or quality results. The academic success is mainly recognized by number and quality of publications, while administrators rarely get a chance to publish articles related to successes in leadership roles.
- Most physicians value autonomy and are skeptical about collaboration and view it as a threat to their independence.
- Majority of medical schools and teaching programs throughout the world do not provide structured leadership and management training. Hence, most professionals learn these important skills through experiences thrust upon them because of their seniority or rotation in the organization. Hence, many physician-leaders feel themselves to be “accidental leaders.”
- Finally, allocating time for leadership training and education in the already tight medical curricula causes a challenge for delivering leadership training and education to medical students.
- Medical leadership is not recognized as a specialty in the medical curriculum. So, there is lack of a clear concept of where a medical leadership career will lead to. Hence, there is an unwillingness to take this field as a full-time career.

Thus, it is evident that there is significant shortage of leaders in medicine who have the ability to develop innovative ideas in clinical practice as well as education. Thirty five percent of US hospitals had doctors as their CEOs in 1935.<sup>10,11</sup> Whereas, in 2008, 6500 US hospitals (approx. 4%) were led by clinicians reporting a decline of 90%.<sup>10,11</sup>

## METHODS TO DEVELOP MEDICAL LEADERSHIP

In order to bridge the leadership gap in medicine, many countries around the world are developing and conducting programs for strengthening leadership skills in medical professionals. Fortunately, “leadership can be taught and developed with time through training and hardwork.”<sup>12</sup>

To this effect, several medical leadership frameworks and models have been designed, which are discussed in detail later. Some of the universities conducting leadership development programs include: Harvard Medical School, USA; Oxford University, UK; University of Calgary, Canada; Albany Medical College and Union College, USA; John Hopkins, USA; University of Queensland, Australia, etc.

The methodologies used for leadership development programs are numerous, such as<sup>13</sup>:

- Attending leadership courses
- Mentoring
- Action learning
- Seminars
- Self-directed learning
- Multisource (360° feedback via questionnaire)
- Developmental assessment centers
- Developmental assignments
- Coaching
- Networking
- Experiential learning

## MEDICAL LEADERSHIP DEVELOPMENT FRAMEWORKS/MODELS

According to a study of Leadership Best Practices, “An effective leadership development programme has broad organizational reach, touching both employees and affiliated professionals and spanning the organization. With this reach, leadership development programmes can be used to help new and established leaders, as well as those in administrative and clinical roles, to improve their leadership skills and ability to perform their job functions.”

### Medical Leadership Competency Framework of NHS Institute for Innovation and Improvement and Academy of Medical Royal Colleges, UK

The Medical Leadership Competency Framework (MLCF)<sup>14</sup> is built on the concept of shared/collective

leadership. This means that leadership is not confined to people with designated leadership positions. Instead, there is a shared sense of responsibility based on the concept that all people working in the organization have potential to develop as leaders. Hence, it is a collaborative achievement of the organizational goals.

The MLCF<sup>14</sup> applies to all medical students, qualified doctors, and dental surgeons. Three main career stages have been identified:

- Stage I: up to the end of undergraduate training.
- Stage II: up to the end of postgraduate training.
- Stage III: up to 5 years or equivalent continuing practice.

Five main domains are highlighted in the MLCF.<sup>14</sup> Within each domain, there are four elements and each of these elements is further divided into four competency outcomes. Two other domains, viz., creating the vision and delivering the strategy have been added, which focus more on the role and contribution of individual leaders.

- Demonstrating personal qualities: Developing self-awareness, managing yourself, continuing personal development, and acting with integrity.
- Working with others: Developing networks, building and maintaining relationships, encouraging contribution, and working within teams.
- Managing services: Planning, managing resources, managing people, and managing performance.
- Improving services: Ensuring patient safety, critically evaluating, encouraging improvement and innovation, and facilitating transformation.
- Setting direction: Identifying the contexts for change, applying knowledge and evidence, making decisions, and evaluating impact.

Based on the MLCF, a self-assessment tool has been developed that aims to help professionals to manage their own learning and development by allowing him/her to reflect on which area/areas of leadership framework that he/she would like to enhance further.

### **National Center for Health Care Leadership Health Leadership Competency Model**

The National Center for Health Care Leadership Health Leadership Competency Model<sup>15</sup> was created by the Hay Group with practicing health leaders from administrative, nursing, and clinical backgrounds in early, mid, and advanced career stages. It contains three domains with 26 competencies, which are as follows:

1. Transformation refers to “Visioning, energizing, and stimulating a change process that coalesces communities, patients, and professionals around new models of health care and wellness.” Leadership competencies listed are: “Achievement orientation, analytical thinking, community orientation, financial skills,

information seeking, innovative thinking, strategic orientation.”

2. Execution pertains to “Translating vision and strategy into optimal organizational performance.” This includes following leadership competencies “Accountability, change leadership, collaboration, communication skills, impact and influence, information technology management, initiative, organizational awareness, performance management, process management/organizational design, project management.”
3. People: It includes “Creating an organizational climate that values employees from all backgrounds and provides an energizing environment for them.” Further, it refers to leader’s duty to recognize his/her impact on target people and to further develop his/her ability, and the capabilities of others. Leadership competencies mentioned under this segment are: “Human resource management, interpersonal understanding, professionalism, relationship building, self-confidence, self-development, talent development, team leadership.”

This leadership competency model provides the basis for necessary management training and leadership development initiatives critical for medical practitioners at all levels of their education and careers.

### **NHS Health Care Leadership Model: The Nine Dimensions of Leadership Behavior**

The NHS Health Care Leadership Model<sup>16</sup> is organized in such a way that it helps all professionals to develop as better leaders. The model comprises nine dimensions of leadership competencies, viz.: “Inspiring shared purpose, leading with care, evaluating information, connecting our service, sharing the vision, engaging the team, holding to account, developing capability, influencing for results.”

For each dimension, leadership behaviors are depicted on a four-part scale, which ranges from “essential” through “proficient” and “strong” to “exemplary.” Although the complexity and sophistication of the behaviors increase as one moves up the scale, the scale is not tied to particular job roles or levels. For example, one may be mostly “strong” in a few dimensions, “exemplary” in one, and “essential” or “proficient” in others.

### **The CanMEDS Physician Competency Framework**

The Royal College of Physicians and Surgeons of Canada developed the CanMEDS leadership framework<sup>17</sup> in 1996 and further modified it several times subsequently. In 2015, the word manager was replaced with leader. The framework explains the talent that physicians must

possess in order to effectively cater the health care needs, which are grouped under seven roles. These roles include: "Medical Expert (central role in the framework), Communicator, Collaborator, Leader, Health Advocate, Scholar, and Professional." The CanMEDS model is widely accepted and recognized for its applicability as a physician competency framework across the globe.

### The Health Care Leadership Alliance

The Health Care Leadership Alliance Model<sup>18</sup> is very exhaustive and recommends 300 competencies in five domains with seven domain subsets.

1. Communication and relationship management (26 competencies)
2. Leadership (24 competencies)
3. Professionalism (24 competencies)
4. Knowledge of the health care environment (22 competencies)
5. Business knowledge and skills (36 competencies)
  - (i) Financial management (35 competencies)
  - (ii) Human resources (24 competencies)
  - (iii) Organizational dynamics and governance (18 competencies)
  - (iv) Strategic planning and marketing (21 competencies)
  - (v) Information management (36 competencies)
  - (vi) Risk management (18 competencies)
  - (vii) Quality improvement (17 competencies)

In addition to these, "emotional intelligence—self-awareness, self-management, social awareness, and relationship management," are also quoted widely as critical competencies required for doctors in leadership roles.

### USIHI: High Impact Leadership

The USIHI model<sup>19</sup> includes "mental models, behaviors, and domains" that should be aimed to achieve what IHI refers to as "triple aim," i.e., "improving patient experience of care, improving the health of population, and reducing the cost of care." This is highly acknowledged in the US and considered critical to develop leadership behaviors.

### UK Faculty of Medical Leadership and Management (FMLM)

The FMLM<sup>20</sup> has published gold standards for leadership. These standards should apply to all physicians working in the UK and at all levels of the health care organizations. These standards primarily include "core values and behaviors," viz., "self-awareness and self-development; personal resilience drive and energy; effective team work and cross team collaborations; corporate team player; culture and innovation."

### LEADERSHIP LACUNAE AND NEED FOR LEADERSHIP DEVELOPMENT IN INDIA

Traditionally, medical leadership in India has been hierarchical. Both in the public and private sector organizations, seniority is the sole criterion for promotions. Medical professionals assume leadership roles as they acquire higher positions either by virtue of their seniority or by rotation. Thus, leadership role for them is "accidental" or by chance.<sup>21</sup>

Like many other countries across the world, medical curriculum (both at undergraduate and postgraduate levels) in Indian universities does not comprise of structured leadership development. There is no or very little in-service leadership development for faculty/consultants. Thus, once the leadership responsibilities are thrust upon medical professionals, they start acquiring the necessary skills and competencies by one or other of the following approaches:

- Trial and error
- Observations
- Self-learning
- Attending management development courses, if available

This develops a huge leadership gap among the medical doctors in the country as they attain leadership roles in their organizations.<sup>21,22</sup> A study done by Patnaik et al<sup>23</sup> reported gaps in perceived "existing competency" and "required competency" levels in select leadership traits of health care leaders in India. There is, thus, a need for imparting training in areas of leadership development to bridge this "leadership competency gap" among Indian health care leaders. It is, therefore, important for Govt. of India to develop a comprehensive approach to strengthen medical leadership skills for health professionals at all levels of their education and career in the following ways:

- To include leadership and management development training in undergraduate and postgraduate medical curriculum.
- Provide in-service training courses for consultants/faculty at regular intervals throughout their career.
- Setup an expert group to monitor and advice regarding development of medical leadership programs in the country.

To date, there is no structured model/framework of medical leadership development in India. Some efforts in this direction have been started by institutes, such as: National Institute of Health and Family Welfare, New Delhi; Indian Institute of Public Health; Institute of Health Management Research; South Asia Public Health Leadership Institute; International Clinical Epidemiological Network Trust. These organizations provide training to working professionals with funding

from Government of India, World Health Organization, or self-payment basis. However, the efforts are miniscule and need to be strengthened at both education and service levels. Further, professional associations, societies, and national establishments, i.e., Medical Council of India, National Board of Examinations, and Indian Council of Medical Research should also encourage research in the area of medical leadership and organize these programs across the country.

## CONCLUSION

The key challenge to the Indian health sector today is to nurture culture that ensures delivery of high quality, safe, and affordable health care. For this, effective medical leadership is extremely critical. Hence, it is becoming imperative to make leadership development a critical component of medical education and training of health professionals at different hierarchical levels and career stages. In the rapidly changing Indian health sector environment, doctors must not only be academically and clinically strong in their respective disciplines but also develop leadership and management skills to ensure delivery of better health care services as well as organizational development.

It is high time that Government of India through its various apex institutions, medical, and research bodies takes a serious note of this leadership gap in the Indian medical education and training and starts working in this direction to bridge this gap. Development of leadership competencies for doctors should not be taken as a distraction or compromise to patient care but an additional method for delivery of safe and better care to their patients. Like in many universities abroad, leadership development should be included as a core element of clinical training, which rather being done in isolation should be incorporated into the medical curricula and service.

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