EFFECT OF LEAN DAILY MANAGEMENT (LDM) SYSTEM ON QUALITY OF HEALTHCARE DELIVERY IN INDOOR SETTING – A PILOT STUDY

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ABSTRACT

Objective: To determine the effect of introducing Lean Daily Management (LDM) System on the quality of indoor healthcare delivery.

Study Design: Quasi experimental study.

Place and Duration of Study: Officer's Family Hospital (OFH), Combined Military Hospital (CMH) Rawalpindi, May 2017 to Sep 2017.

Methodology: Twelve locations in Officer's Family Hospital were selected for introducing Lean Daily Management System. Greater Baltimore Medical Centre's (GBMC) quadruple aim was taken as the standard for introducing Lean Daily Management. The four aims included "best health outcomes", "best care experience", "lowest cost" and "most joy". Each department defined a goal for one of these four aims to achieve over the next month. Data collection was done independently in each location everyday on standard printed charts. The incidence of failure to attain the aim was recorded. Reasons of failure to achieve a goal were identified and broken down to reach the root cause. Based on this analysis an action plan was formulated to improve the results and implemented over the next month. The same aim was pursued by a department over successive months till it achieved substantial score in that area.

Results: The delayed collection of lab reports in family medical unit (FMU) decreased by 66% after implementation of lean daily management system.

Conclusion: Application of Lean Daily Management system in indoor healthcare improves the quality of care being provided to the patients.

Keywords: Greater Baltimore Medical Centre's quadruple aim, Healthcare delivery, Lean daily management.

INTRODUCTION

In 1937, Joseph Juran stated that 80% of the problems are caused by 20% of the defects - and he named this effect Pareto Principle or the law of the vital few[1]. This law forms the core of the concept of lean management. The concept of LDM was founded by the manufacturing industry, Toyota Motor Corporation[2]. As a lean organization it believes that problems are opportunities for meaningful learning rather than errors to be quickly resolved. At Toyota Motors managers act as coaches, helping others get comfortable in identifying problems and practicing daily continuous improvement.

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The lean methods have recently been adopted by various health care systems in the world with reports of improvements of health-care delivery in the literature[1]. In the healthcare setup LDM enables frontline workers to monitor their work process, identify and solve problems in the process as a team and prevent future occurrences by dissecting the root cause(s) of the problems[2]. One example of which is Greater Baltimore Medical Centre's (GBMC). It applied LDM system by defining four/quadruple aims related to the healthcare setup, each with corresponding goals. In military hospitals the maximum contact with patients is in their indoor stay. Hence we chose an indoor setup that is OFH for application of LDM to analyze its effect on the standard of healthcare. OFH is a 250 bedded facility. It includes the medical, surgical, gynecology

and obstetrics, pediatric, oncology departments and a high dependency unit. The fields work as 12 independent units each with its own medical and paramedical staff. The entire complex is commanded by Medical Officer In Charge (MOIC) OFH. Other team members include 1 Assistant MOIC, 12 MOIC's of wards and 1 Assistant Matron. OFH offered a wide array of indoor settings and human resources to study the effects of LDM system. We launched LDM in OFH by adapting GBMC quadruple aim at the micro level of management.

METHODOLOGY

This study was approved by Ethical Committee of CMH Rawalpindi. The quasi experimental study was conducted at Officer's Family Hospital (OFH) CMH Rawalpindi in twelve departments from June 17 to July 17. Sample size was calculated by using WHO calculator. We present the data of Family Medical Unit (FMU) as a prototype. The department chose "better care" from GBMC quadruple aim for the month of June. It picked the goal of better care as: "reports of critical laboratory investigations will be available within 4 hours from the time of advice of investigations". One hundred fifty eight female patients admitted in FMU over the months of June and July were selected by purposive sampling technique after the informed consent. Only those patients were included in the study who were advised urgent laboratory investigations at least once in their admission. For statistical analysis SPSS-20 was used.

RESULTS

During June, 78 admitted patients were advised a total of 181 laboratory tests marked urgent. Average patient age was 35 ± 2 years and average hospital stay was 5 ± 1 days. The patients were seen every day in the morning by medical specialist. The cases who were advised laboratory tests marked "urgent" on documents were followed by ward MOIC. Average number of patients advised urgent labs was 7 ± 1 per day. Blood samples for laboratory tests were drawn by nursing officer on duty and dispatched with signed laboratory investigation forms to laboratory. The time at which samples were advised was taken as time zero, seen from the time of clinical notes from patient documents. The ward runner delivered the samples to one of the three attached laboratories vis: CMH main lab, OFH lab, Armed Forces Institute of Pathology (AFIP) lab. Each lab returned a receipt with unique code for every sample sent to it. The receipts were delivered to ward by the same runner. Ward staff chased report within 4 hours of advice of lab investigation. The number of patients whose lab results did not arrive within 4 hours was noted every day and each day was marked on a month calendar sheet with color coding. Green indicated

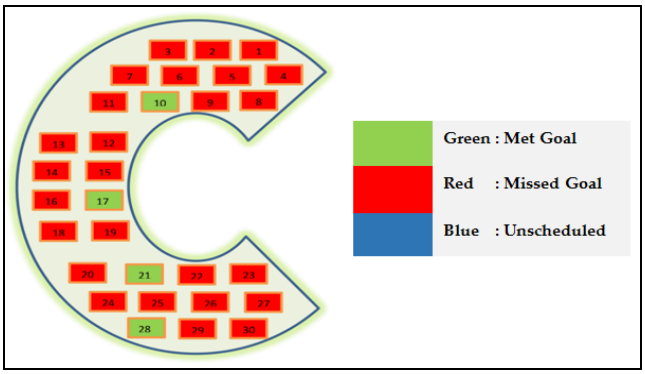

Figure-1: Better care aim for Family Medical Unit in the month of June.

timely collection for all patients in that day and red was used for days where 100% labs were not collected within defined time. For the month of June 26 days were marked red and only 4 as green as shown in fig-1.

These charts were displayed in the department and served as the visual management system of the ward. Members of the central LDM team visited FMU every day to monitor the visual management system of the ward. Report on LDM was also provided to commandant CMH Rawalpindi on weekly rounds with request for any administrative support.

The data for each day was further categorized on the Run Chart where number of times the goal was missed each day marked red was charted. For the 26 red days in June; 30 patients out of the 78 who were advised urgent lab tests

faced delay in collection of laboratory reports. That made a total of 83 out of 181 investigations marked urgent as shown in fig-2.

cause was marked on the Living Pareto Chart resulting in identification of most commonly recurring causes of delay as shown in fig-3.

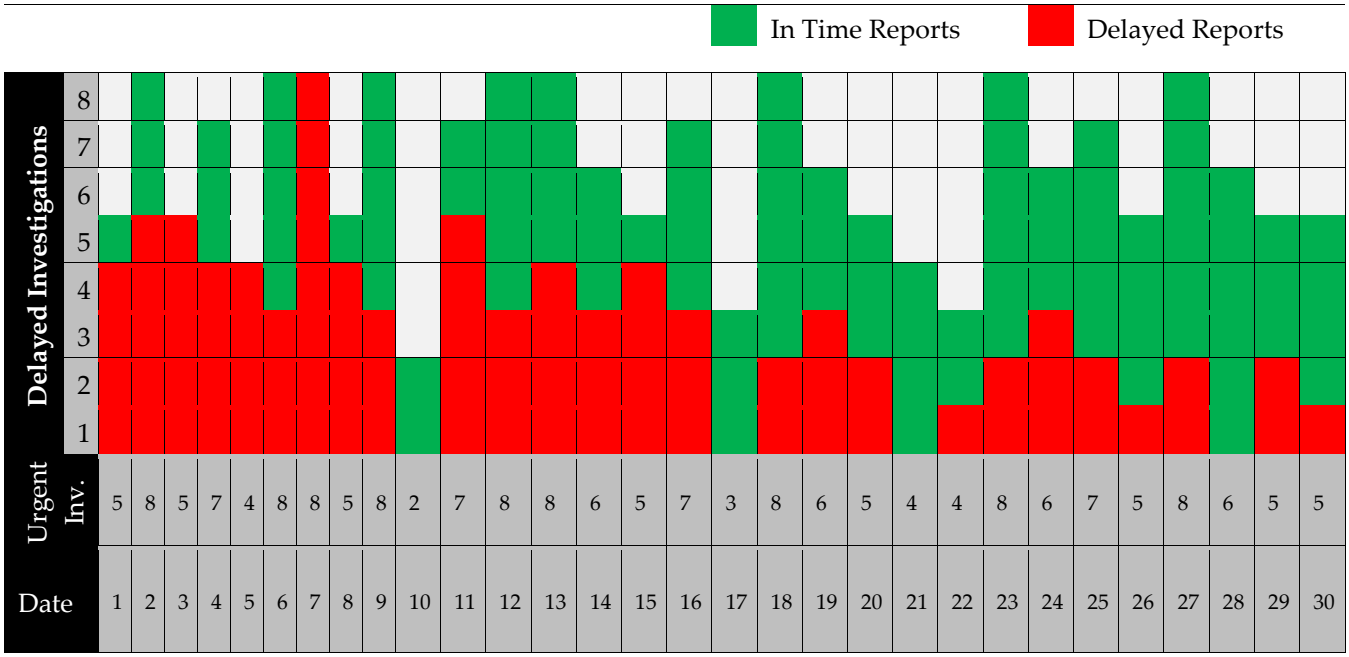

Figure-2: Run Chart of Family Medical Unit showing no. of patients per day whose lab reports were collected later than target.

For each day marked red, analysis of the delay was done by ward team. Each time a report was delayed, its cause was identified and marked on the Pareto Chart. In all, 6 causes were identified that led to the delay. Incidence of each

The commonest cause figured out from data for delayed collection was failure to deliver samples in time to laboratory (52.45%). It was broken down to reach its root cause by the "5 whys" problem solving approach, shown in table.

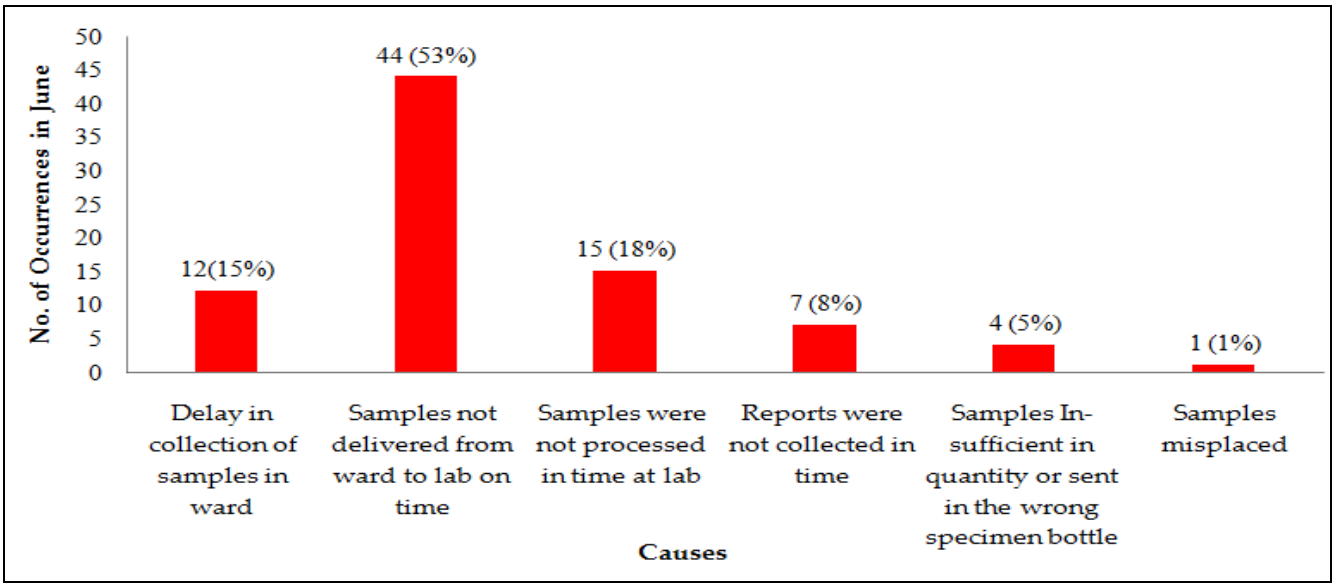

Figure-3: Living Pareto Chart for the causes of delay in lab reports.

The problem solving was done by the ward staff (MOIC ward and nursing officer in charge) in consultation with LDM team. The above problem solving analysis revealed the root cause of the problem that the samples were not segregated at the point of collection. An action plan with the following measures was formulated to address the root cause: Lists of the lab investigations available at each laboratory were displayed at FMU. This helped for segregation of blood samples into color coded baskets with red showing AFIP, green for CMH lab and blue for OFH lab. The ward staff placed each sample in the basket of the lab where test was to be conducted. The runner then easily delivered each basket to the concerned lab without undue delay. To further expedite results of samples delivered at AFIP, MOIC family wing coordinated at AFIP so that OFH lab and AFIP were connected through Hospital Management Information System. There after, the unsigned reports at AFIP became accessible at OFH lab within 4 hours of dispatch. The action plan was implemented over the month of July at FMU and similar data gathered to compare with that of June.

The results of FMU revealed that out of the total 78 patients advised urgent labs in FMU in June, 30 patients had delayed collection of lab reports. In July out of the 80 patients with labs advised as urgent, only 10 patients faced that problem. The delayed collection of labs decreased by 66% in July as shown in fig-4.

Table: "5 why" problem solving for one of the identified causes of delay in lab reports.

Problem Description	**Samples were not delivered from ward to lab on time.**
1st why	Q: Why were samples not delivered from ward to lab on time? A: Time was wasted because the runner had to take the samples to three labs one by one.
2nd why	Q: Why did the runner take samples to all three labs? A: Some tests are done at OFH lab, others at CMH lab and the rest at AFIP. He was unaware where to deliver which samples.
3rd why	Q: Why was the runner unaware where to deliver the samples? A: All the samples were handed to him by the nursing staff in a single container without segregation / instructions of delivery to specific labs.
4th why	Q: Why was he not given specific instructions about delivery? A: There was rapid turnover of nursing staff and communication of concerned information was poor.
5th why	Q: Why was communication of concerned information poor? A: Information about the availability of kits/test facility in OFH lab, CMH lab and AFIP was not displayed in the wards.

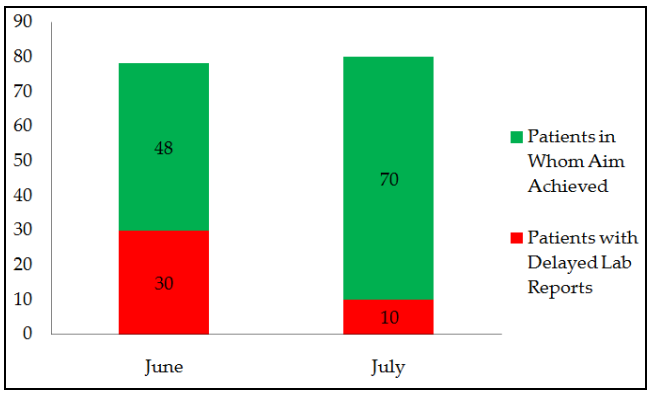

Figure-4: Comparison of the number of patients with timely and delayed collection of lab tests in the months of June and July.

DISCUSSION

One important question for healthcare setups is how can the healthcare experience for their patients be improved? A reasonable approach is to adopt a quality improvement methodology which include lean, six sigma and lean sigma etc. The lean approach can provide an efficient means of achieving this goal as it highlights not only the most frequent healthcare problems but also identifies the commonest

causes of those problems. We employed GBMC quadruple aim for introduction of LDM in our study. It was first launched in the spring of 2013 in four departments at GBMC[3]. At present it has spread to involve 30 different areas. The quadruple aim categorized a myriad of patient care related metrics into four aims i.e, "best health outcomes", "best care experience", "lowest cost" and "most joy"[3]. They recorded a decrease in hospital acquired urinary tract infections, decrease in pressure ulcers, decrease in serious safety errors and increase in overall hospital rating[4]. At OFH each department defined its goal after selecting an aim for itself. Every morning the hospital's executive leadership at GBMC splits into teams to visit assigned units. At each unit, the executive team members review the unit's data, discuss successes and any barriers preventing staff from achieving its collective goals. At OFH there was only one executive team that visited all 12 departments every day to supervise their progress in goal achievement. At GBMC all the medical inpatient and surgical units have their own posted LDM boards. Soft boards were especially installed at each department in OFH to display their tools of data collection and analysis i.e, visual management system. We employed the same standard printed sheets for run charts, living Pareto charts, problem solving chart, action plan as used at GBMC.

The foundation of Lean Thinking in a healthcare organization is based on establishing stability and standard work in areas of patient care[5]. The goals of stability and standardization are to promote a working environment in which the health care workers are able to perform their daily work in a standard way that the workers created (not just the way work evolved), and to constantly be aware of the things that go wrong. One of the ways in which this can be accomplished is by applying standard Lean tools[5], such as the workplace visual management system like we used in our study, and standard operating procedures by sequencing work which is already a part of the military setup. When well executed, LDM can help in improving quality and efficiency while controlling costs and saving time. The Veteran Affairs Palo Alto healthcare system recorded a decrease of 12.6 min in "Door to Doctor" time at their emergency department after implementing Lean principles[6]. There are 6 principles that constitute the essential dynamic of Lean management: attitude of continuous improvement, value creation, singularity of purpose, respect for front-line workers, visual tracking, and flexible regimentation[7].

Lean has been employed at multiple healthcare institutes in variable contexts with improvements in almost all areas. The da Care, an integrated healthcare delivery system in Wisconsin, introduced Lean to its five hospitals and 27 physician clinics in 2003 with considerable improvement in its healthcare delivery processes[8]. At the University of Colorado the lean management was used to improve the insulin pump initiation process for pediatric patients with type 1 diabetes with a decrease in median lead time of waiting from 132.5 to 98.5 days[9]. A study was conducted at the five-hospital healthcare system in Veterans Health Administration (VHA) to standardize the Workplace Violence Prevention Program (WVPP) by using the lean process. The effect was a significant standardization in both the threat assessment and education arms of the WVPP[10]. A systematic review of 23 studies of quality improvement methodologies in radiology department shows that Lean and Six Sigma QI methodologies have the potential to reduce error and costs and improve quality[11]. A study employed the lean methods to enhance heart failure patient identification processes and increase core measure scores. It identified a decrease in re-admissions within 30 days of implementation from 12% to 8%, and Heart failure core measures compliance score increased from 88% to 100%[12]. Bheppard Pratt Health System, the largest private psychiatric Care setup in Maryland used the Lean methods to reduce inappropriate use of anti-psychotics for agitation. They noticed a 90% (p<0.001) reduction in the rate of antipsychotic prescribing for agitation and a 10% reduction in overall antipsychotic prescription[13].

The implementation of Lean in healthcare settings has had a great influence on the roles, responsibilities, and job characteristics of the employees. The focus has shifted from healthcare professionals, where clinical autonomy and professional skills have been the guarding principles of patient care, to process improvement and teamwork[14]. Senior nurses at Virginia Mason Medical Center in Seattle used the Lean methodology with a result in increased time for nurses to care for their patients[15]. Another study conducted across 46 primary care departments in a large ambulatory care delivery system at USA employed Lean workforce re design to analyze the work experience of physicians and other staff. They concluded higher levels of engagement and teamwork after implementing redesigns. However, they also experienced higher levels of burnout and perceptions of the workplace as stressful[16]. This however needs further exploration.

Lean production in health care is mostly used as a process improvement approach. The usual implementation steps include conducting Lean training, initiating pilot projects, and implementing improvements using inter-disciplinary teams. A multiple case study of three Italian hospitals conducted with the aim to explore the organizational conditions that are relevant for an effective system-wide lean implementation showed that Lean implementation requires an integrated and coordinated strategy involving all components ofthe overall hospital system[17]. For the adaptation of Lean methods effective strategies for selecting and presenting metrics to physicians are essential for successful quality improvement effort[18]. One of the barriers is lack of educators and consultants in health care sector who can educate about real-life applications of Lean in health care.

LDM has the potential to change the role of quality management from a system that is reactive to crises and quality issues to one that proactively pursues methods, processes and strategies to improve quality for the patient and prevent future crises[10]. The authors believe LDM approach can open doors to the realization of evidence based health care delivery and a sustainably evolving healthcare setup. This was a pilot study and hence long term effects of introducing LDM still remain to be investigated. The authors suggest similar studies at other military healthcare setups to evaluate the effect of LDM.

CONCLUSION

This pilot study recommends that introduction of LDM in hospital setting can lead to better quality health care by solving the most frequent issues at the grass root level. The concept of LDM may serve as a framework for military hospitals as they seek to deliver health care services with greater value.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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