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## Application of integrated Lean Six Sigma quality healthcare system practice in Indian healthcare

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K. Sathish Kumar\* and R. Venkatesh Babu

Bharath Institute of Higher Education and Research,

Agharam Road, Selaiyur, Chennai,

Tamil Nadu 600073, India

Email: pkskumar88@gmail.com

Email: rvbaboo76@gmail.com

\*Corresponding author

K.P. Paranitharan

TVS Sensing Solutions Private Limited,

Madurai-Melur National Highway Road,

Vellaripatti, Madurai, Tamil Nadu 625122, India

Email: paranikp4@gmail.com

**Abstract:** Integration of continuous improvement methodologies has gained momentum and international fame on improving healthcare performance. However, there is an individual methodology not gained due to dynamic conditions in the marketplace. The study investigates the impact on the integration of Lean, Six Sigma (DMAIC) and TQM concepts in the Indian healthcare sector to maintain its sustainability. The integrated Lean Six Sigma quality healthcare system (ILSSQHS) was developed under ten critical success factors (CSFs) through extant literature review and from experts' opinions. The purpose of this ILSSQHS model is to assess the performance and quality of care in private hospitals in India. Data were analysed by performing statistical analysis using SPSS. This study revealed that CSF leadership management commitment is higher in rank and healthcare operational effectiveness seems lower rank in the healthcare. The result revealed that all CSFs are found a significant and positive association with ILSSQHS practice as perceived by healthcare managers.

**Keywords:** healthcare; hospitals; lean; Six Sigma; quality; India; integrated Lean Six Sigma quality healthcare system; ILSSQHS model; critical success factors; CSFs.

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**Biographical notes:** K. Sathish Kumar is a research scholar in the Department of Mechanical Engineering, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India. He has published two papers in international conferences and national conferences held across India. His area of research is total quality management and lean manufacturing.

R. Venkatesh Babu is working as a Professor and the Dean in the Department of Mechanical Engineering, Bharath Institute of Higher Education and Research, Chennai, Tamilnadu, India. He has published research papers in international journals and conferences. His areas of research are internal combustion engine and manufacturing management.

K.P. Paranitharan is working as a Senior Engineer at TVS Sensing Solutions Private Limited, Tamil Nadu, India. He obtained his Bachelor's in Mechanical Engineering, Master's in Lean Manufacturing and PhD in Industrial Engineering from the Anna University, Chennai. He received his Master's of Business Administration from the Madurai Kamaraj University, Madurai, Tamil Nadu State, India. He has published various papers in international journals including those published by Springer, Taylor and Francis, Inderscience and in reputed conferences. His areas of research interest are manufacturing management, healthcare engineering, industry internet of things, data mining, data analytics and system engineering.

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## **1 Introduction**

The healthcare sector in India is one of the largest service sectors in the world, particularly Tamilnadu is considered to be the most favoured healthcare hub in the world wherein private healthcare system plays a major role by providing 80% of ambulatory care at increased cost to customer. Though public healthcare system renders superior services, due to various reasons like infrastructural availability and lacking of good service its popularity among middle class and higher class people has shaded away and hence majority of people opts for private establishments. Therefore, the private healthcare sector has to take the whole burden of giving an excellent care service to the common man at the affordable cost. This prompts the private healthcare sector to play a major role through effective contribution and participation in public domain in order to reduce the financial burden of economically deprived community and to induce trust among people for dependence on public care system. Like US, Indian healthcare sector keeps operating on a supply induced demand, thereby growing geometrically in the context of emerging new technologies (Duggal and Gangolli, 2005). The cost of medicine is increasing to high day by day which the economically deprived could not afford to it. The aging population and technological advancement are the significant factors which contributes to the increasing percentage of cost of medicine and healthcare treatment and are inevitable due to technological and advancement of modern society (De-Koning et al., 2006). Various nation healthcare systems from Germany, France, Canada, the UK and USA are rich in healthcare system under ten themes universal healthcare system. Comparing the two distinct different responses by US and Indian healthcare system, the US healthcare spends close to 18% GDP and in India it is less than 4%. The difference of healthcare based on the quality of support through public and private facility. In the USA and the India, the business interests, hospitals, medical doctors and other influencing health policies, India healthcare system has better impact in healthcare in same boundary. The developing country may use such integrated quality practice for better healthcare system. However, another significant source of increase in healthcare cost is the operational inefficiency which could be weeded out by making the system

more effective through necessary changes in logistical, administrative, and operational side of healthcare delivery system. In Indian healthcare industry, the operational care and the waiting time and customer satisfaction is becoming challenging in both semiautomated and fully automated model of healthcare improvement need a holistic and integrated methodology of TQM, Lean thinking and Six Sigma (SS) practices in entire hospitals (Chiarini and Bracci, 2013) and its significance in the resource is observed and inadequate in the Indian context (Yaduvanshi and Sharma, 2017).

In recent years, Lean thinking and SS goes hand in glove and are favoured by quality experts. The integration of two approaches in healthcare sector is essential and may help for rapid improvement to drive excellence in service. These integration with support of total quality management (TQM) could achieve customer satisfaction and also maintained quality in aligned to operational performance in healthcare. The synergetic effect of integration of the three approaches which are similar in process objectives leads to improve performance with different level in achieving success (Sunder, 2013). The two approaches namely Lean and SS are at present popular in healthcare sector (George, 2003; De-Koning and Demast, 2006; Vaishnavi and Suresh, 2020a) while integrated with TQM practice, the quality healthcare could easily and successfully be achieved.

Application of SS (DMAIC) practice in the present pandemic situation is a dare need to contain the deadly outbreak of SARS-2 (COVID-19) virus all over the world. Findings based on the gathered data come out continuously every day. Due to the variations in the data with regard to the trend of spread, mortality, and morbidity, doctors are helpless and still trying to find a suitable strategy to contain it and the situation is blind folded. In this time of pandemic situation, application of SS (DMAIC) methodology is considered to be more appropriate to manage the emergency situation in any type of environment and can be of more helpful to mitigate the deadly impact (Alharthi and Aziz, 2018). This tool will be more helpful in managing the affected and to be affected population. The government and the hospitals can effectively apply Lean tool like value stream mapping (VSM) to prepare a layout to handle the COVID-19 affected patients. Egli (2020) has suggested that countries must take real time data and analyse it to come out with solution by using SS methodology (DMAIC).

The purpose of this study targets private healthcare service in India especially in the state of Tamil Nadu, India. Health Vision 2020 reported a number of challenges for enhancing and developing healthcare research which in due course may have an impact on quality management performance that are lack of funds, inadequate approach towards national plan and organisational cultural transformations, increased cost of patient and medical care, lack of research, poor coordination with ministry of healthcare and healthcare organisations in India and immature research culture among healthcare providers and also other challenges (Srinivisan, 2010). In this regard, Yaduvanshi and Sharma (2017) point out that the positive impact of productivity; quality and minimum waiting time lead to increase the healthcare efficiency. In order to address the above challenges, it becomes necessary to alter the business strategies, methodologies and structures for improving healthcare delivery. This mandates to have a deep organisational insight along with the management commitment to bring a complete transformation in the organisation mission through broader perspectives. In the context stated above, the present authors have developed an integrated Lean Six Sigma (LSS) quality healthcare system (ILSSQHS) model which may contribute performance and efficiency with limited resources in a unified way and can deliver a world class quality care at affordable cost in healthcare sector.

The following objectives were listed below to review the impact of ILSSQHS approach implementation.

- 1 To identify and propose the critical success factors (CSFs) of ILSSQHS model using statistical analysis.
- 2 To assess the power of selected critical success factor in influencing the quality and performance of healthcare as perceived by healthcare executives.
- 3 To list out the theory and practical implementation of ILSSQHS in health sector.

This study has been designed and presented in five sections. Section 1 is an introductory one. Section 2 reviews the past related studies and under which there are five sub-sections. The research methodology of this study has been presented in Section 3 which includes six sub-sections. Section 4 has been devoted to the discussion. The conclusion, theoretical implication, practical implication and the limitations and future research direction of the study has been presented in Section 5 respectively.

## **2 Literature review**

There are different methodologies which are successful in different sectors. The various elements related to quality management in healthcare, LSS practices in healthcare and the gap have been discussed in the following sections by reviewing of a number of related research studies and those have been classified under various sub headings.

### *2.1 Quality management in healthcare*

The healthcare industry is facing a major problem of increasing cost of healthcare worldwide (De-Koning et al., 2006). When compared to manufacturing and other service industries, healthcare industry seems to be complex and the pace of adaptation of new quality improvement practice is very slow. Till now the previous researchers could not arrive at a uniform agreement in defining the quality management practices in healthcare sector due to geographical, cultural and economical differences. Basically healthcare system has tremendous pressure to advance the performance by controlling the healthcare cost, ensure high quality patient service and better access to care. According to Harteloh (2003) satisfaction of patient has been widely used for standard definition of quality in healthcare service. The national healthcare service definition of quality (UK) considered the three components namely, care provided to patients, effectiveness of treatment and experience of patients who had the treatment to provide better healthcare service (Darzi, 2007). The high level of patient's expectation about the service quality is considered as a key to detect the important elements which are essential to improve patient satisfaction, i.e., minimising time and money involved in managing patients and complaints. In the context stated above, the following five domains viz communication and relationship management, knowledge on healthcare system, professionalism, business skills and knowledge and leadership play a critical role to healthcare managers/leaders to overcome these challenges in healthcare sector.

## 2.2 *LSS in healthcare*

Lean thinking and SS practice in continuous quality improvement methods complement each other. Lean is an integrated system based on principle, and tools, by synchronising the workflow and managing variability in process. Its important distinction is value added activities that is customer satisfaction from service (George, 2003). SS is a customer driven approach, which emphasis on decision making based on continuous analysis of data and make profitable by achieving cost reduction (Bisgaard and Freiesleben, 2004). It is used for project improvement based on translation of company strategy in to operational goals (Pyzdek, 2004). SS includes five phases; define, measure, analyse, improve and control (DMAIC) that are followed rigorously wherever problem is small or large (De-Koning et al., 2006). Lean offers a number of solutions to common organisational problems and to prevent sub optimisation by focus on entire value chain (De-Koning et al., 2006). Lean healthcare focuses on efficiency and patient satisfaction (Brandao de Souza, 2009). Lean not only seeks the elimination of waste but also has real motivation for innovation and value creation. The net result of Lean implemented organisation s showed the increased capability of office, lowered waiting time, increased opportunity of patient with less time and provide an intrinsic motivation for large scale change in healthcare environment (George, 2003; Lummus et al., 2006; Waring and Bishop, 2010). Consequently, it could be concluded that the success of Lean implementation in healthcare depends on organisation infrastructure, deployment plan, analytical tools and control (De-Koning et al., 2006).

Since early 2000, the SS practice has been applied in healthcare services. SS is a structured and analytical methodology for solving problems in an entire organisation. Lean concepts offer faster solutions in improving the process by eliminating the wastes. Integration of Lean and SS initiatives are poised to increase quality, reducing cost, patient inconvenience and risk. Setting of Lean and SS culture in business lead to gain competitive advantage (Yaduvanshi and Sharma, 2017). Vaishnavi and Suresh (2020b) identified the 16 readiness factors from Indian hospitals that would help the hospital managers for successful implementation of LSS in healthcare organisation. The result identified that customer – oriented and goal management culture is the key readiness factor of LSS. Hundal et al. (2021) studied the tools, application, challenge and benefits of LSS in COVID'19 impact and also studied the mitigation of healthcare environment of LSS. An integration of these two approaches in scientific method is to achieve quality at significant level and to focus on process innovation, productive and empowerment at process analysis phase (De-Koning et al., 2006; Pepper and Spedding, (2010). The integrated healthcare system is commonly considered as a trustable tool for enhancing the performance in terms of quality of care and patient safety within the hospital (JCI, 2010) which could be effectively implemented through a holistic LSS approach by the top management of hospitals.

## 2.3 *Integration of TQM, Lean and SS*

According to Snee (2010), LSS is defined as a business strategy and practice that increased bottom line results, improve performance, speed, cost, enhanced customer satisfaction, and quality. Therefore, the integration of Lean and SS facilitate the lower cost complexity, operation room efficiency using staff involvement, sharing performance metrics and process mapping (George, 2003; Cima et al., 2011; Laureani and Antony,

2011). The synergy of Lean and SS in integrated manner resulted a systematic innovation and consistent deliveries of intended end – results especially pertaining to delivery of services (De-Koning et al., 2006; Sunder, 2013). To achieve the synergy of healthcare practice, the systematic framework model is proposed in this study by integrating strategic quality concepts namely TQM, Lean thinking and SS in healthcare in Indian context with help of CSFs. Gopi et al. (2019) has reviewed various literatures pertaining to healthcare practice and developed integrated quality healthcare establishment model with the help of few important CSFs. Varkey and Kollengode (2011) discussed the framework of healthcare quality with the help of quality improvement techniques like PDCA, Lean and SS for increasing desired healthcare outcome quality and efficiently across India. Revere et al. (2004) claimed that SS from the emerging environment has been created by TQM movement in healthcare organisation. The TQM is an integrated organisational approach by meeting customer needs through continuous basis. Therefore the development of integrated model which is compatible to varying culture and changing operating environment prevailing in various countries is preferred. This should incorporate the factors and drivers of quality awards and also should include various quality management principles in a holistic way. The implementation methodology in national and international studies is tabulated in Table 1 comprising of various tools and techniques of Lean, TQM and SS adopted in healthcare organisation.

**Table 1** Summary of integrated practice of TQM, Lean and SS in healthcare sector

| <i>S. no.</i> | <i>Authors</i>             | <i>Objective</i>                                                       | <i>Methodology /tools</i>                                                                                      | <i>Findings</i>                                                                                                                                                                                                 | <i>Conclusion/ challenges</i>                                                                                                                                |
|---------------|----------------------------|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1             | Yu and Yang (2008)         | To minimise the average waiting time in patient registration process.  | LSS methodology is used.<br>Simulation, regression analysis, control chart, ANOVA, Gemba and time series plot. | <ul style="list-style-type: none"> <li>• Average waiting time reduced from 42.3 minutes to 6.55 mins.</li> <li>• Lean score card serves motivation mechanism to clerk to have high value added time.</li> </ul> | LSS has potential to tackle the healthcare cost and efficiency by implementing Lean and SS methodology.                                                      |
| 2             | Lokkerbol et al. (2012)    | To decrease the number of workplace injuries in the hospital           | Control chart, histogram, SIPOC                                                                                | <ul style="list-style-type: none"> <li>• The number of injuries reduced from 12 to 7.2.</li> </ul>                                                                                                              | The LSS project deployment in organisation changing behaviour of employee safety and developing creative system for LSS project.                             |
| 3             | Chiarini and Bracci (2013) | To examine the ways of implementing healthcare organisations in Italy. | TQM, Lean thinking and SS methodology are integrated.                                                          | <ul style="list-style-type: none"> <li>• The system regulations (institutional, cultural and technical) are important issue in implementing LSS in healthcare (public).</li> </ul>                              | The hospital staffs are unaware of using statistical tools due to lack of engineering education/statistical knowledge is main challenges in problem solving. |

**Table 1** Summary of integrated practice of TQM, Lean and SS in healthcare sector (continued)

| <i>S. no.</i> | <i>Authors</i>             | <i>Objective</i>                                                                                  | <i>Methodology /tools</i>                                                    | <i>Findings</i>                                                                                                                                                                                                       | <i>Conclusion/ challenges</i>                                                                                                                                                                                   |
|---------------|----------------------------|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3             | Chiarini and Bracci (2013) | To examine the ways of implementing healthcare organisations in Italy.                            | Statistical tools (ANOVA, multiple regression), VSM tools are used.          | <ul style="list-style-type: none"> <li>• The system regulations (institutional, cultural and technical) are important issue in implementing LSS in healthcare (public).</li> </ul>                                    | The hospital staffs are unaware of using statistical tools due to lack of engineering education/statistical knowledge is main challenges in problem solving.                                                    |
| 4             | Sanders and Karr (2015)    | To decrease turnaround time (TAT) in USA hospitals emergency department.                          | Statistical tools and Lean tools (5S, Poka yoke and visual management)       | <ul style="list-style-type: none"> <li>• Turnaround time decrease by 18.2%.</li> <li>• 50% of reduction in vials used for testing.</li> <li>• Registered nurse rainbow draw time decreased by 2.5 minutes.</li> </ul> | Application of structural methodology in LSS project improvement. The improvement was addressed in addition to team target goals in emergency department.                                                       |
| 5             | Almutairi et al. (2019)    | To identified and asses the Lean principles and tools in healthcare supply chain in Saudi Arabia. | Multigrade fuzzy logic for leanness index measurement.                       | <ul style="list-style-type: none"> <li>• The weaker attributes of case organisation related to Lean are identified.</li> </ul>                                                                                        | Leanness assessment healthcare model is developed for assessing the level of single organisation in Saudi Arabia. This model helps in understanding and determining attributes of Lean for further improvement. |
| 6             | Al-Khamisi et al. (2019)   | To develop KBLSS and QM performance in healthcare environment.                                    | Rules based approach (if and then), Guaging absence prerequisite techniques. | <ul style="list-style-type: none"> <li>• KBS-based LSS improved QM performance and decision making against healthcare environment</li> </ul>                                                                          | The hybrid integration of KBL6S-QMSE system asses the healthcare organisation capability by enhancing the strategic and operational level. This approach was helpful in decision making process.                |

**Table 1** Summary of integrated practice of TQM, Lean and SS in healthcare sector (continued)

| <i>S. no.</i> | <i>Authors</i>                | <i>Objective</i>                                                              | <i>Methodology /tools</i>                                                           | <i>Findings</i>                                                                                                                                                                                 | <i>Conclusion/ challenges</i>                                                                                                                                                                              |
|---------------|-------------------------------|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7             | Taner et al. (2007)           | To analyse the root cause of healthcare problem.                              | Flow chart and Fishbone diagram were used.                                          | <ul style="list-style-type: none"> <li>• Redundancies</li> <li>• The patient satisfaction level is improved and cost saving is achieved.</li> </ul>                                             | Integrating SS cultures in to entire organisation by top level management can multiply the positive effect at all levels. The true impact of SS focuses on core healthcare and quality of living patient.  |
| 8             | Bhat et al. (2014)            | To study the LSS implementation                                               | LSS (DMAIC) approach and Lean thinking are used.                                    | <ul style="list-style-type: none"> <li>• The project has 94% reduction in average waiting time. And the cycle time is reduced from 3 minutes to 1.5 minutes in registration process.</li> </ul> | <p>The improvement of hospital using LSS methodology have benefited by improved customer satisfaction.</p> <p>Lack of human resource and collecting data are identified as challenges in this project.</p> |
| 9             | Trakulsunti and Antony (2018) | To improve medication process using Lean and SS tools.                        | DMAIC, process mapping, control chart, DFSS, QFD, VOC, process capability analysis. | <ul style="list-style-type: none"> <li>• LSS tools and methodology increase patient safety reduce operational cost and error in the medication process.</li> </ul>                              | <p>The project use LSS in healthcare sector to reduce medication error.</p> <p>The methodology also provides right tools and making them financially accountable.</p>                                      |
| 10            | Ahmed et al. (2018)           | To identify the LSS and quality performance dimensions in Malaysian hospitals | Independent sample t-test, EFA, one way ANOVA                                       | <ul style="list-style-type: none"> <li>• LSS, patient safety and team work are more favourably in private hospitals.</li> </ul>                                                                 | The public health sector play important role in providing healthcare service and however it is observed that private healthcare provide better medical service.                                            |

**Table 1** Summary of integrated practice of TQM, Lean and SS in healthcare sector (continued)

| <i>S. no.</i> | <i>Authors</i>              | <i>Objective</i>                                                                 | <i>Methodology /tools</i>                     | <i>Findings</i>                                                                                                                                                                                          | <i>Conclusion/ challenges</i>                                                                                                                                       |
|---------------|-----------------------------|----------------------------------------------------------------------------------|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10            | Ahmed et al. (2018)         | To identify the LSS and quality performance dimensions in Malaysian hospitals    | Independent sample t-test, EFA, one way ANOVA | <ul style="list-style-type: none"> <li>Senior hospital staff perceived more in patient safety and team work compared to other experience group.</li> </ul>                                               | The challenge faced by public health is between patient and doctors appointment. LSS approach can maximise by increase quality of care and operational performance. |
| 11            | Trakulsunti et al. (2021)   | To reduce the dispensing errors in inpatient pharmacy                            | DMAIC methodology and its tools are used.     | <ul style="list-style-type: none"> <li>The number of errors in dispensing is reduced from 6 to 2 incidents per month. The communication channel between hospitals and pharmacy has improved.</li> </ul>  | The study employs a CI methodology for improving dispensing process and quality of care by improving pharmacy service and increased patient safety.                 |
| 12            | Chiarini and Vagnoni (2017) | To evaluate the lack of leadership in TQM implementation                         | Quality tools                                 | <ul style="list-style-type: none"> <li>The study find three cause of failure in leadership of public healthcare which are lack of senior manager involvement commitment, combined leadership.</li> </ul> | The study confirms implementing TQM program succeeded only in complex organisation such as in some department in large hospitals which need a visionary leadership. |
| 13            | Baidoun et al. (2018)       | To measure the level of TQM practice in Palestinian public and private hospitals | MBNQA framework                               | <ul style="list-style-type: none"> <li>The result of study indicates that non-governmental hospital is better level of TQM implementation than governmental hospital.</li> </ul>                         | The study clearly emphasis that healthcare organisations of quality management program achieving sustainable performance over time.                                 |

**Table 1** Summary of integrated practice of TQM, Lean and SS in healthcare sector (continued)

| <i>S. no.</i> | <i>Authors</i>         | <i>Objective</i>                                                                 | <i>Methodology /tools</i>                                        | <i>Findings</i>                                                                                                                                                                                                                                     | <i>Conclusion/ challenges</i>                                                                                                                                                                             |
|---------------|------------------------|----------------------------------------------------------------------------------|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|               | Baidoun et al. (2018)  | To measure the level of TQM practice in Palestinian public and private hospitals | MBNQA framework                                                  | <ul style="list-style-type: none"> <li>The result of study indicates that non-governmental hospital is better level of TQM implementation than governmental hospital.</li> </ul>                                                                    | TQM improve quality of service based on continuous learning and improvement.                                                                                                                              |
| 14            | Gözükara et al. (2019) | To adopting the culture by TQM in Turkish healthcare organisation.               | Structural equation modelling and Factor loading tools are used. | <ul style="list-style-type: none"> <li>The findings pointed out that development culture has positive effect on TQM practice.</li> <li>Top management leadership which mediate the relationship with TQM and not on employee empowerment</li> </ul> | <p>TQM strategy and transition process in terms of CSFs.</p> <p>TQM is more important in healthcare setting for problem solving and should create and should create an innovative empowering culture.</p> |

**Table 2** Identified CSFs of ILSSQHS practice in healthcare

| <i>Critical success factors</i>                                      | <i>Authors</i>                                                       |
|----------------------------------------------------------------------|----------------------------------------------------------------------|
| Leadership and management commitment (LMC)                           | Taner et al. (2007), Antony et al. (2019) and Gözükara et al. (2019) |
| Project selection and prioritisation (PSP)                           | Sunder (2013), Muraliraj et al. (2018) and Antony et al. (2019).     |
| Organisational quality culture (OQC)                                 | Al-Khamisi et al. (2018).                                            |
| Customer focus (CF)                                                  | Shazali et al. (2013)                                                |
| Healthcare policy and infrastructure (HPI)                           | Ratnaningtyas and Surendro (2013)                                    |
| Learning and innovation management system for sustainability (LIMSS) | Desai et al. (2012), Laureani et al. (2013) and Jorma et al. (2016)  |
| Strategic management (SM)                                            | Hilton and Sohal (2012)                                              |
| Workforce management (WFM)                                           | Sabry (2014)                                                         |
| Support process and performance management (SPPM)                    | Noori (2015) and Ahmed et al. (2018)                                 |
| Healthcare operational evaluation (HOE)                              | Matteo et al. (2011) and Ahmed et al. (2018)                         |

By examining the literatures, the precise and holistic approach on integrated model of quality oriented Lean thinking, TQM, SS (DMAIC) methodology in healthcare operations is lacking all over the world and their relevance is very much limited in both private and public sector hospitals in India. This motivates the study intend to contribute and fulfil the gap which would lead to better understanding of health operations and

decision making in unified way through ILSSQHS model. To complement the above discussion, the suitable healthcare model is developed by infusing quality management practices for achieving quality of care in healthcare service. The common CSFs of Lean, TQM and SS in ILSSQHS practices are listed in Table 2.

#### 2.4 *Integrated Lean Six Sigma quality healthcare system*

This is a typical model developed by synergising the effects of TQM, Lean and SS integration (Sunder, 2013; Paranitharan and Babu, 2019; Al-Khamisi et al., 2019) for attaining performance in organisational practice. The ILSSQHS implementation process is done through three phases. In the first phase (input) quality management and statistical approach of TQM, Lean and SS were bundled into one and put in to the practice. Then, in the second, the selected ten CSFs from the input phase were infused to the ILSSQHS practice (process). The third phase is the result output with regard to the performance outcome (PO) of healthcare service in terms of financial metrics of healthcare, communication, internal management infrastructure, public health, emergency service and care service. It is strongly believed that the integrated synergic effect of Lean and SS with TQM may improve the quality and performance of healthcare to meet the global competitiveness in India. This model is unique one comprising of continuous improvement methodology and the application gap of Indian healthcare system using LSS related to the performance outcome gap which are poor turnaround time, missing and misplaced records, understand and simplify the complex process, reduce error in process and reduce repetition of work. Therefore, there is an immediate need to improve and sustain the quality of services and patient care in the hospitals in India and very few study has fill this lacuna of healthcare organisation. Therefore, this ILSSQHS model intends to improve the hospital performance in India by application of LSS and quality management. The achievement of performance is very much depending upon the timely action by the top management.

In this present study a theoretical framework is proposed by the authors to explore the significance of ILSSQHS construct and identified ten CSFs which have motivated and impacted on integrated practice among various healthcare services based on expert opinion and literature review. Abu Bakar et al. (2015) have studied the LSS implementation CSFs namely, CF, management commitment, leadership, business strategy, competency, PSP, training and education, infrastructure which are made significant contribution in improving performance and customer satisfaction in healthcare industry. Further, patient satisfaction, competitive advantage, organisation culture, standardisation, technology and WFM and operational efficiency were studied by various authors namely Antony et al. (2019), Bhat et al. (2014), Muraliraj et al. (2018) and Vinodh and Dhakshinamoorthy (2018) and found these contribute for improving operational performance and sustainability in healthcare practice. The integration of TQM in LSS cultivates the quality concepts among the employees to progress continuous improvement in daily operations and process (Yang, 2012; Salleh et al., 2015). Trakulsunti et al. (2021) examined the inpatient pharmacy dispensing errors using LSS in Thai public hospitals and awareness of LSS helps the manager to prevention and reduction of medication error. TQM principle is an efficient approach in achieving overall customer satisfaction in various types of organisations. The aim is that the synergy of integrating management system is to reduce cost, increased customer satisfaction, improved internal organisation and financial performance. Accordingly the

following ten CSFs namely, ILSSQHS namely, LMC, CF, PSP, OQC, LIMSS, HPI, SM, WFM, SPPM and HOE which have positive impact of healthcare performance were identified and selected since, those are considered to be the driving force towards achieving performance of healthcare, (De-Koning et al., 2006; Balasubramanian, 2016; Lighter, 2014). The theoretical model shown in Figure 1 and the description with support of literature may suffice the model effectiveness. The present study was supported by previous study findings conducted by Paranitharan et al. (2017), Laureani and Antony (2012) and Ahmed et al. (2018). Also to validate the above mentioned findings, the ten hypotheses were framed and tested in this study through managerial perspectives.

#### *2.4.1 Leadership and management commitment*

LMC is the most successful implementation factor in Lean healthcare practice which largely helps to shape and sustain the change process (Patri and Suresh, 2017). Therefore, support of senior management and their commitment for communicating policies, developing infrastructure and implementing integrated practice for leveraging the performance of healthcare service (Laureani et al., 2013; Birken et al., 2015) is considered to be more important. For which the following hypotheses were framed:

H<sub>1</sub> LMC has positive association with outcomes of the ILSSQHS practice.

#### *2.4.2 Project selection and prioritisation*

Project selection is the method of assessing and selecting a good project with proper criteria (Jeyaraman and Teo, 2010). Prioritisation is the order of execution for achieving organisational objectives and maximisation of performance (Antony et al., 2018). Therefore framed the following hypothesis:

H<sub>2</sub> PSP has positive association with outcomes of the ILSSQHS practice.

#### *2.4.3 Customer focus*

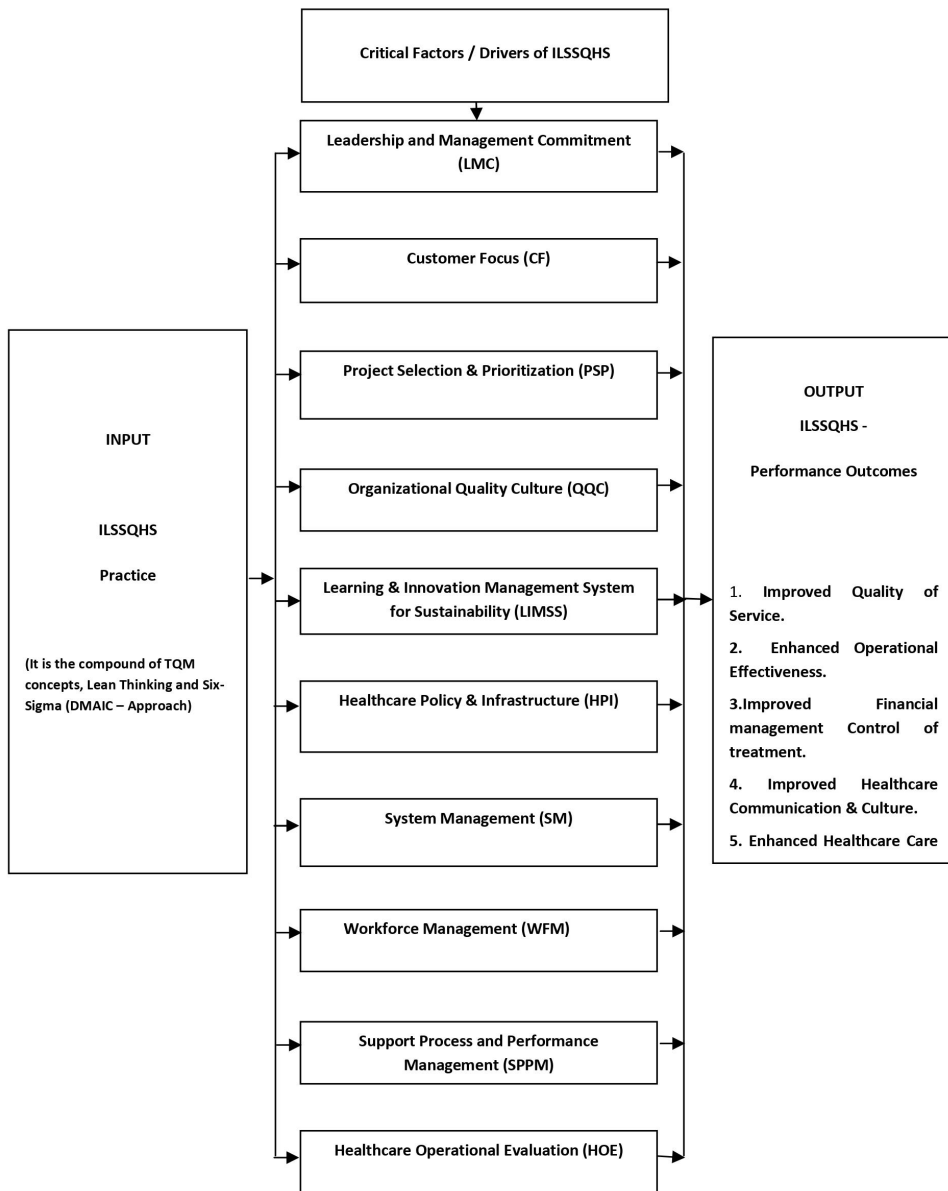
The organisation that understand the customer requirements and values are more important for the business to strive or exceed customer expectation (Paranitharan and Babu, 2019). According to Alshourah (2020), CF is a strategic aspect of managing quality in healthcare to evaluate the quality of care and satisfaction of customers (patients). So framed hypothesise the following:

H<sub>3</sub> CF has a significant positive association with outcomes of the ILSSQHS practice.

#### *2.4.4 Organisational quality culture*

Organisation culture is a pattern of shared beliefs, values, attitudes and behaviour under the leadership for organisational improvement (Laureani and Antony, 2012). Integrating the Lean and SS culture involves changing the way of thinking among the employee for process improvement (Achanga et al., 2006) and participation of top-level management in SS can increase the positive effect in all level of the organisation (Taner et al., 2007). Therefore the framed hypothesis is

H<sub>4</sub> OC has a significantly positive association with outcomes of the ILSSQHS practice.

**Figure 1** Conceptual model of ILSSQHS for healthcare sector

#### 2.4.5 Learning and innovation management system for sustainability

The technological and improved management system that alter the health innovation in the patient treatment plan to diagnose it correctly in order to increase organisational performance by introducing new changes (Sharma et al., 2014). Gopi et al. (2019) insist that the system for sustainability in a healthcare organisation would attain socio-economic and environmental protection commitment in their practice to offer better healthcare. Thus hypothesis framed as:

H<sub>5</sub> LIMSS has a significantly positive association with outcomes of the ILSSQHS practice.

#### *2.4.6 Healthcare policy and infrastructure*

Healthcare policy is a decision taken for planning and action to achieve the specific objective of healthcare goals (Kamra et al., 2016). Infrastructure improvement is the vital factor while implementing the LSS and other quality improvement concepts compatibility to organisation for developing organisation through expert advice and reward system (Fadly Habidin and Mohd Yusof, 2013). Therefore the authors has framed following hypothesis:

H<sub>6</sub> HPI has a significantly positive association with outcomes of the ILSSQHS practice.

#### *2.4.7 Workforce management*

WFM is creating responsibility for providing exceptional care for patients in managing the dynamics in order to improve quality, and to reduce cost of care (Willis et al., 2018). The workers in continuous improvement process ensures that employee engagement increase of empowerment of workers and make them involve in decision making (Wahab et al., 2013). In this connection, the following hypothesis framed as:

H<sub>7</sub> WFM has a significantly positive association with outcomes of the ILSSQHS practice.

#### *2.4.8 Strategic management*

According to Zovko (2001), the strategic plan focuses on high quality, exceptional medical process and pioneering techniques to meet the organisation's needs and objectives to render an excellent healthcare service. The strategic transformations of hospitals have to be undertaken after understanding the real purpose and long period involvement in quality of care (Speziale, 2015). Since the following hypothesis is framed:

H<sub>8</sub> SM has a significantly positive association with outcomes of the ILSSQHS practice.

#### *2.4.9 Support process and performance management*

Hewko and Cummings (2016) defined support process and performance as value creation and its contribution to attain the mission of an organisation for improving quality performance in healthcare service. According to Mettler and Rohner (2009) adoption of performance management in healthcare offers economic value and also optimises the efficiency and effectiveness of service. Therefore the following hypothesis is framed:

H<sub>9</sub> SPPM has a significantly positive association with outcomes of the ILSSQHS practice.

#### *2.4.10 Healthcare operational evaluation*

HOE is a measure for tracking and improving quality, efficiency, and availability of infrastructure and efficacy of healthcare operational systems (Gomes et al., 2010). The

evaluation model in integrated healthcare service prompts to improve healthcare performance outcome (Reeve et al., 2015). Therefore framed hypothesise as follows:

- H<sub>10</sub> HOE has a significantly positive association with outcomes of the ILSSQHS practice.

## 2.5 *ILSSQHS performance outcome*

Performance outcomes (PO) are metrics used by some organisations to track the success and also intensification of competitiveness in the organisation to ameliorate their quality and services in order to achieve specific strategic objectives (Cruz Villazón et al., 2020). The healthcare industry in the India and Abroad has major policy and business model changeover the past decades for improving the quality of healthcare service (Miyake, 2017). This change spurred healthcare organisation to look in to new metrics to begin tracking today to achieve strategic goals. In this connection the author studied, the integrated quality healthcare model helps to track the performances under five major important PO process exclusively in Indian health system. The outcome namely operational effectiveness, quality of service, improved financial management of treatment, improved healthcare communication and culture and improved healthcare delivery are the five PO were identified from review of existing literature as major influencing factors of performance outcome of integrated healthcare practice. The identified ILSSQHS PO with support of literature has been shown in Table 3. These five performance outcome/Measures help change in individual process of thinking and even provide opportunities for improvement in ILSSQHS Implementation.

**Table 3** Performance outcome of ILSSQHS model for quality HCS

| <i>Sl. no.</i> | <i>Performance outcome</i>                    | <i>Literature support</i>                                                                                                       |
|----------------|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 1              | Improved quality of service                   | Mozammel and Mapa (2011), Bhat et al. (2014) and Al-Khamisi et al. (2019)                                                       |
| 2              | Enhanced operational effectiveness            | Al-Khamisi et al. (2018) and Bhat et al. (2020)                                                                                 |
| 3              | Improved financial management on treatment    | Stanton et al. (2014), Remondino (2018), Rahman et al. (2019) and Sunder and Kunnath (2020).                                    |
| 4              | Improved healthcare communication and culture | Bhat et al. (2014), Madhani (2018), Alkinaidri and Alsulami (2018), Brown et al. (2019) and Burlea-Schiopoiu and Ferhati (2021) |
| 5              | Enhanced healthcare care delivery             | Lopez Colon (2013), Sabry (2014), Furterer (2018) and Sunder and Kunnath (2020).                                                |

## 3 Research methodology

This section explains the methodology of the study and is divided into various sub-sections comprising of demographic profile, survey response, development of survey instrument, main analysis followed by result and discussion. Finally conclusion concluded with theoretical and practical implications.

**Table 4** Demographic profile responses statistics

| <i>Profile</i>                          | <i>Number of respondent</i> | <i>Category</i>      | <i>Count</i> | <i>Percentage</i> |
|-----------------------------------------|-----------------------------|----------------------|--------------|-------------------|
| Gender                                  | 148                         | Male                 | 112          | 75.67             |
|                                         |                             | Female               | 36           | 24.43             |
| Age                                     | 148                         | 20–25                | 26           | 17.57             |
|                                         |                             | 26–30                | 40           | 7.03              |
|                                         |                             | 31–35                | 28           | 18.92             |
|                                         |                             | 36 and above         | 54           | 36.48             |
| Qualification                           | 148                         | Diploma              | 6            | 4.01              |
|                                         |                             | Bachelor             | 52           | 35.09             |
|                                         |                             | Master               | 85           | 57.70             |
|                                         |                             | PhD                  | 5            | 3.20              |
| Number of employees in the organisation | 148                         | Less than 50         | 14           | 11.09             |
|                                         |                             | 50–100               | 34           | 21.70             |
|                                         |                             | 101–150              | 45           | 30.2              |
|                                         |                             | 150 and above        | 55           | 37.02             |
| Experience                              | 148                         | 0–5 years            | 12           | 8.10              |
|                                         |                             | 5–10 years           | 46           | 31.08             |
|                                         |                             | Above 10 years       | 90           | 60.82             |
| Job position                            | 148                         | Supervisor           | 30           | 20.27             |
|                                         |                             | Managerial executive | 90           | 60.82             |
|                                         |                             | Senior management    | 28           | 18.91             |

### 3.1 Demographic profile

According to the sample taken, 112 (75.67%) are males and 36 (24.43%) are females. The profile age was stratified into three groups, wherein, 6% were between 21 to 25 year old, 8% were between 26 to 30 years old, 12% were between 31 to 35 year old and remaining 74% were above 36 years old. Among the age group, the population of manager in the survey was considered mostly middle level managers and they are middle aged. Out of the 148 responses, 6 (4.01%) have diploma level qualification, 52 (35.09%) were bachelor degree holder, 85 (57.70%) were master degree holder and the remaining 5 (3.20%) were PhD holder. The job position of the respondents was stratified in to three levels that are 30 (20.27%) supervisors, 90 (60.82%) managerial executives and 28 (18.91%) senior management executives. Among the three positions, most of the respondents were senior management executives. With regard to the experience, 90 (60.82%) were above ten years of experience 46 (31.08%) were between 5–10 years experience, and 12 (8.10%) were between 0–5 years experience. 14 (11.09%) respondents were drawn from the organisations having less than 50 employees, 30 (21.70%) from 50–100 employees, 45 (30.21%) respondents from the organisation having 101–150 employees and 55 (37.02%) respondents from the organisations having more than 150 employees. The result of demographic profile responses are summarised in Table 4.

### *3.2 Development of survey instrument*

Ten CSFs were identified and selected from reviews and are incorporated in the study instrument, which have major presence in most of the studies due to its essentiality and importance. The variables/constructs pertaining to each of the CSFs were formed carefully and put forth with 25 experts drawn from academicians (5), research practitioners (5), healthcare operational managers (9) and other experts (6) to ascertain its relevance to the subject and for discussion to ascertain the quality of instrument. Finally, after having considered their suggestions, necessary corrections were carried out in the statements of variables to be precise and meaningful and then incorporated in the instrument. The survey instrument was categorised into three parts. First part contains six questions related to the demographic profile of the organisations to which the respondents belong to. In the second part questions related to awareness of ILSSQHS concept were discussed. The last part includes the ten CSFs which would be used to measure the practice of ILSSQHS in selected healthcare organisations. The perception of managers/executive which ranges from 1 to 5 scales were rated using five point Likert scale. The scale '1' = not important for implementation and '5' = important for implementation.

### *3.3 Survey responses*

A sample of 500 hospitals was taken as sample from Quality Circle of India directory out of which consideration was given only to the hospitals having National Accreditation Board of Healthcare (NABH) and Hospitals Accredited by Quality Circle of India. Initially the hospital managers were approached through postal survey and the response was found to be not satisfactory. Therefore, it was decided to increase the response by using email, telephonic interview, the help of third party channels and face to face interview. Finally, 160 responses were received out of which, only 148 completed and valid responses (from out of 500 samples) were taken for further analysis. Thus the calculated response rate accounts to 29.6%. It is to be noted that the response rate achieved in this study is confirmed with similar studies performed in both manufacturing and service sector in Indian context, i.e., Ghosh (2012) studied Lean implementation in manufacturing from the data obtained from 20% response, Pandey et al. (2010) and Upasani (2012) have conducted their studies with the response rate of 18.02% and 17.5% respectively in service sectors. Further, Sahay et al. (2006) have recommended that the response rate of more than 15% is adequate for this type of survey in Indian context. The responses of second part of instrument about familiarisation of concepts namely, TQM, Lean, SS and NABH certifications/other certifications, 54.05% have responded positively about the use of Lean and hence it could be presumed the existence of Lean in healthcare in India. For the second question, which is about LSS, 20 (13.51%) have replied positively and hence it could be ascertained that the presence of SS in healthcare practice in Indian scenario. And the third question deals with the implementation of LSS and TQM practices in integrated manner, which about less than 5% have replied positively and the remaining 27.44% have replied negatively to reveal the non-practice of these concepts. The fourth question is about NABH accreditation, to which all were replied positively about their present status. Out of 148 hospitals taken for this study, 82% were large size hospitals including multispecialty hospitals and paediatric care, etc. Only 18%

of responses were in small size hospitals which include clinics, primary hospitals and paediatric care, etc.

### 3.4 Test of internal consistency

In order to test the reliability and the internal consistency of all CSFs the value of 0.7 were considered for analysis as threshold coefficient of Cronbach values, and the particular factor has considered as having adequate consistency between the CSFs. Accordingly all the ten CSFs were taken for the study since, satisfied the threshold Cronbach alpha values. The SPSS reliability analysis method was used. The results have been shown in Table 5.

**Table 5** Reliability of the test result

| <i>LSS practice implementation factors</i>                                 | <i>Cronbach alpha values</i> |
|----------------------------------------------------------------------------|------------------------------|
| CSF-1-Leadership and management commitment (LMC)                           | 0.910                        |
| CSF-2-Project selection and prioritisation (PSP)                           | 0.831                        |
| CSF-3-Organisational quality culture (OQC)                                 | 0.856                        |
| CSF-4-Customer focus (CF)                                                  | 0.828                        |
| CSF-5-Healthcare policy and infrastructure (HPI)                           | 0.810                        |
| CSF-6-Learning and innovation management system for sustainability (LIMSS) | 0.878                        |
| CSF-7-Strategic management (SM)                                            | 0.905                        |
| CSF-8-Workforce management (WFM)                                           | 0.820                        |
| CSF-9-Healthcare operational evaluation (HOE)                              | 0.810                        |
| CSF-10-Support process and performance management (SPPM)                   | 0.756                        |

### 3.5 Data analysis

Data analysis was carried out using Statistical Package of Social Science and by the application of various statistical tools. The results of regression analysis performed to obtain the contribution of TQM and LSS practices in healthcare implementation.

### 3.6 Regressions analysis

The CSFs were characterised based on the area of implementation (internally and externally) in the ILSSQHS practice. The ILSSQHS practice was categorised into ten CSFs such as LMC, OQC, PSP, HPI, SM, learning management and innovation system for sustainability, WFM, were classified as internal oriented practice whereas CF, SPPM and HOE were support both internal and external practice. The variable of leadership and top management commitment was measured through the factors, 'committed procedure', 'execution ability', 'continuous improvement' and 'senior management commitment'. The factors, adoption of modern management tools, quality improvement practice, culture change and maintaining flight standards were used to evaluate the OQC. Management strategy was evaluated through the factors to achieve desired objective and targets. The patient safety, loyalty, customer friendly members of staff was studied under the critical factors CF. Similarly cross functional collaboration, regular meetings,

training, rewards and recognition system were tested under critical factor WFM. The factors, learning and innovation system for sustainability was used for improvement of project and sustenance in healthcare service. The factors, supportive process and performance management system are generally considered to manage and measure the performance of the organisation. The insurance program, support process were used to evaluate healthcare policy and the tools and technique, technology is used to measure the healthcare infrastructure. Ultimately, the successful implementation of SS tools in healthcare industry could be measured and depend only under the factor 'PSP'. Linear regression analysis was done to ten CSFs to estimate the contribution of CSFs towards ILSSQHS practice. The CSFs were taken as independent variable and integrated LSS quality healthcare service practice as dependent variable. The results from the analysis have been presented in Table 6 and 7. Table 6 indicates that  $R^2$  is 0.725 which confirms the positive support of 72.5% for the overall performance.

**Table 6** Model summary of ILSSQHS

| <i>Model</i> | <i><math>\beta</math> (Beta)</i> | <i><math>R^2</math></i> | <i>Adjusted <math>R^2</math></i> | <i>Standard error estimate</i> |
|--------------|----------------------------------|-------------------------|----------------------------------|--------------------------------|
| 1            | 0.725                            | 0.720                   | 0.705                            | 0.20124                        |

The coefficient of regression was evaluated to verify the contribution of ten CSFs which would most effectively predict the effect of ILSSQHS practice.

**Table 7** Table of reliability coefficient and ranking of ILSSQHS and outcomes

| <i>Model</i>                            | <i><math>R^2</math></i> | <i>F-statistics<br/>(Fcr-3.674)</i> | <i>Unstandardised<br/>coefficient (<math>\beta</math>)</i> | <i>'t'<br/>statistics</i> | <i>Durbin-<br/>statistics</i> | <i>Beta<br/>(<math>\beta</math>)<br/>rank</i> | <i>Significance</i> |
|-----------------------------------------|-------------------------|-------------------------------------|------------------------------------------------------------|---------------------------|-------------------------------|-----------------------------------------------|---------------------|
| H <sub>1</sub> : LMC $\rightarrow$ PO   | 0.780                   | 850.23                              | 0.885                                                      | 6.843**                   | 2.064                         | 1                                             | 0.000               |
| H <sub>2</sub> : PSP $\rightarrow$ PO   | 0.764                   | 804.04                              | 0.844                                                      | 5.934                     | 1.854                         | 3                                             | 0.000               |
| H <sub>3</sub> : OQC $\rightarrow$ PO   | 0.760                   | 780.65                              | 0.840                                                      | 4.809**                   | 1.820                         | 4                                             | 0.000               |
| H <sub>4</sub> : CS $\rightarrow$ PO    | 0.778                   | 790.65                              | 0.852                                                      | 4.699**                   | 1.745                         | 2                                             | 0.000               |
| H <sub>5</sub> : HPI $\rightarrow$ PO   | 0.678                   | 690.24                              | 0.782                                                      | 5.830**                   | 1.620                         | 6                                             | 0.000               |
| H <sub>6</sub> : LIMSS $\rightarrow$ PO | 0.742                   | 760.32                              | 0.824                                                      | 4.959**                   | 1.765                         | 5                                             | 0.000               |
| H <sub>7</sub> : SM $\rightarrow$ PO    | 0.680                   | 640.50                              | 0.773                                                      | 5.230**                   | 1.521                         | 7                                             | 0.000               |
| H <sub>8</sub> : WFM $\rightarrow$ PO   | 0.532                   | 480.42                              | 0.598                                                      | 5.310**                   | 1.423                         | 8                                             | 0.000               |
| H <sub>9</sub> : SPPM $\rightarrow$ PO  | 0.520                   | 386.08                              | 0.578                                                      | 5.988**                   | 1.401                         | 9                                             | 0.000               |
| H <sub>10</sub> : HOE $\rightarrow$ PO  | 0.530                   | 368.42                              | 0.572                                                      | 5.650**                   | 1.419                         | 10                                            | 0.000               |
| ILSSQHS $\rightarrow$ PO                | 0.742                   | 488.26                              | 0.628                                                      | 4.965**                   | 1.870                         |                                               | 0.000               |

Note: \*\*5% level of significance.

It is observed from Table 7, the calculated beta coefficient ( $\beta = 0.6$ ) of above ten CSFs (independent variables) show that if one unit is increased in the ILSSQHS model there would be 62.8% increase in performance outcome of healthcare service (dependent variables). The statistical significance of all structural values of CSFs was examined with beta coefficient value to ascertain the validity of hypothesis. The result of analysis indicated that LMC (0.885, i.e., 88.5%), PSP (0.844, i.e., 84.4%), OQC (0.840, i.e., 84.0%), CS (0.852, i.e., 85.2%), HPI (0.782, i.e., 78.2%), LIMSS (0.824, i.e., 82.4%),

SM (0.773, i.e., 77.3%), WFM (0.598, i.e., 59.8%), SPPM (0.578, i.e., 57.8%), HOE (0.572, i.e., 57.2%). The above CSFs were perceived to be significantly and highly positively at  $p < 0.000$  level and hence are considered as highly effective on increasing percentage of ILSSQHS practice in healthcare service. Therefore, all the framed hypotheses  $H_1$  to  $H_{10}$  have high power to contribute for performance Outcome and therefore the framed hypothesis ( $H_1$ – $H_{10}$ ) is totally accepted and hence supported the study and also found significant relationship with PO of ILSSQHS practice. The results of hypotheses framed in this study were supported by Bhat et al. (2014), Gopi et al. (2019) and Vaishnavi and Suresh (2020b). The accuracy of meta model was also confirmed to achieve higher healthcare performance. Ranking of CSFs was done according to the obtained beta coefficient values. The following rankings draw the support of the previous research findings of Sunder and Kunnata (2020), Babu and Thomas (2020) and Bhat et al. (2014). The rank is as follows: LMC-1; CS-2; PSP-3; OQC-4; LIMSS-5; HPI-6; and SM-7, WFM-8; SPPM-9; and HOE-10. According to obtained beta value the contribution of the critical success factor namely WFM (59.8%), support process (57.8%) and performance management and HOE (57.2%) were found to be in the range of 57.2% to 59.8% and hence consider as having moderate effect in ILSSQHS HOE (57.2%) were found to be in the range of 57.2% to 59.8% and hence consider as having practice in healthcare. The above ten CSFs contribute 62.8% to achieve the performance excellence. This result draws support from the previous studies conducted by Sunder et al. (2019) and Gopi et al. (2019). The CSFs SPPM and HOE are new factors in Indian healthcare improvement but due to its essentiality and less important in practice, contribute lesser in Indian healthcare performance improvement. It enables the firm effectively balance their priority and improve quality performance in healthcare.

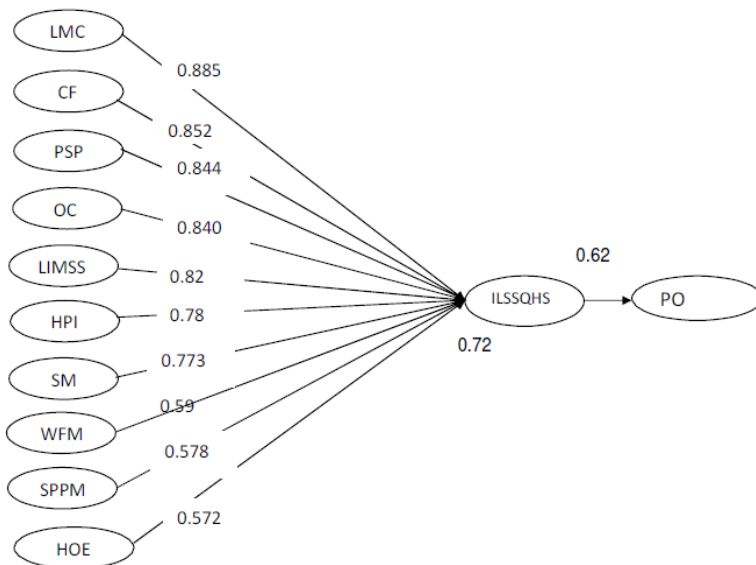
#### 4 Discussion

The results from present study confirm the significant contribution of the identified ten CSFs towards integrated quality oriented LSS practice in healthcare industries. Further, the CSFs were ranked using beta score, to measure the performance of CSFs in ILSSQHS model. The significant impact of CSFs was determined using reliability and regression analysis. It was ascertained that three factors namely WFM, SPPM and operational evaluation (OE) were found to be weakest CSFs in the ILSSQHS. And remaining CSFs namely, LMC, CF, PSP, HPI, LIMSS, SM and OQC were significantly and positively related to ILSSQHS practice. The overall performance was positively to 72.5% ILSSQHS practice and 62.8% predicted for performance Outcome (PO) on ILSSQHS model based on beta value. And it supports the results of Paranitharan et al. (2017) and Gopi et al. (2019). Considering the beta values of CSFs and its relations with ILSSQHS practice in Indian healthcare was predicted as satisfactory and reliable. The relations and ranking values of CSFs of ILSSQHS in healthcare quality was shown in Figure 2.

Figure 2 signifies that LMC, PSP, OQC, HPI are significant and positively related to ILSSQHS practices in Indian healthcare industries. Among the ten factors, the seven factors were contributing more than 70% to health performance outcome and the result were supported by Laureani and Antony (2012), Ahmed et al. (2018) and Alshourah (2020). The remaining three factors contributing above 50% in aligned with health

outcome. The three factors namely WFM, SPPM and HOE was seems lower contribution in similar findings from the studies conducted by Achanga et al. (2006), Ahmed et al. (2018), Sunder and Kunnath (2020) and Noori (2015).

**Figure 2** Regression model of ILSSQHS implementation process



The highest ranking is LMC and the lowest is HOE. These results are agreed with other similar studies, (Reeve et al., 2015; Lee et al., 2012). This study highlights that the one of important low level contributors during implementation of ILSSQHS is WFM in which people and their culture have to be moulded to embrace the change. Employees and quality culture tends to resist change in old way of doing things (Zahraee, 2016). In essence, the LSS and TQM concepts prevail in India in the organisations mostly run by private management and the multinational companies (Sengupta, 2011). Pepper and Spedding (2010) have found that top management commitment and communication is important for continuous improvement and this could be achieved by implementation of ILSSQHS.

## 5 Conclusions

Healthcare sectors are trying to adopt integrated healthcare model for enhancing the outcomes of the sectors. From this work, the ten CSFs are being significant contributors of practicing ILSSQHS in healthcare sectors. In the present ever changing customer expectation and socio cultural and economic situation, the healthcare industries are in a precarious position to accept change or transformation of organisational process and hence should come forward to adopt integrated Lean model in the key area of healthcare organisations for enhancing the outcomes of the healthcare sectors in terms of improved quality of service, enhanced operational effectiveness, reduced treatment cost, improved healthcare culture and enhanced healthcare delivery. The change could be materialised by educating employees through regular training on LSS and TQM tools and practice to

acquire professional skills. The present study shows the important necessity and frantic need of integrated TQM and LSS implementation in healthcare sectors in India in order to sustain in global competitive environment. In this study from regression analysis, it is clearly showed that all the ten CSFs of ILSSQHS model have significantly contribute to PO in achieving quality of healthcare service. Therefore all the framed research hypotheses based on the objective of the study are totally accepted. Besides, this ILSSQHS model may help to evaluate the barriers in achieving sustainability in healthcare organisation. Therefore, this study may support researchers to further taking up researches regarding the role of ILSSQHS model in increasing the organisational benefits/outcomes in healthcare sector.

### *5.1 Theoretical implications*

The findings of the present study provide a useful insight to healthcare industries who wish to implement TQM and LSS concepts and would assist to identify the critical factors that poorly as well as positively impact integrated LSS and TQM implementation. The poorly performing factors could be made to be rich contributor by rectifying the internal or the external barriers to come out from adverse effect. This research also helpful to academicians and other research practitioners who wish to study the LSS implementation process in healthcare industries in future.

### *5.2 Practical implication*

The findings help to understand the methodology of ILSSQHS implementation to increase operational efficiency, thereby improving healthcare delivery and sustainability. This work also delivers findings drawn from ILSSQHS practice in Indian healthcare settings and managerial executive's point of view, by being the first study addressing the integration of TQM, Lean thinking and SS (DMAIC) through ILSSQHS methodology in the Indian context. Secondly, the critical factors WFM, HOE and support process performance management were identified as the low level contributor in implementing ILSSQHS methodology. Based on the identified low level contributors, this paper provides useful inputs to managerial executives of healthcare the ways and means to control and to increase the power of contribution through effective analysis of LSS tools for achieving operational efficiency and customer satisfaction.

### *5.3 Limitation and scope for future research*

The present study has few limitations, to be considered for future research. The proposed ILSSQHS model has been incorporated with ten CSFs for analysing the healthcare performance of Indian healthcare organisation. Some of the identified CSFs were common to healthcare service and other service industries. Further the variables classified as PO was restricted to seven. In this study were done only limited research samples for evaluating the ILSSQHS model in Indian healthcare system. This is due to less number of quality management practice followed in hospitals in the state of Tamil Nadu. Further this study increasing research samples by including more hospitals in the entire states of the country to increase validate the study. The research was also restricted to studying the impact of LSS on the workflow and resource consumption in hospitals only. This study

also intends to implement integrated LSS framework to obtain greater insights in Indian healthcare system. Based on the above limitation, the listed scope was considered for ILSSQHS model through empirical means. Further, the study may extend to other healthcare system. The differing demographic, cultural and economic environments may need few additional CSFs to be included in the present constructed model. The variables under KPI could be extended to cover all the aspects related to the country where the study is proposed to be under taken.

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