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A SYSTEMATIC REVIEW OF LEAN IN HEALTHCARE: A GLOBAL PROSPECTIVE

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STRUCTURED ABSTRACT

Purpose: Fostered by a rapid spread beyond manufacturing sector, Lean philosophy for continuous improvement has been widely used in service organizations, primarily in the healthcare sector. However, there is limited research on the motivating factors, challenges, and benefits of implementing Lean in healthcare. Taking this as a valuable opportunity, we present the key motivating factors, limitations or challenges of Lean deployment, benefits of Lean in healthcare, and key gaps in literature as an agenda for future research.

Design/Methodology: We use the secondary data from the literature (peer-reviewed journal articles) published between 2000 to 2016 to understand the state of the art. Our systematic review identified 101 articles across 88 journals recognized by Association of Business Schools (ABS) ranking guide 2015.

Findings: The systematic review helped us to identify the evolution, current trends, research gaps, and an agenda for future research for Lean in healthcare. A bouquet of motivating factors, challenges/limitations, benefits of Lean in healthcare are presented.

Implications: The implications of this work include directions for managers and healthcare professionals in healthcare organizations to embark on a focused Lean journey aligned with the strategic objectives. This work could serve as a valuable resource to both practitioners and researchers for learning, investigating and rightly adapting the Lean in healthcare sector.

Originality and Value: This study is perhaps one of the comprehensive systematic literature reviews covering an important agenda of Lean in Healthcare. All the text, figures and tables featured here are original work carried by five authors in collaboration (from three countries viz., India, USA and UK).

Keywords: Lean services, Healthcare, Motivating factors, Challenges, Benefits, Research gaps
1. INTRODUCTION

The importance and applicability of healthcare services have evolved as a significant constituent of services sector in recent years. The increased competitiveness within the healthcare sector with an urge to improve operational efficiencies has been a key driver for healthcare firms to stay ahead in business (Ebrahimi and Sadeghi 2013; Carter et al., 2012). Further, the increasing customer expectations for high quality services, demands continuous process improvement through quality practices (Koning et al., 2006). To meet this cause, a focused approach to reduce operational costs and increase process throughput is required. An overview of literature on continuous process improvement shows that there is significant amount of research available on various quality practices, that were applied in services sector. While examining the proportion of papers published among the services sub-sectors in the field of continuous process improvement, Sunder et al., (2018), in their review, ranked healthcare sector as the number one. In other words, compared to any other services sectors where continuous process improvement has been studied/applied in the past, healthcare sector has the higher number of papers in scholarly publications. However, this increasing trend in body of knowledge is unorganized and deserves a structure, to enable future theory development (Sunder et al., 2018).

Erstwhile scholars have noted various quality practices adopted by healthcare organizations such as Total Quality Management (TQM), Business Process Re-engineering (BPR), quality circles, etc. (Hietschold et al., 2014; Knights and McCabe, 1997). Further, contemporary thinkers indicate various quality improvement initiatives implemented by various organizations such as Six Sigma, Lean and Lean Six Sigma (Ebrahimi and Sadeghi 2013; Allen and Davenport, 2009; Altria and Carley Smith, 2009; Idris and Zairi, 2006; Antony, 2004; Suresh Chandar et al., 2002; Powell, 1995). Among these, Lean, has been recognized as an effective and practical philosophy for systemic elimination of waste and the non-value-added activities which serves the above purpose (Pinho and Mendis, 2017; Rees and Gauls, 2017; Sunder, 2016b; Koning et al., 2006; Kilpatrick, 2003; Juergensen, 2000). This is because, Lean entails the examination of the process through customer-centricity to eliminate waste and reduce process inefficiencies. Further, Lean is rapid and easy to understand by organizational resources across all levels unlike a few other methods.
(such as Six Sigma) which are perceived as a statistics-rich and requires significant investment of
time and niche skilled resources for deployment.

According to Lean literature, it has a huge potential in healthcare services to improve operational
efficiency and effectiveness when rightly embedded as part of organization culture (de Koning et
al., 2008a; George, 2003; Snee and Hoerl, 2003). Though it originated as a philosophy, Lean has
proved as a practice with several practical implications in organizations (Jing, 2009; Furterer and
Elshennawy, 2005; Antony et al., 2003).

Lean is interpreted in diverse ways by researchers. While some find it as an approach to redesign
business operations (Altria and Smith, 2009; de Koning et al., 2008a), others feel it more as
strategic resource which helps business in achieving high quality, quick delivery and cost reduction
(Antony et al., 2004). This is strongly supported by Lubowe and Blitz (2008), who suggested Lean
as a strategy to foster a culture of innovation in organizations. Literature also suggest integration
of Lean and Six Sigma. De Koning et al. (2008) proposed a framework for Lean and Six Sigma
integration and this resulted in increased application in the fields of banking and finance (Pinho
and Mendis, 2017; Sunder, 2016a; Jasti and Kodali, 2015; Sunder and Antony, 2015; Hayler
and Nichols, 2006; Hensley and Dobie, 2005; George, 2003) and healthcare (Kim et al.,
2006; de Koning et al., 2006; George, 2003). Antony (2004) visualized the growth and importance
of finance and healthcare sectors in coming years and thus the need for quality improvement
initiatives such as Lean and Six Sigma. Even recently, Sunder (2013) endorsed this claim though
a global study with 98 percent acceptance rate from the respondents about Lean and Six Sigma as
improvement initiatives in services such as healthcare and finance, confirming a high interest on
this topic. Literature also shows integration of Lean with TQM, Total Preventive Maintenance
( TPM), Just in Time (JIT) and Human Resources Management (HRM) (Shah and Ward, 2003).
However, all these studies that examined line alongside Six Sigma, TQM, TPM, JIT, HRM and a
few other socio-technical practices agreed directly or indirectly that Lean is the fundamental basis
for all these quality management practices, and hence reinforcing its importance for research.

However, not all organizations have gained real benefits from Lean (and its combinations,
mentioned above) as a few abortive implementations have rendered it ineffective (Maike et al.,
2009). In addition, the scholarly literature is rather disconnected with many gaps that need to be addressed (Pinto and Mendis, 2017; Gupta et al., 2016; Laureani and Antony, 2011; Pepper and Spedding, 2010). A few of them include, understanding the motivation factors that drive Lean deployment in firms, major challenges and limitations, and benefits. Hence, this study intends to synthesize the Lean literature within the scope of healthcare sector, and further provide directions for future research. This study is novel and different from the traditional literature reviews due to two primary reasons. Firstly, it is performed not merely to identify research gaps in the existing body of knowledge but also aims to create a structure to various disconnected but relevant topics that are present in the existing literature. Secondly, this review examines the motivating factors, challenges, and benefits of Lean in healthcare sector, and apparently one such work was not found in the extant literature reviewed. Thus, this study is novel and adds value to body of knowledge.

Following this introduction, we present an overview of literature on Lean in healthcare to arrive at focused research questions. Section-3 features the three-step methodology adapted in this paper. Classification of the reviewed literature and subsequent analysis is featured in Section-4, followed by findings and appropriate discussion in Section-5. The paper concludes with identification of significant research gaps as an agenda for the future research.

2. THEORETICAL BACKGROUND AND RESEARCH QUESTIONS

2.1 An overview of Lean: With its origins from the manufacturing shops of Toyota Production System (TPS), Lean has become particularly essential in services and consequently gained popularity (Jasti and Kodali, 2015; Liker, 2004; Womack and Jones, 2003). The primary focus of Lean philosophy has been to eliminate Muda (process waste), Mura (unevenness in operations), and Muri (over-burden on resources). According to the Lean literature, Muda exists in seven forms, including transportation, inventory, motion, waiting, overproduction, over processing and defects (Gupta et al., 2016). Lean principles are used to identify and further eliminate these wastes. The first principle is to identify value from the customers’ perspective. Second is to understand the value-stream to identify value adding and non-value adding activities. Value stream mapping is performed for this purpose in order to discriminate, measure and map the value-added steps from the non-value-added activities. The third principle focuses to create and improve the process flow.
This helps in moving out from silos towards integrated work for achieving the intended value to be delivered to the customer. Fourthly, Lean encourages “pull” methods, where customers pull products or services as and when they need them rather than pushing them to the customers as per the producer’s schedule. “Just-in-time” ways of working uphold this concept. Finally, Lean also works on the principle of continuous improvement towards achieving perfection in operations, and thus aims to build a culture of continuous improvement in firms. In practice, the application of Lean thinking involves a wide range of tools and techniques (Womack and Jones, 2003). These include value stream mapping, 5S, five-why analysis, kanban, visual management, waste analysis, standard work, mistake proofing, spaghetti diagrams etc. Further, Lean thinking is part of leadership agenda in firms to shape and sustain the change process (Mann, 2009).

2.2 Lean in Healthcare: Healthcare is one of the biggest beneficiaries of Lean implementation. Hadid and Mansouri (2014) reviewed Lean implementation in services sector and proposed a theoretical model with key constructs and discussed their impact on overall organizational performance. According to Radnor (2010), Lean is widely applied in both public and private sector healthcare organizations. Based on a NHS-III (2007) report, ‘Lean’ in healthcare helps in removing duplicate processes and unnecessary procedures by organizing the patient records, reduced waiting for staff, and coordinating the discharge process for patients. The original application of Lean in healthcare first appeared in 2000 in the UK followed by 2002 in the USA, and further accepted globally today (Radnor et al., 2012).

The Lean implementation in healthcare is varied in its approach and scope. While some firms implement it as an enterprise initiative, a few firms limit to certain projects on need basis (Sunder, 2016c). This limit appreciating the full benefits that Lean, that could be leveraged in healthcare sector (Radnor, 2010; Brandao de Souza, 2009). According to Spear (2005) “[…in healthcare, no organization has fully institutionalized to Toyota’s level the ability to design work as experiments, improve work through experiments, share the resulting knowledge through collaborative experimentation and develop people as experimentalists (pg. 91)]”. One of the most widely cited Lean implementation initiative is by The NHS Institute for Innovation and Improvement in the UK. The initiative provided how an approach such as 5S can bring breakthrough improvements in hospital settings such as in wards, theatres and community services, etc.
One of the major deterrents of Lean initiative in healthcare is due to the complexity of the health care system (across different practices globally). The healthcare system is bound by various professional groups within and due to regulatory bodies externally. These are a few reasons why quality initiatives take longer time to be successfully implemented in healthcare sector (McNulty and Ferlie, 2002; Pettigrew et al., 1992). According to Weiner (2004), there are some quality management techniques which are not well aligned with healthcare sector and requires administrative procedures. These act as constraints for healthcare professionals to embrace quality. Inherent limitations of healthcare sector in embracing quality initiatives is documented by Currie et al. (2008). Their study noted how knowledge management system could widely be used in various sectors but was difficult in healthcare because of their “deeply embedded cultural norms and organizational customs”. Further, the variability and ambiguity of clinical practices restrict databased improvement initiatives (McDonald, Waring, and Harrison, 2006). Hence, ‘Lean’ in healthcare is both challenging and exciting (Waring and Bishop, 2010). Despite the rich scholarly literature of Lean in healthcare, the complexity of the subject and diversity in the body of knowledge has rather led to disconnectedness. Therefore, there is a need to study and synthesize the same. For this purpose, the following research questions were framed:

**RQ-1:** What are the driving factors that motivate healthcare firms to embark on the Lean journey, as noted in the literature?

**RQ-2:** What are the challenges/limitations in deploying Lean in the healthcare sector, as noted in the literature?

**RQ-3:** What are the benefits of deploying Lean in health care, as noted in the literature?

**RQ-4:** What are the key gaps in the extant literature?

### 3. METHODOLOGY

A Systematic literature review (SLR) method proposed by Transfield et al. (2003) was chosen for this study. SLR has been successfully applied in other reviews in the field of operations management (Shukla and Jharkharia, 2013; Sunder et al., 2018). The SLR method consists of three phases suggested from Tranfield et al. (2003). In the first step, leading databases were investigated...
to gather relevant papers from January 2000 to December 2016 from peer-reviewed journals recognized by the Association of Business Schools (ABS). By excluding myriad articles, book reviews, prefaces, editorial notes, 101 relevant peer-reviewed journal articles (Aboelmaged, 2010) were considered for this study. The second step featured the classification of these papers based on their research methodology, type of industry, author profile, country of research and year of publication (Dangayach and Deshmukh, 2001; Reosekar and Pohekar, 2014). Finally, as part of step-3, these papers were analyzed to derive meaningful implications.

3.1 Planning the review: To collect suitable literature related to Lean in healthcare, the following steps were followed:

1. Research articles published between January 2000 and December 2016 were gathered from search engines and research databases such as ProQuest, Emerald Insight, Web of Knowledge, and Medline using the following keywords: lean assessment, lean evaluation, lean measurement, lean quantification, degree of leanness, and leanness. Usage of multiple keywords resulted in studies that addressed assessment topic in specific and thereby added studies of high relevance to the material collected.

2. The initial search for this review yielded many articles related to lean, many of which did not pertain to this review topic of lean assessment, evaluation, measurement and quantification. To restrict the search to articles relevant to the scope of this study, the following inclusion criteria were used:
   a. Papers that are relevant to healthcare sector
   b. Papers published in journals
   c. Papers answering research questions related to leanness, degree of leanness, leanness assessment, leanness evaluation, leanness measurement, and leanness quantification

3. Above listed inclusion criteria reduced the number of papers of interest from hundreds to 101 articles. Focused papers relevant to the research questions were included, and papers that broadly describe and discuss the lean implementation aspects such as listing the principles, practices and tools of lean, roadmap for Lean implementation, lean deployment frameworks, etc., were excluded.

3.2 Conducting the Review:
3.2.1 Descriptive Analysis: Data on publication outlet, year of publication, authorship, keywords, and geographic region of the study were collected and analyzed to understand the trend evolving over years in this research domain.

3.2.2 Category Analysis: It is an iterative process, with authors adding to the exhaustive list of categories based on their relevance to the current study. Detailed analysis of the papers was further performed within the structural attributes. For example, under the ‘methodology’ attribute, a sub category ‘nature of the study’ was identified to help in classifying the articles based on whether it utilizes a single case study, multiple case study, or survey.

Figure 1: Research Methodology

3.3 Reporting the results: On the above identified structural attributes, the collected papers were critically evaluated and analyzed by all the researchers of this study. The summary of the results obtained from the articles were collected in the review database. Relevant issues and trends in the literature were identified and presented.

4. CLASSIFICATION AND ANALYSIS

4.1 Descriptive analysis: A descriptive analysis was carried out on the articles collected following the methodology discussed in the previous section.

4.1.1 Article Distribution: It is evident from the distribution (refer Figure 2) that the topic of leanness assessment is at its nascent stage and the literature has grown in recent years. Preston (2000) was the first to perform integration of Lean with healthcare which leads to greener and profitable service. But the technique got popularized after 2008 (Nathan et al., 2008; Ann et al., 2008). There has been a considerable rise in the number of Lean in healthcare publications in academic journals since 2008. Since, 56 articles on Lean healthcare have been published, which represent the growing importance of quality consciousness in healthcare sector whereas only 22 articles were published from 2000 to 2010.

Figure 2: Year wise publication
4.1.2 Authorship: Papers with four or more authors accounted for over 39% whereas papers with three and two authors accounted for 24% and 22% respectively (refer Table 1). An indication of increased collaboration between academicians and/or academicians and practitioners as about 85% of the articles have more than a single author was another keynote finding. The positive slope in the year-wise publication graph suggests a steep growth in the number of journals and 9 articles published in a particular year in the domain of Lean in healthcare. The trend chart features the time period during which 85% of the publications were carried out. From this, it can be concluded that majority of the articles belong to the 2010-2016 period and only 16 papers belong to the 2000-2009 period.

Table 1: Author Details

4.1.3 Country: Papers were also classified based on where the study had been conducted, that is, the geographical location of the firms from which the data have been collected for review as shown in Figure 3. Classification of papers based on country of research suggests the location in which the data was collected, and analysis was carried out. The chart distributes 101 papers over 23 countries across continents. About 47% of the research was found to be conducted in the USA and the UK. Another 23% were found to be from Sweden, Italy and Brazil. Comparing the nature of the Lean healthcare scenario of these countries with regards to developing economies like India could establish direction for future research.

Figure 3: Country of research (arranged alphabetically)

4.2 Categorical analysis: After understanding the overview and trend of the review topics through descriptive analysis, categorical analysis was performed with respect to the structural attributes. Supporting citations for each of the specific cases of the attributes are provided.

4.2.2 Number of organizations involved: Articles were classified based on the number of organizations studied and data collection methods adopted to test their methodology into three categories: single case study (one organization), multiple case study (> 1 organization), and empirical study (data collected from potential respondents from different organizations or survey
questionnaire?). Leanness assessment techniques in the manufacturing sector have been predominantly adopting single case study approach. Leanness assessment literature in the healthcare sector lacks assessment techniques which have been empirically generalized, thereby opening the scope for future research. About 30% of the papers were longitudinal studies, i.e. based on data from a single organization taken over varying periods of time. 26% of the papers were based on data from more than one organization. It was not possible to find the number of organizations involved for about 44% of the papers (refer Figure 4). This is primarily due to large number of conceptual papers involving literature reviews and case studies.

*Figure 4: Number of organizations*

### 4.2.3 Nature of business/industries:
Only 72 studies reported the nature of business performed by the organizations studied, as the remaining studies were either under the category of conceptual study or the details of the organization were not explicitly stated in the paper. Hence, those articles were coded as ‘not mentioned’. The papers selected can be categorized into two broad categories, namely conceptual and practical (includes empirical) studies. Totally, 73% of the papers were in the category of practical study, while the remaining 27% were conceptual studies. The papers that used models and example data were classified into conceptual category where in the rest of the papers that collected data through various means were categorized as practical.

### 4.2.4 Nature of the Studies:
Based on the type of data and the extent of empirical and statistical analysis involved in a paper, they were classified into quantitative and qualitative categories. 51% of papers were quantitative studies and only 49% were qualitative studies. Qualitative assessment studies have started picking up in the recent past, and in parallel, quantitative assessment studies have increased. Scope exists for developing qualitative data-based assessment techniques as most of the past studies were of quantitative nature. Categorizing based on organization type, it was interesting to observe that qualitative assessment techniques in the service industry were more in number than the quantitative assessment techniques. More qualitative assessment techniques can be developed to take forward the existing literature on leanness assessment in the HC as shown in Figure 5.
From the Figure 7 it can be seen that about 46% of studies were conducted through surveys and interviews. Around 5% articles discuss about the publicly available report while the rest of the study were descriptive in nature. Data collection methodology: The distribution of articles based on the methodology adopted for data collection, indicates that 28% of the papers presented a framework, ~15% papers used a survey instrument, 1 paper used fuzzy logic, and 2 papers used indexing methods. Classifying the papers based on whether benchmarking was adopted while assessing Lean transformation. Not many studies have extended or adapted their assessment methods to make it capable of performing benchmarking of Leanness attained. Only a very small percentage that is 11% of the papers were found to use benchmarking. Majority of the papers were found to not use benchmarking. Papers have developed numerical index as a measure of leanness of the organization. About 83% of the papers were found to use no scales. Only 17% used scales. Some common scales that were used include the Likert scale. By categorizing the reviewed literature based on number of participative organizations, it was interesting to observe that Lean initiatives were implemented in cases when multiple organizations are involved. This has helped healthcare services sector to evolve drastically in last decade. But, Lean can evolve more rapidly in healthcare sector when more and more organizations individually start implementing the initiative.

5. FINDINGS, DISCUSSIONS AND IMPLICATIONS
This section presents the key findings of the analysis and further discusses the directions for future research. For the ease of readers, this section is presented into subsections viz, motivating factors, lean practices adapted, and challenges existing within the assessment methodology. In addition, it also features gaps in the extant literature reviewed proposing directions and an agenda for future research.

5.1 Motivating Factors: There are 11 different factors mentioned in various articles, identified in our study, that motivate healthcare services to apply Lean in their organizations, as shown in Table 2. In most cases, the common driving reasons for deploying Lean are, (1) to provide better services to patients (2) to improve the process and operational efficiency, (3) to improve service quality,
4) to transform organizational culture, (5) to standardize and streamline the process, (6) to reduce delays and operational time, (7) to reduce staff and administrative inefficiencies, (8) motivation to outperform others and gain competitive advantage, (9) to eliminate waste, and (10) to eliminate non-value adding tasks. Additionally, it is observed that the drivers which motivate organizations to implement Lean also include increased customer satisfaction, cost reduction and improvement in bottom-line. The full benefits of Lean implementation are not realized by majority of the organizations in the extant literature as the implementation takes place in most cases in a particular business unit rather than the whole of an organization. In a few cases, it was narrowly focused on improving a few metrics and not across the enterprise. This shows that there is a considerable gap in understanding the full benefits of Lean implementation. Thus, we feel that there is strong link between motivation and benefits realization in Lean since weak motivation will lead to limited deployment which further leads to lower benefits. As Albiwi et al. (2015) mentioned that one of the strong motivator for organizations to implement Lean is by disseminating knowledge about its success stories from other organizations and highlighting the realized benefits achieved by these organizations. Further, this review unearthed the reasons behind the implementation of Lean in healthcare services inspired by two kinds of reasons: proactive (i.e., self-desire by the company); and reactive (responds to customer requirements and threats whereby failure comply may result in adverse effects). These reasons are presented in Figure 6 and ranked in order of their frequency.

Table 2: Motivating factors for implementing Lean in healthcare services

Figure 6: Driving reasons for implementing Lean in healthcare services

5.2 Limitations/Challenges: In the case of Lean deployment, organizational limitations become challenges for a successful implementation. Literature highlights that there exists a significant number of limitations in Lean implementation. Twelve fundamental limitations were addressed in the articles reviewed here are presented in Table 3. Strategies to overcome or mitigate these limitations could be a potential area for future research. According to Table 3, the top five limitations of Lean in the healthcare services are: Lean is new in healthcare sector which makes it difficult to implement, lack of empirical evidence to convince top management, lack of
coordination between functions, managerial resistance to change and employee resistance to change.

Table 3: Limitations/challenges in implementing Lean in healthcare

5.3 Benefits: An analysis of articles indicating Lean benefits in the healthcare services sector has resulted in 12 benefits (refer Figure 7). Some of the most cited benefits in the literature include (1) improved operational efficiencies, (2) reduced error rate, waste and operational losses, (3) reduced delay and improved cycle times, (4) improved service quality, (5) positive change in culture, eliminated unnecessary or non-value-added steps in the process, (6) improved satisfaction of customers or patients, and (7) reduced operational costs. The other benefits mentioned in the literature are increased profits, outperformed competitors and reduced complaints.

Figure 7: Benefits of Lean implementation in healthcare services

5.4 Key gaps in the reviewed literature (An agenda for future research)

As the paper highlights key driving motivation factors, challenges/limitations and benefits of Lean in healthcare sector, most of the reviewed literature showed significant gaps for future research. A few of them include:

- **Lack of systemic leanness at firm level**: Reviewed literature lacks a fully developed assessment methodology (and subsequent frameworks) that can capture the systemic nature of lean practice implementation at a hospital level.

- **Lack of systemic leanness at hospital**: Leanness assessment at hospitals is found to be at its nascence. Not many studies have attempted to assess how Lean implementation in hospital impacts.

- **Assessment for Lean implementation procedure**: Assessment techniques capable of assessing the outcomes of Lean in healthcare were found to be generic with a few perceptions (opinions and awareness on Lean), rather than customized to firm specific attributes. Future research on this could lead to studying impact of Lean on strategic outcomes like organizational decision making, managerial effectiveness etc.
• **Assessment methods based on simulation:** Assessment methods based on simulation with realistic assumptions have a huge potential to deliver great insights for firms implementing Lean in healthcare, as the past research lacks such usage. Simulation experiments provide a field to test for different possibilities and help firms in making an informed decision.

• **Assessment for entire lean journey:** Existing assessment techniques do not capture the entire lean journey of the firm. Most of them take a piece meal approach by assessing for shorter time periods and draw interpretations. This provides an opportunity for future researchers to conduct longitudinal studies over a period of several years on firms.

• **Leanness for organizational learning:** There is a dearth of studies to investigate the organizational patterns (routines) that Lean implementation could enable, which can further emerge into organizational learning capabilities. These studies could have a foundational theoretical underpinning according to Resource Based View (Bromiley and Rau, 2016) or Dynamic Capabilities View (Sunder et al., 2019).

• **Index/Metrics for measuring wastes:** Most of the existing indexes attempt to provide a single numeric for the entire leanness of the firm. Metric capturing the extent of prevalence of individual seven wastes proposed in lean literature and a metric that logically cumulates these seven metrics into a single metric capturing the total amount wastes in the firm would be a worthwhile contribution.

• **Behavioral aspects of Lean implementation:** Cho et al., (2017) presented a framework of behavioral quality management as an organizational strategic resource. A similar assessment of behavioral aspects of Lean deployment in healthcare would help in further understanding of the variance associated with the success or failure outcome of lean implementation. None of the assessment techniques in the reviewed literature have attempted to capture the behavioral aspects that play a key role in Lean implementation, reinforcing this opportunity for future research.

• **Development of benchmarks:** Assessment technique that can develop benchmarking index or metric that indicates the maximum or optimal improvements that a hospital can attain through Lean implementation could be a great value addition to the body of knowledge.

• **Financial viability of implementing Lean:** Most of the healthcare firms see huge benefits while initially graduating to Lean from their traditional ways of working. But, sustenance
of Lean methods usually drops after a few years (Sunder et al., 2013). Assessment technique capable of indicating a “threshold” point beyond which the firm would earn decreasing returns on investment would be a very useful tool for practitioners. This could also help in creating organizational controls to avoid or prevent these undesired outcomes.

6. CONCLUSION

Lean has proved its caliber as a successful continuous improvement practice in both manufacturing and services, and healthcare is not an exception. The increasing trend of Lean application in healthcare demands for further research within the academic community to strengthen the associated theory. Along with Lean implementations, impetus to researchers and practitioners to develop various mechanisms and methodologies to perform an assessment of the system to understand the effectiveness of implementing Lean in hospitals has also increased. By reviewing the Lean literature, this study answered all the four research questions raised at the beginning of this paper. Firstly, the fundamental analysis featured here classified the literature across variants viz., year, country, organizations and the methodological nature of studies. Secondly, to answer RQ1, various drivers and motivational factors for Lean deployment in healthcare were presented. Thirdly, in response to RQ2, various challenges/limitations of Lean in scope of healthcare sector are presented. Fourthly, the key benefits noted by various scholars in the erstwhile literature is compiled to see patterns that resulted in twelve key benefits of Lean in healthcare, as a response to RQ3. Finally, for RQ4, key research gaps were presented as an agenda for future research in this field.

We believe that, this study would help healthcare professionals to onboard on their Lean journeys by aligning their motivation drivers, realizing and estimating the desired outcomes (benefits) and being cognizant of the challenges/limitations. This study could also serve as a resource for researchers as it provides directions for future research.
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Establishing the research Questions
- To identify the different types of qualitative and quantitative methodologies adopted to assess the learnness in hospitals
- To evaluate the methodological perspectives used in the study of Lean in HCs
- To review the research issues addressed by lean in the hospitals and its evolution over the years
- Transfield, (2003) Review method was used - Planning, Conducting, Reporting

Planning: Defining the conceptual boundaries:
- Broadly defining Lean
- Defining the HCs and its variants
- Defining the HCs context based on Lean

Setting the inclusion criteria

Search limits:
- ABS ranked (3&4*) journals
- Primary and secondary subject areas
- Electronic databases

Keywords for search:
- "Lean",
- "Six Sigma",
- "Lean Six Sigma",
- "Health Care Services",

Cover period
Jan 2000 – Dec 2016

Conducting: Applying the exclusion criteria:
- Articles that primarily focused on Lean and its key components of training, learning and development in HCs
- Articles that primarily focused on hospitals, but not the other service ventures like Banking and ITES.

Full papers appraised = 101 articles

Reporting: Validating search results

Descriptive analysis
Categorical analysis
Key gaps in existing literature

Conclusion
- Reporting the Results
- Scope for future research
- Research Implications

Figure 1: Research Methodology
Figure 2: Year wise publication

Figure 3: Country of research (arranged alphabetically)
Figure 4: Number of organizations

Figure 5: Nature of the Study
Figure 6: Reasons for implementing Lean in healthcare services

Figure 7: Benefits of Lean implementation in healthcare services
Table 1: Author Details

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Table 2: Motivating factors for implementing Lean in healthcare services

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<th>Motivating factor</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>To provide better services to customers</td>
<td>Crema (2016); Costa et al. (2015); Crema et al. (2015); Goodridge et al. (2015); LaGanga (2011); Kim et al. (2006)</td>
</tr>
<tr>
<td>To enhance patient satisfaction</td>
<td>Chiu et al. (2016); McFadden et al. (2016); Kovacevic et al. (2016); Costa et al. (2015); Miller et al. (2015)</td>
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<tr>
<td>To outperform others and gain competitive advantage</td>
<td>Dannapfel et al. (2014); Waring et al. (2010)</td>
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<tr>
<td>To improve the process and operational efficiency</td>
<td>Cirrone et al. (2016); Efe et al. (2016); Ishijima et al. (2016); Matos et al. (2016); Costa et al. (2015); Daultani (2015); Abdelhadi et al. (2014); Drotz et al. (2014); Radnor (2012); Meredith et al. (2011)</td>
</tr>
<tr>
<td>To improve service quality</td>
<td>Andreamatteo et al. (2015); Costa et al. (2015); Hussain et al. (2015); Ker et al. (2014); Boyer et al. (2012); Porter (2009); Vest et al. (2009)</td>
</tr>
<tr>
<td>To transform organizational culture</td>
<td>Costa et al. (2016); Eriksson et al. (2016); Moraros et al. (2016); Tiirinki et al. (2016); Drotz et al. (2014); Procter et al. (2014); Chiarini (2013); Poksinska et al. (2013); Mazzocato et al. (2010); Esain et al. (2008); Young et al. (2004)</td>
</tr>
<tr>
<td>To standardize and streamline the process</td>
<td>Langstrand et al. (2016); Tay (2016); Guimaraças et al. (2014); McIntosh et al. (2014); Burgess et al. (2013); Bamford et al. (2012); Cima et al. (2011); Fillingham (2007)</td>
</tr>
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</table>
To reduce delays and operational time | Costa et al. (2016); Ishijima et al. (2016); Kovacevic et al. (2016); O'Reilly et al. (2016); Abdelhadi (2015); Dahlgaard et al. (2011); Yeh et al. (2011)

To eliminate waste | Kılıç et al. (2016); Malik (2016); Daultani (2015); A.L. Grove et al. (2010)

To eliminate non value adding tasks | Kılıç et al. (2016); Al-Balushi et al. (2013); Collar et al. (2012); Waring et al. (2010)

To reduce staff and administrative inefficiencies | Rossum et al. (2016); Costa et al. (2015); van Eeghen et al. (2015); Mazur et al. (2012); Radnor et al. (2012); Papadopoulos (2011)

Table 3: Limitations in implementing Lean in healthcare

| No Commonly followed criteria to assess the project value | Dobrzykowski (2016); Miller et al. (2015)

| No Commonly followed criteria to assess the project complexity | Hussain et al. (2015); Radnor (2012)

| Lean is new in Healthcare services which make it difficult to implement | Ishijima et al. (2016); Jorma et al. (2016); Kılıç et al. (2016); Kovacevic et al. (2016); Robinson (2012); Waring et al. (2010)

| Lack of empirical evidence | Andreamatteo et al. (2015); Shazali et al. (2013); Al-Balushi (2013); Grove et al. (2010)

| Lack of plausible theory | Costa et al. (2016); Collar et al. (2012)

| Few projects to generalise the result | Chiu et al. (2016); Henrique et al. (2016); Mazzocato et al (2010)

| Broad set of tools make it difficult to select the proper one | McIntosh et al. (2014)

| Lack of in-depth knowledge of tools and techniques | Drotz et al. (2014); Meredith et al. (2011); de Souza (2009)

| Long project duration reduces employee | Daultani et al. (2015); Waring et al. (2010)
<table>
<thead>
<tr>
<th>motivation</th>
<th>Chiu et al. (2016); Rossum et al. (2016); Cima et al. (2011); Villa (2010); Harrington et al. (2005); Young et al. (2004)</th>
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<tr>
<td>Lack of coordination between functions</td>
<td>Chiu et al. (2016); Eriksson et al. (2016); van Eeghen et al. (2015); Papadopoulos et al. (2010); Kim et al. (2006)</td>
</tr>
<tr>
<td>Managerial resistance to change</td>
<td>Guimaraes et al. (2014); Stanton et al. (2014); Papadopoulos (2011); Esain et al. (2008)</td>
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