



Lean Six Sigma as an organizational resilience mechanism in health care during the era of COVID-19.

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Abstract

Purpose: This paper aims to present the results of a qualitative research interview study on the utilisation and importance of Lean Six Sigma methods in the Healthcare sector in COVID-19 and pandemics in general. **Design/methodology/approach:** a qualitative interview approach was utilised by interviewing leading Lean Six Sigma academics and practitioners who are expert and have experience in Lean Six Sigma.

Findings: Lean Six Sigma methods are proven and can be utilised in pandemic situations to improve efficiency and resilience in the healthcare system and readiness for pandemics.

Research limitations/implications: One limitation of this research was that most of the interviewees who participated in this study come from Europe. Also, the interviews were short and at a high level. There is an opportunity for further detailed quantitative study and longitudinal case study analysis.

Originality: The paper provides an excellent resource to get an insight into the value of applying Lean Six Sigma methods in pandemic situations to aid Healthcare process improvement, operational excellence and enhance public and patient safety.

Introduction

COVID-19 has severely disrupted operations in health care systems. A pandemic generates demand for healthcare systems services and puts constraints on its capacity. The health care community faces unprecedented how-to challenges, from rapidly scaling up disease testing to physically protecting workers with limited resources to creating physical and clinical capacity to care for highly contagious patients. The ability to manage the disease until viable vaccinations are available and rolled out is partially based on the health care systems' ability to treat patients with the disease. Fortunately, the virus is showing signs of abating since the development of several approved vaccines that are being marketed. However, new strains are emerging and could result in more lockdowns. Globally, countries have been focused on controlling the pandemic and minimising the effects on the economy and society, but their

approaches are different.

Lean Six Sigma (LSS) has been applied to various health care processes to improve operations. Lean principles are applicable in health care operations to manage demand and capacity, improve quality, improve safety, improve supplier relations and reduce costs to improve supporting processes for patient care. Lean offers the opportunity to manage demand and capacity, improve quality and safety of care and reduce cost.

This research article aims to answer the questions:

1. "What healthcare problems can Lean Six Sigma solve in COVID-19"?
2. "What LSS tools and methods can be applied within the healthcare environment to cope with COVID-19?"
3. "What are the benefits of LSS to healthcare during in COVID-19 times?"

There are valuable lessons to be learned from the utilisation of Lean Six Sigma in Healthcare daily and as a method of resilience and mitigation for future pandemics and as an enabler of operational excellence.

Methodology

The research approach used in this study is based upon content analysis, a research methodology for making valid inferences from data to their context. Content analysis is widely adopted among scientific fields to gain knowledge, insight, and guiding practise.

In this paper, the concepts include LSS uses, benefits and applications in COVID-19 within Healthcare settings. A Qualitative research approach with interviews was taken to focus on describing and understanding observations and opinions on the topic from a series of experts. In this research, an expert is a person with at least ten years of experience in the research discipline through research and publications or applications in a real-world setting. The participants were experienced and represented a wide range of LSS roles, organisational types and geographical areas.

interview data.

Qualitatively researching using interviews to access the potential of LSS methods and associated tools/techniques were selected as a research approach. The interviews were short and unstructured with short questions in which the interviewees were asked to answer the main question, which was "How can Lean Six Sigma enable Operational Excellence in healthcare in the era of COVID-19" and asked various sub-questions around the tools, concepts, and practices of different LSS tools and techniques that would be of benefit. Analysis was carried out utilising NVivo, a qualitative analysis software program to aid the content analysis approach to identify the themes. Three techniques of open coding (creating a list of themes within data), axial coding (categorising or linking subcategories of themes) and selective coding (condensing of specific or excessive categories into higher-order themes) were used.

One of the first questions asked was, "Where do you think Healthcare environments have an opportunity to utilise LSS during COVID-19?". The respondents in this study answered with some comments explicated in Table 2, and the quotes are taken "ad verbatim". This question on the potential application areas of LSS for the COVID-19 response in health care

operations yielded many responses in terms of the application areas of LSS. It was felt that LSS could be applied in contact tracing, improving testing turnaround times, expediting testing processes, producing reliable results, and identifying high-risk groups. Within the vaccination process, there is an increased need for a standardised high volume process with limited waste and delays. The test time variance in terms of waiting for testing, turnaround time for results as well as variance inaccuracy of results was also an area where LSS could help. There is much-documented research on the application of LSS in Healthcare environments before COVID-19, but many studies and articles have emerged supporting the respondents' views, with many practical examples and real-world applications. The respondents were very positive on many areas and opportunities for LSS to be utilised in Healthcare using terms like "value add", "basic process improvement", "simple process maps", "delay reduction", "risk mitigation" to highlight how LSS could be applied in terms of service delivery and treatment.

Table 2: Excerpts of respondents on the opportunities for LSS to be utilised in Healthcare
<i>"A value-add approach has been taken by vaccine developers and regulatory authorities with the elimination of non-value-added delays, which should shorten the development time" The success of this approach is now being seen with high vaccination rates and several available approved vaccines."</i>
<i>"The current reality being faced by our healthcare workers are very challenging - we can and should be using Lean and Six Sigma or basic process improvement methodologies to help Healthcare personnel to fix, improve, and transform their delivery".</i>
<i>"Keeping variance as low as possible and eliminating root causes for the variation is key in an integrated approach (i.e., Lean Six Sigma) on mitigating risk."</i>

A second question was asked on "What types of LSS tools do you think would be appropriate to help with the COVID-19 response"? The excerpts of respondents on the types of LSS tools that can be utilised are outlined in Table 3. Data analysis was considered very important and a recurring theme in terms of tracking and tracing outbreaks, identifying patterns and directing resources and supplies during outbreaks. There is evidence of data and statistical analysis in the study to predict and prioritise breast cancer treatment based on their needs and the urgency of the treatment. Risk analysis to mitigate and prevent infections and identify potential sources of risk was also deemed significant. Mapping of flow, demonstrating flow, and ensuring pull processes were considered to be very important to minimise infection and avoid backlogs in Health have ratified the importance of risk mitigation and flow management and given examples of hospitals in Argentina, Spain and the USA. In their examples, the critical patient flow was mapped in areas like the ICU and the flow of patients, physicians, nurses, technicians, materials and information identified to make improvements to reduce exposure, reduce and mitigate against risk and reduce the number of PPE per patient seen.

Table 3: Excerpts of respondents on types of LSS tools for COVID-19 response

"FMEA and Risk Assessment can help identify mission-critical areas, e.g., materials, people, processes, systems, customers, components, suppliers, etc., in healthcare environments. Workplaces and health care facilities can be subsequently error proofed, risks mitigated and contained. Risk Analysis can help prioritise, identify, and mitigate especially against high-probability and high-impact risks."

"LSS can be used to review historical facts and data to assess for three things for causal triggers by leveraging prediction analysis tools, speeding up identification and isolation of an outbreak, and finally mitigation of impact amid a pandemic."

"Six Sigma with its structured DMAIC approach can be utilised for projects to improve the testing process, reduce testing turnaround times using simple, effective Lean tools such as Value Stream Mapping. Six Sigma tools can help identify if test results are accurate utilising tools such as correlation, regression analysis, hypothesis tests, etc."

"Healthcare is a process -right through from registration of patients to the most sophisticated surgery. This means that they lend themselves to analysis and development using the core concepts, tools, and applications of LSS for continuous improvement."

"All premises with public access need to completely redesign their access flow, to be compliant with new health and safety requirements: this is where operational tools like 5S can be beneficial."

Discussions

All respondents emphasised the importance of Lean Six Sigma as an enabler for operational excellence in COVID-19 times. The common denominator across all responses was that the tools and techniques of LSS have a role in protecting public safety in healthcare environments in identifying and mitigating against infections. LSS methods are thought of as a common-sense approach to ensuring public safety and improving healthcare treatments, testing, diagnosis and protecting the public. LSS as a means of providing risk assessment to minimise infection risk, provide contingency and mitigation plans for dealing with outbreaks was a common theme. Statistical and data analysis and measurement have a role in measuring, managing, and understanding infection rates and prioritising areas of concern. Lean tools have a role in reducing non-value add work, error-proofing and visual management to minimise infection. The findings from this research are a valuable source for healthcare practitioners of all levels in hospitals and healthcare settings, both inpatient and outpatient. The research demonstrates a link between how LSS will enhance patient, staff and public safety and treatment efficiency in healthcare environments. The lessons learned from applying LSS methodologies have relevance to and practical applications for healthcare settings in aiding readiness for pandemics such as COVID-19.

Conclusions, limitations, and Future Work

Lean Six Sigma can enhance patient and public safety and enable operational excellence within healthcare services. LSS can provide practitioners and academics with effective guidance to mitigate and manage everyday healthcare situations and pandemic times.

The two key findings from the study are:

1. The methodology and tools of Lean Six Sigma can help healthcare organisations treat, prevent, diagnose, and mitigate during pandemics and improve healthcare process and operational excellence.
2. Lessons learned from the COVID-19 pandemics can be utilised and integrated with Lean Six Sigma tools and techniques to aid readiness and operational resilience for these events. Opportunities for further exploration of the use of Lean Six Sigma in a pandemic include further case studies on how hospitals coped and applied methods during COVID-19 and have lowered their infection rates. Further research via more detailed quantitative surveys on the application of LSS with a broader section of stakeholders would be valuable in informing how Lean Six Sigma was applied in COVID-19

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