HEIJUNKA IN SERVICE SETTINGS: ADAPTING THE CONCEPT FOR ENHANCED SERVICE LEVELING AND EFFICIENCY FOR PATIENT WAIT TIMES IN HOSPITALS

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Abstract

The comprehensive study has been done on Lean tools that are used to define customer values as the primary basis for developing possibilities for service improvement, identifying wastes, and establishing current state procedures. Research has shown that healthcare providers apply Lean thinking and employ a variety of Lean tools and approaches to assess their operational processes as they stand. The study brings out the emergence of application of lean tools in healthcare sector since patient flow is hectic and unmanageable. Patient wait times in hospitals are a major concern impacting patient satisfaction and overall efficiency. This paper explores the concept of Heijunka, a lean manufacturing principle, and its adaptation for service settings like hospitals. It examines the significance of implementing Heijunka to level patient flow, reduce wait times, and improve service efficiency. The paper discusses the application of Heijunka tools like the Heijunka box and its role in managing patient flow. It also explores the connection between Heijunka and Taguchi's principles of variation reduction and the applicability of the 7 wastes framework in identifying areas for improvement. The paper delves into the implementation of Heijunka and its potential advantages for hospitals. Finally, it analyzes the case of Virginia Mason Hospital, a successful example of Heijunka implementation leading to smoother patient flow.

Key Words : Heijunka, Service sector, Patient flow, 7 wastes principles

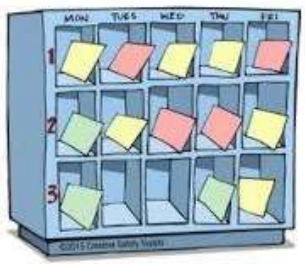
I.Introduction

Heijunka, meaning "production leveling" in Japanese, is a core principle of Lean manufacturing that focuses on creating a level production schedule. This paper proposes adapting Heijunka for service settings, particularly hospitals, to address the critical issue of patient wait times. Long wait times negatively impact patient experience and satisfaction, highlighting the need for improved service levelness and efficiency.

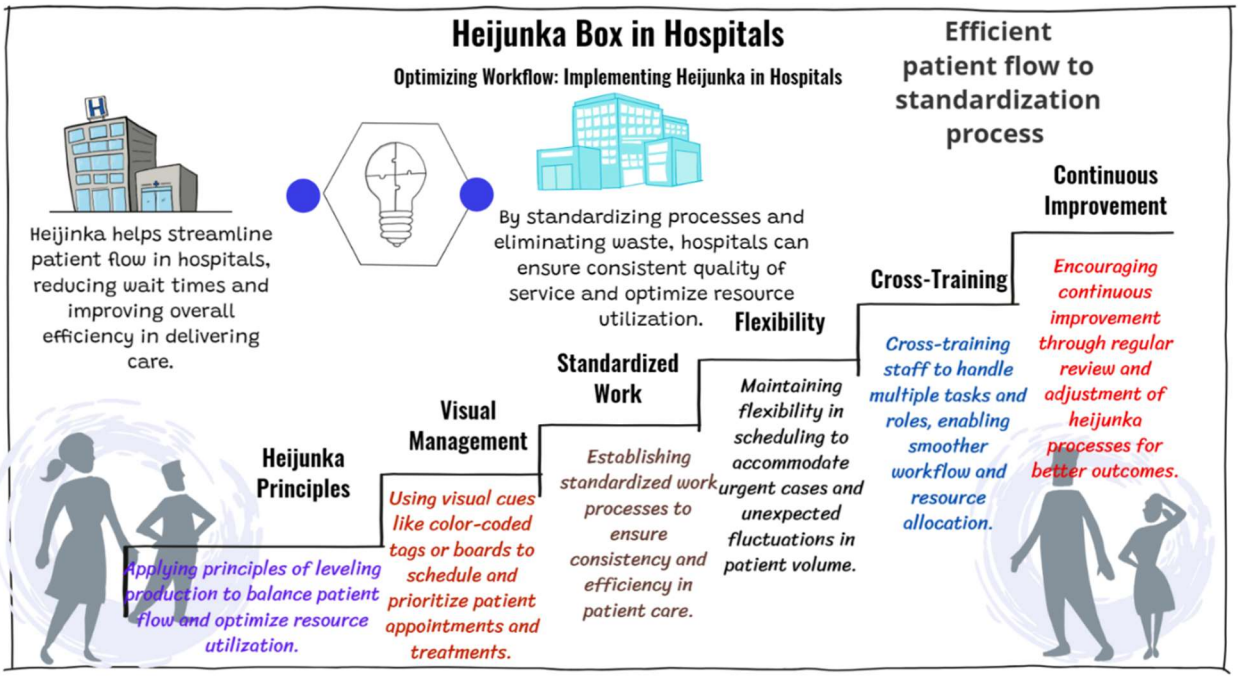
1.1 Heijunka Concepts

S.No	Concepts	Meaning and defnition	Hospital Industry
1	Definition	"Levelling, equalisation, alleviation, and harmonisation" is the definition of Heijunka. The Heijunka principle is extremely potent and forces us to consider how "load/demand" is affecting our	Translate the concept of leveling, equalization, and harmonization to patient flow management in hospitals.

		operations and what steps we can take to try to balance it. We wish to stay away from the highs and lows.	Understand the variation in patient demand and strive to balance it to avoid peaks and troughs in the number of patients seeking care.
2	Sequence plan of Heijunka	Over a predetermined length of time, Heijunka is levelling the type and quantity of production. This leads to minimum inventories, capital expenses, labour costs, and production lead times throughout the complete value stream and allows manufacturing to effectively fulfil consumer demands while avoiding batching.	Apply the principle of leveling production over a fixed period of time to patient flow in hospitals. Aim to efficiently meet patient demands while avoiding batching, which can lead to inefficient resource utilization and longer wait times. Strive to minimize inventories (e.g., patients waiting for appointments or beds), capital costs, manpower, and production lead time (time spent waiting for care) across the entire patient care journey.
3	Elements of Heijunka	There are two ways of leveling production using the Heijunka concept, it can be implemented by volume or type. Leveling by Volume – deals with the number of items per type of product produced in each batch. ... Leveling by Type – adds different sequences of what product is being produced in every batch.	**Leveling by Volume**: Manage the number of patients seeking care per type of medical service or procedure over a specific time period. **Leveling by Type** Implement different sequences of patient care based on the type of medical condition, procedure, or service required.
4	Importance of Heijunka	Levelling the type and quantity of manufacturing over a predetermined time period is known as heijunka. The objective is to resolve problems such as overproduction, or batching, which also minimises waste, labour costs, maximises inventory space, and shortens the lead time for production.	Emphasize the importance of leveling patient flow to minimize issues such as overproduction (e.g., excessive wait times), batching (e.g., clustering patient appointments), and waste (e.g., underutilized resources). Highlight the benefits of Heijunka in hospitals, including reducing labor, maximizing space utilization, minimizing inventory (e.g., empty beds), and decreasing production lead time (e.g., time spent in waiting rooms).
5	Goal of Heijunka	Heijunka is the process of "levelling the type and quantity of production over a fixed period of time," according to the Lean Lexicon. Heijunka's primary objective is to completely rule out the possibilities of Mura and Muri by levelling the market according to product kind and volume.	Align the goal of Heijunka in hospitals with the elimination of unevenness (Mura) and overburden (Muri) in patient care processes. Focus on leveling patient demand by volume and type to create a smoother and more efficient patient flow, ultimately improving the patient experience and operational efficiency.
6	Set up heijunka Box		Develop a visual management tool, such as a Heijunka box, to help hospital staff visualize and manage patient flow over time. Use the Heijunka box to plan and schedule patient appointments, procedures, and treatments in a balanced and efficient manner, ensuring that

			resources are allocated effectively to meet patient demand without overloading the system.

Setting Heijunka Box in Hospital



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II. Summary of Previous Studies on Lean service Systems applied to Service Sector- Hospital (LSS)

Author(s) and Year	Industry	Remarks/ findings
Hussain, M., & Malik, M. (2016).	Hospital	They implemented LS in the UAE Healthcare system. The authors identified **waste minimization** in public and private hospitals.
Alnajem, M. et al. (2019).	Hospital-Emergency department	They have identified and validated their results based-on experts' opinions on lean six main categories, such as **human resources, patient relations, top management and leadership, supplier relations, processes, and Kaizen.**

Agarwal, S. et al. (2016).	Cardiac Catheterization Laboratory	After incorporating lean six sigma inside the lab, there is substantial improvement in physician downtime, turn-time, on-time physician arrival, on-time patient arrival, on-time start in the side.
Robinson, S. et al. (2012).	Healthcare sector	'SimLean' approach is developed through education, facilitation, and evaluation to improve patient service quality.
Varkey P, Kollengode A, 2011	Hospital	They introduced an emerging framework to an Indian hospital to improve the quality perception of patients through the council of India.
Angel Díaz et al. 2012	Hospital	Aravind eye hospital implemented lean service in Madurai, Tamilnadu state. They performed lean service through the simplified patient brochure, **5S, VSM** to improve the process and quality of customer care.
Monica Sharma Shradha Gupta,2015	Hospital	They assessed the readiness of the systemic leanness for the hospital. They emphasized that lean service will be beneficial for the patients if the hospital sincerely implemented the lean system
Richard Miller & Nirisha Chalapati, 2015	Hospital	They found that most of the patients are spending their own money on healthcare and scheduling difficulties for the treatment that has to be taken within a day. Several wastes were found out which will affect the hospital's attitude of patient care.

Nicola Burgess and Zoe Radnor (2011) did a study on the use of lean in English hospitals and discovered that lean implementation is still common in hospital trusts in England. English hospital managers are progressively improving and elevating their Lean implementation approaches in line with organization-wide programmes and the organization's strategy. Hospital trust managers are implementing Lean in a variety of ways, from a tentative exploration through learning from others. Typically, the implementation is not system-wide but rather confined. This serves as a manual for implementing lean in English hospitals.

The "flow model" performance assessment system, developed by Beata Kollberg, Jens J. Dahlgaard, and Per-Olaf Brehmer in 2007, is intended to track the adoption of lean thinking in healthcare services. Lean thinking may be used in healthcare environments, and the *flow model is a useful tool for monitoring these efforts.* A true picture of lean performance requires balancing the flow model with other data. Future managers can use the model as a reference to better understand the processes and changes occurring in organisations as they shift towards sustainable practices.

Research on the significance of Lean methodology and its implications and application in the service industry from its inception in the 1990s to the present was conducted by Shradha Gupta, Monica Sharma, and Vijaya Sunder M. in 2015. It has been mandated that Lean methods and instruments be modified for the service sector. Managing the intangibility of waste that arises from the inability to identify it and, consequently, the customer's presence as a co-producer, is the primary challenge with services. The lack of knowledge regarding Lean implementation in service organisations is another difficulty for its application in the service sector. By identifying and

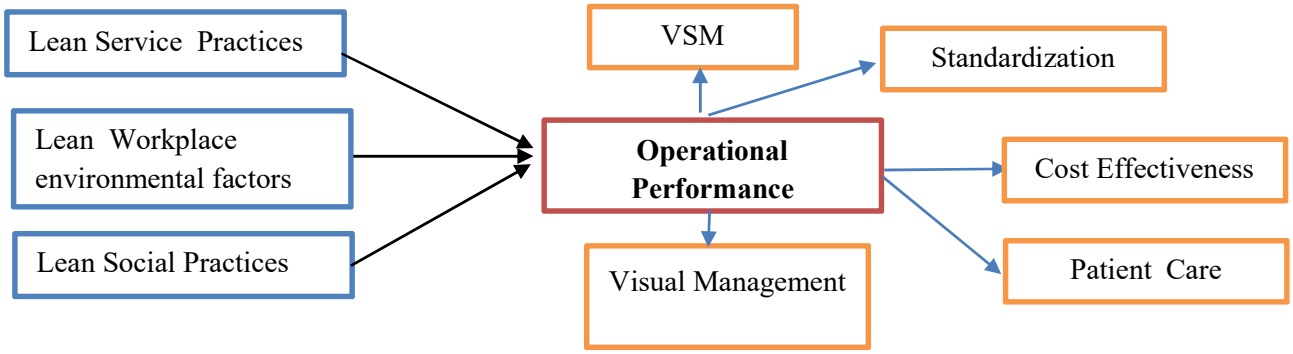
avoiding the root causes, one can eventually enhance service quality and the customer experience through the use of lean technologies like VSM, Standardisation, and Visual Management.

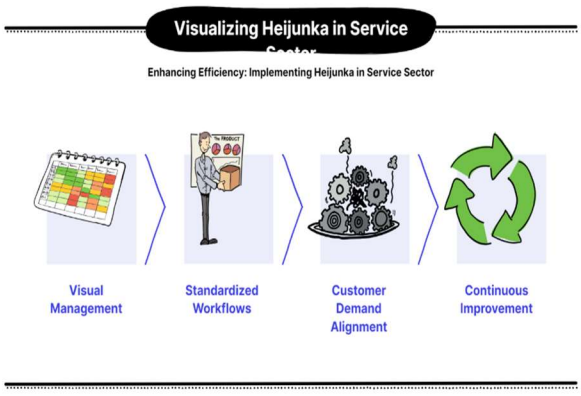
2.2 Objectives of the Study :

1. Investigate the principles of Heijunka (production leveling) and how they can be adapted and implemented effectively within the hospital context.
2. Assess the potential benefits and impact of Heijunka implementation on hospital operations, including improvements in workflow efficiency, Patient flow Management, resource utilization, staff satisfaction, and patient outcomes.
3. Define key performance indicators (KPIs) and metrics to measure the success of Heijunka implementation, such as wait times, resource utilization rates, and patient satisfaction scores.
4. Explore best practices and case studies of Heijunka implementation in other healthcare settings (Case of Virginia Mason Hospital) to draw lessons learned and insights applicable to hospitals.

Ultimately, the overarching objective is to contribute to the enhancement of healthcare quality, efficiency, and patient satisfaction through the effective implementation of Heijunka principles within hospitals.

2.3 Theoretical / Conceptual Framework proposed for the study



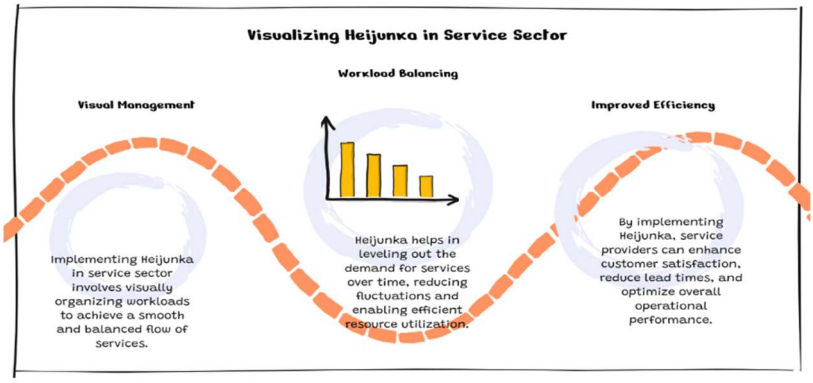


III. Factors considered for Heijunka to be implemented in Hospital

No	Wait time- factors	Proposed Research & prospects of Implementing Heijunka
1	Wait time for patients	Conduct a comprehensive analysis of wait times in hospitals, including data collection on patient arrival times, triage, consultation, diagnostic procedures, and discharge. Identify bottlenecks and inefficiencies in the patient flow process that contribute to longer wait times, such as staff shortages, equipment availability, scheduling issues, or administrative delays.
2	Factors contribute to longer wait times	Evaluate factors contributing to longer wait times, such as high patient volume, inadequate staffing levels, inefficient scheduling practices, delayed test results, or complex administrative procedures. Consider external factors such as emergencies, unexpected patient arrivals, or seasonal variations in demand that may impact wait times unpredictably.
3	Reduce wait times and improve faster patient flow	Implement Heijunka principles to level out patient demand and optimize resource utilization, ensuring a smoother and more consistent patient flow. Streamline processes through efficient appointment scheduling, prioritization of urgent cases, cross-training staff to handle multiple tasks, and implementing electronic health record systems to reduce paperwork and administrative burdens. Enhance communication and collaboration between departments to facilitate seamless transitions between stages of care and minimize handover delays.
4	Managing Patient expectations and anxieties during wait time wait times.	Communicate transparently with patients about anticipated wait times, reasons for delays, and steps being taken to expedite their care. Provide comfortable waiting areas equipped with amenities such as Wi-Fi, refreshments, and entertainment options to help distract patients and alleviate anxiety during wait times. Offer regular updates on wait times and encourage patients to ask questions or express concerns to healthcare staff, fostering a sense of trust and engagement in the care process.
5	Biggest concerns during wait time	Address concerns related to discomfort, boredom, uncertainty, and frustration experienced by patients during wait times. Prioritize patient safety and well-being by ensuring prompt access to medical attention for patients with urgent needs or deteriorating conditions. Implement measures to mitigate the risk of nosocomial infections and promote a clean and hygienic environment in waiting areas to reassure patients and minimize health-related anxieties

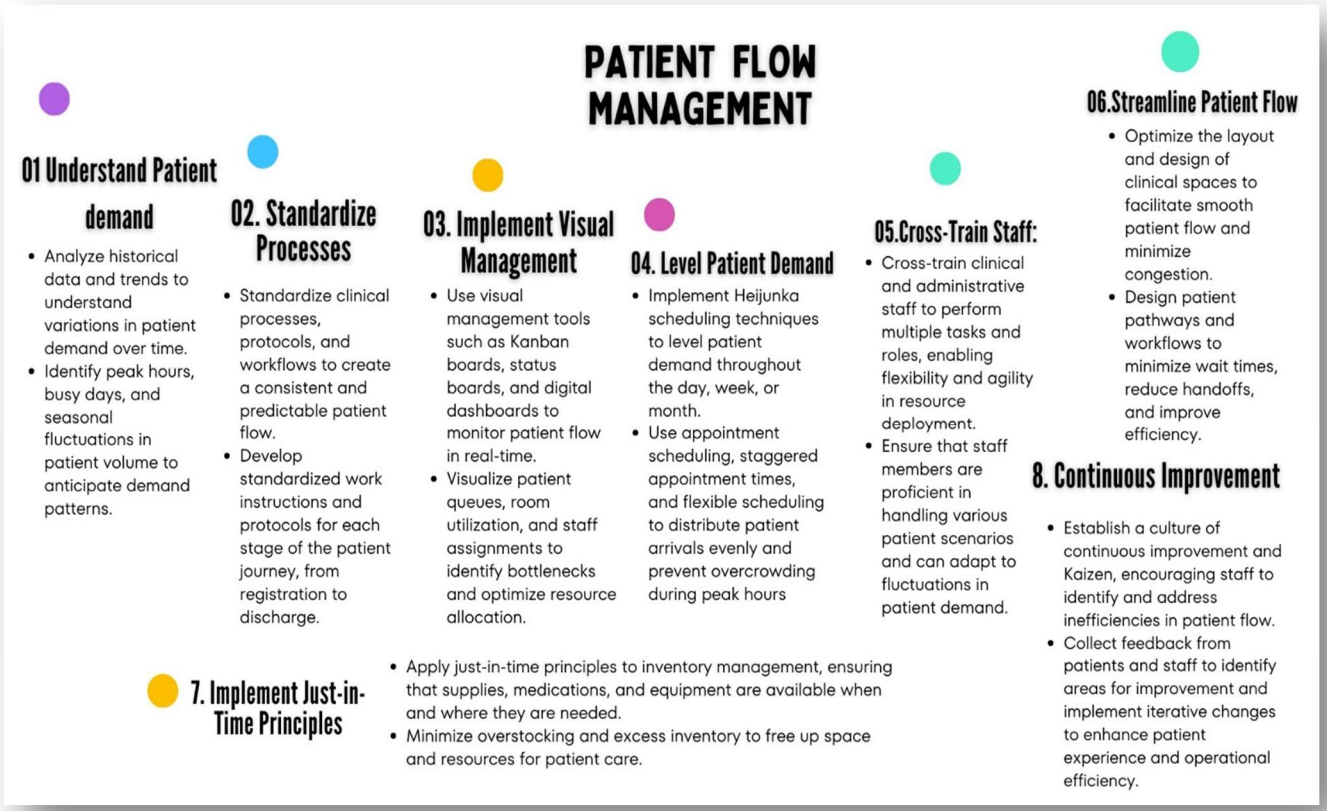
By analyzing wait times in hospitals, identifying contributing factors, and implementing strategies to reduce wait times and manage patient expectations, healthcare facilities can enhance the quality of care, optimize resource utilization, and improve patient satisfaction and outcomes.

Health Care Sector and Heijunka Implementation



4.1 Patient flow management

Patient flow management is depicted in the below infograph.



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By implementing Heijunka principles in patient flow management in healthcare facilities can achieve smoother, more efficient patient flow, optimize resource utilization, and enhance the overall quality of care provided to patients.

4.2 Work load Management

Workload management in hospitals is a crucial strategy for ensuring efficient operations, staff well-being, and ultimately, high-quality patient care. Here's a breakdown of key aspects:

- Analyze patient arrival patterns and acuity levels to ensure adequate staffing is available based on real-time needs. This may involve flexible scheduling and use of temporary staff.
- Match staff skillsets with patient needs. Utilize advanced practice nurses, technicians, and support staff effectively to free up doctors for more complex cases.
- Implement Lean principles to identify and eliminate waste in processes. Streamline workflows to reduce unnecessary steps and delays in patient care.
- Train staff in prioritization techniques and empower them to delegate tasks appropriately based on skillset and urgency.
- Implement tools to objectively measure workload and identify areas for improvement. This data can help with staffing decisions and **process optimization**.
- Provide support programs like stress management, work-life balance initiatives, and recognition programs to prevent burnout and promote job satisfaction.

V. Taguchi's Focus on Variation Reduction Aligns with Heijunka's Goals:

Heijunka: Aims to level out the demand for various services, leading to smoother workflows and reduced wait times. While the Taguchi method isn't directly applicable to implementing Heijunka (production leveling) in hospitals, some of its principles can be conceptually helpful. Following are the usefulness of Taguchi method in finding variations.

Taguchi Method: Focuses on minimizing variation in processes.
Taguchi highlights how important the design phase is to guaranteeing quality. Manufacturers can produce stronger items that are less prone to problems by taking into account throughout the design process how variances might effect the final product. According to Taguchi techniques, quality is defined as minimising the deviation from the intended result while taking the societal losses into account. This loss function takes into account the wider impact of changes in addition to simple fault rates. Taguchi techniques effectively assess the influence of many parameters on the quality of the final product by utilising specialised statistical tools and experimental designs, such as orthogonal arrays. This makes it possible to find the ideal design parameters more quickly.

Although Taguchi methods deal with product quality, the concept of minimizing variation can be applied to Heijunka in hospitals. By identifying factors causing variations in patient arrival rates or service times for different procedures, hospitals can work towards smoothing these variations.

Here are some ways hospitals might adapt Taguchi's principles for Heijunka:

1. **Identify Factors Causing Variation:** Similar to Taguchi's approach, hospitals can use data analysis to identify factors causing variations in patient flow. This could include:
    - Appointment scheduling patterns leading to peaks in arrivals.
    - Unpredictable emergency room influxes.
    - Varied lengths of procedures due to patient complexity.
2. **Design Solutions to Reduce Variation:** Based on the identified factors, hospitals can implement solutions inspired by Taguchi's emphasis on design:
    - **Appointment Scheduling:** Offer flexible scheduling options to distribute patient arrivals more evenly.
    - **Fast-Track Systems:** Implement protocols to expedite treatment for less complex cases, reducing variation in emergency room wait times.
    - **Standardization of Procedures:** Develop standardized protocols for common procedures to minimize variations in treatment times.

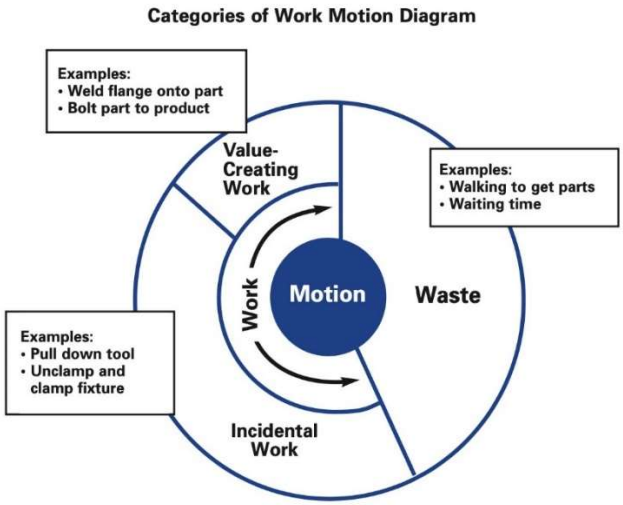
While the Taguchi method isn't a direct Heijunka implementation tool, its focus on variation reduction can be conceptually applied to smoothen patient flow and waiting times in hospitals, contributing to a more Heijunka-like environment.

VI. Seven Wastes and its Applicability to Healthcare :

The 7 wastes are Taiichi Ohno's categorization of the seven major wastes typically found in mass production which is reflected from the service sector (Health care)

S.No	Type of Waste	Manufacturing sector	Application to Healthcare
1	**Overproduction**	Producing ahead of what's actually needed by the next process or customer. The worst form of waste because it contributes to the other six.	Scheduling unnecessary tests, procedures, or medications for patients. Scheduling too many appointments in a short timeframe, leading to overworked staff and patient wait times.
2	**Waiting**	Operators standing idle as machines cycle, equipment fails, needed parts fail to arrive, etc.	Patients waiting for test results, appointments with specialists, medication refills, or bed availability. Staff waiting for lab results, consultations, or equipment.
3	**Conveyance**	Moving parts and products unnecessarily, such as from a processing step to a warehouse to a subsequent processing step when the second step instead could be located immediately adjacent to the first step.	Unnecessary patient transfers between departments for tests or consultations. Inefficient layout of equipment or supplies, requiring staff to walk long distances.

4	**Processing**	Performing unnecessary or incorrect processing, typically from poor tool or product design.	ordering unnecessary tests or procedures due to lack of clear guidelines or communication. Inefficient discharge processes with unnecessary paperwork or delays.
5	**Inventory**	Having more than the minimum stocks necessary for a precisely controlled pull system.	Overstocking medications, supplies, or equipment that may expire before use. Maintaining unnecessary paperwork or duplicate records.
6	**Motion**	Operators making movements that are straining or unnecessary, such as looking for parts, tools, documents, etc	inefficient layout of patient rooms or nurse stations requiring extra steps for staff. Poorly designed workstations leading to repetitive motions and potential injuries.
7	**Correction**	Inspection, rework, and scrap.	Medical errors due to miscommunication, medication mistakes, or improper procedures. Need for repeat tests or procedures due to errors in the first attempt.

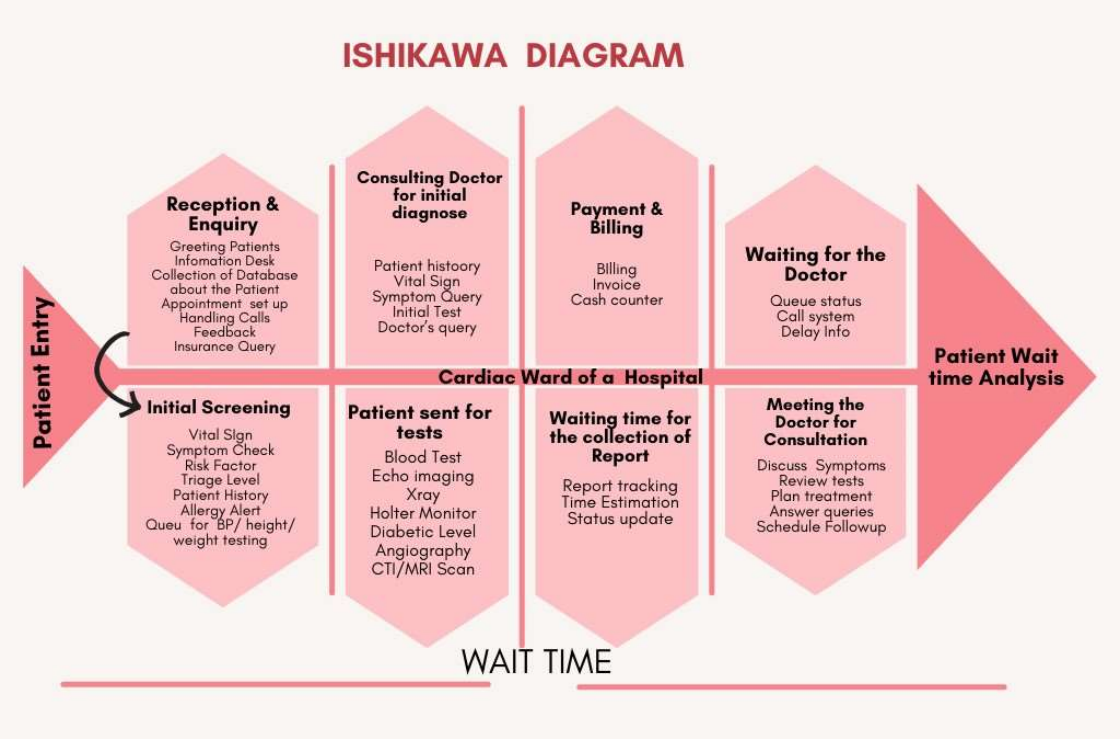


What are the 7 Wastes in Lean? | Lean Enterprise Institute

By identifying and eliminating these wastes in hospital settings, healthcare facilities can improve patient care, reduce costs, and create a more efficient work environment for staff.

VII APPLICATION OF LEAN PRINCIPLES - CREATION OF VSM (Value stream Map) – Sample VSM for healthcare

A sample fishbone analysis for finding the waiting time in a Hospital between processes.



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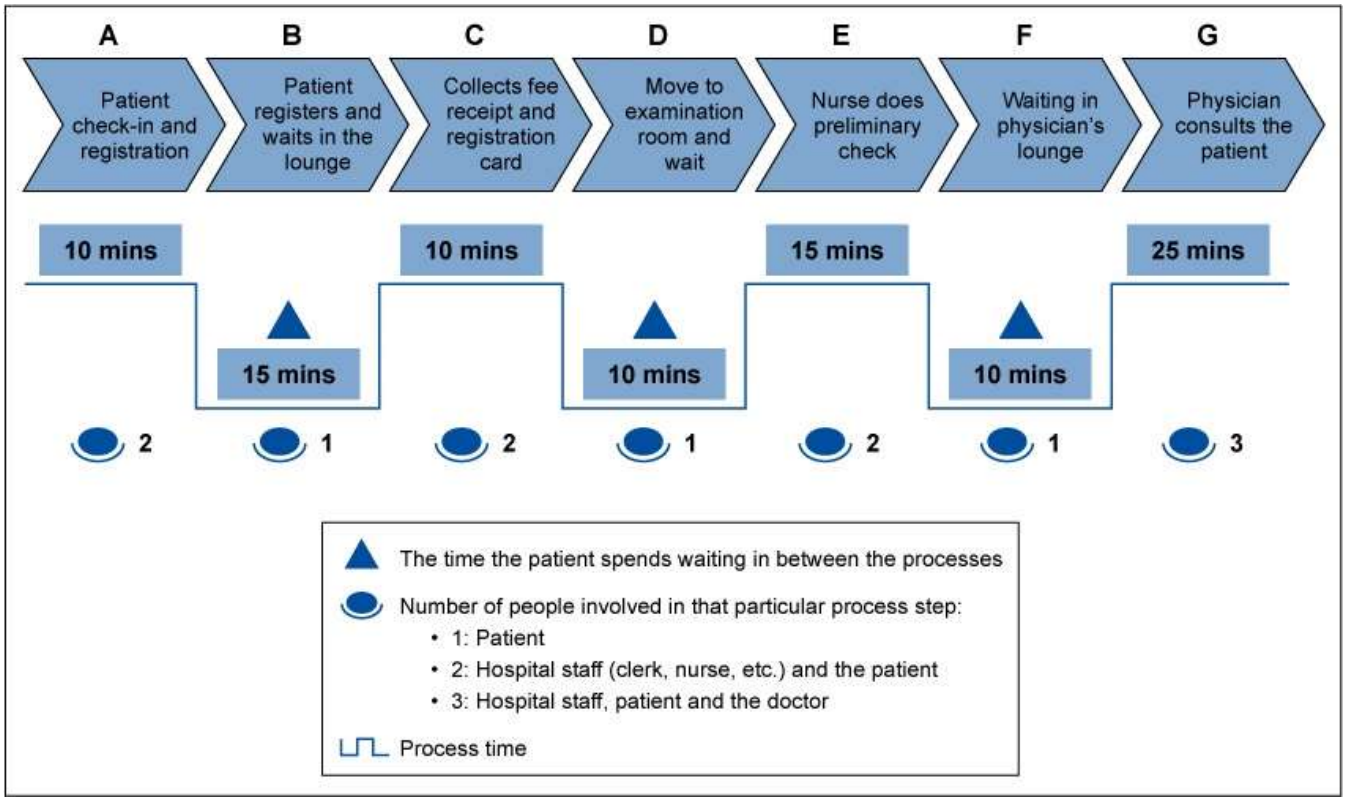
Lean should be applied to reduce the waiting time in hospital industry. They have rules and procedures specific to dissimilar types of patients and procedures, such as for first aid, surgery, tomography, X-ray, Blood test, Echo testing, treadmill etc.,



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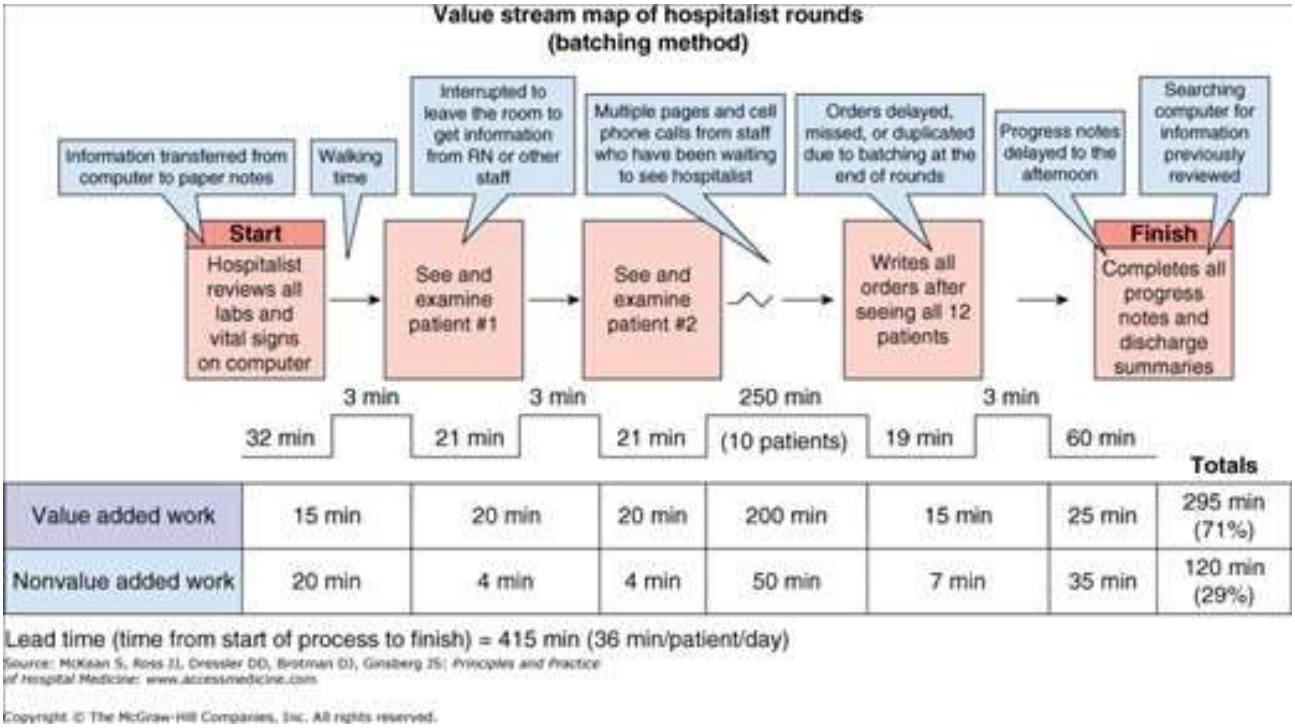


VIII Reason for analyzing Wait time in Hospital

Hospitals collect data on various aspects of patient management, including wait times. This data includes the time patients spend waiting for different services such as triage, consultation, diagnostic tests, treatment, and discharge. Analyzing wait times helps identify bottlenecks in the patient flow process. These bottlenecks could occur at registration desks, waiting rooms, examination rooms, or in accessing specialized services such as imaging or laboratory tests. Long wait times can negatively affect patient satisfaction. Patients may perceive long waits as a lack of care or efficiency in the hospital's operations. Analyzing patient feedback and satisfaction surveys can provide insights into the impact of wait times on overall patient experience. Prolonged wait times can also have clinical implications, especially for patients with urgent or emergent medical conditions. Delayed access to care may lead to worsened health outcomes or complications. Analyzing wait times helps hospitals allocate resources more effectively. By identifying areas with longer wait times, hospitals can redistribute staff, equipment, and facilities to improve efficiency and reduce wait times. Hospitals use various strategies to reduce wait times and improve operational efficiency. This may include optimizing scheduling, streamlining patient flow processes, implementing electronic health record systems, and increasing staff capacity.

Hospitals often benchmark their wait times against industry standards or best practices. Comparing wait times with peer institutions or national averages helps identify areas for improvement and implement evidence-based interventions. Long wait times can increase healthcare costs due to inefficiencies in resource utilization and potential penalties for extended lengths of stay. Analyzing wait times allows hospitals to identify cost-saving opportunities by reducing unnecessary delays and improving resource utilization. By analyzing wait times in patient management is essential for optimizing hospital operations, improving patient satisfaction, enhancing clinical outcomes, and controlling healthcare costs. It requires a comprehensive approach that integrates data collection, performance monitoring, continuous improvement, and stakeholder engagement. The analysis of wait times in patient management within hospitals encompasses several key aspects. Hospitals collect data on patient wait times to identify bottlenecks in the patient flow process, such as at registration desks, waiting rooms, or examination rooms. Long wait times can negatively impact patient satisfaction and clinical outcomes, highlighting the need for efficient resource allocation and operational strategies to reduce delays. Benchmarking against industry standards allows hospitals to identify areas for improvement and implement cost-saving measures. Overall, analyzing wait times is crucial for optimizing hospital operations, improving patient satisfaction, enhancing clinical outcomes, and controlling healthcare costs.

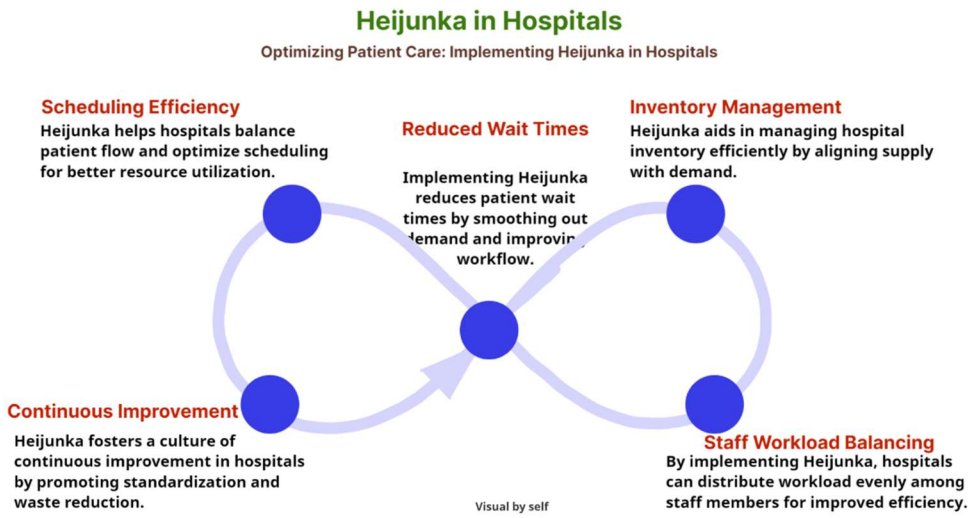
IX The implementation of Heijunka in hospitals

The implementation of heijunka is expected to yield several positive results, including:

1. Improved Patient Flow: Heijunka aims to smooth out the variability in patient demand and resource utilization, leading to more predictable patient flow throughout the hospital. This can result in reduced waiting times, improved access to care, and enhanced patient satisfaction.
2. Increased Efficiency: By levelling patient demand and standardizing processes, Heijunka helps hospitals optimize resource utilization, reduce idle time, and minimize overburdening of staff and equipment. This leads to increased operational efficiency and productivity across various departments.

3. Enhanced Quality of Care: Standardizing processes and reducing variability in patient flow can help hospitals deliver more consistent and reliable care to patients. This may lead to fewer errors, improved clinical outcomes, and a safer healthcare environment overall.
4. Better Staff Satisfaction: Heijunka encourages a more balanced workload and smoother workflow for healthcare staff, reducing stress and burnout. By involving staff in process improvement initiatives and empowering them to contribute to the design of efficient workflows, Heijunka can boost staff morale and job satisfaction.
5. Cost Savings: Through better resource utilization and reduced waste, Heijunka can help hospitals achieve cost savings and improve financial sustainability. This includes lower inventory carrying costs, reduced overtime expenses, and optimized use of facilities and equipment.
6. Enhanced Capacity Management: By aligning capacity with patient demand, Heijunka enables hospitals to better manage fluctuations in patient volume and seasonal variations. This allows hospitals to maintain optimal staffing levels, allocate resources effectively, and adapt to changing demand patterns.

Overall, the successful implementation of Heijunka in hospitals is expected to result in a more efficient, effective, and patient-centered healthcare delivery system, ultimately leading to better outcomes for both patients and healthcare providers.



9.1 Advantages of implementing Heijunka in Hospitals

a. Smoother Patient Experience: Heijunka helps hospitals organize things so patients don't have to wait as long and can get the care they need more quickly. It's like making sure everyone gets their turn at the water fountain without a long line forming.
b. Less Chaos, More Order: By organizing how things are done, Heijunka helps hospitals run more smoothly. It's like having a schedule for chores at home, so everyone knows what to do and when, making everything flow better.
c. Better Quality Care: With Heijunka, hospitals can provide more consistent and reliable care to patients. It's like making sure you get the same level of service every time you visit your favorite restaurant – no surprises, just good quality every time.

d. Happier Staff: Heijunka helps make sure that hospital staff aren't overwhelmed with work and can do their jobs more easily. It's like having a work schedule that's fair and balanced, so everyone feels valued and less stressed.
e. Saving Money: Heijunka helps hospitals use their resources more efficiently, which can save money in the long run. It's like using coupons or shopping during a sale to get the most value for your money – except in this case, it's about using hospital resources wisely.
f. Managing Busy Times: Heijunka helps hospitals handle busy times more effectively by planning ahead and adjusting resources as needed. It's like having extra staff on hand during the holidays to handle the rush, so everything keeps running smoothly.

9.2 Requisites for Smooth Process Flow

The following elements are required for the smooth process flow viz.

1.Assessment and Planning:

- -Understand the current state of hospital operations, including patient flow, resource utilization, and workflow inefficiencies.
- -Identify areas where Heijunka principles can be applied to improve efficiency and quality of care.
- -Develop a plan for implementing Heijunka, including goals, timelines, and resource requirements.

2. Leadership Commitment:

- -Gain buy-in and support from hospital leadership, including administrators, department heads, and frontline staff.
- -Communicate the benefits of Heijunka and the importance of everyone's involvement in the implementation process.

3.Staff Training and Education:

- -Provide training to hospital staff on Heijunka principles, including concepts such as leveling, standardization, and visual management.
- -Educate staff on the goals and objectives of Heijunka implementation and how it will impact their roles and responsibilities.

4.Process Standardization:

- -Standardize workflows and processes across departments to reduce variability and streamline operations.
- -Develop standard work procedures, protocols, and guidelines for patient care, resource allocation, and task management.

5.Visual Management:

- -Implement visual management tools and techniques to make processes and information more visible and accessible to staff.
- -Use tools such as Kanban boards, flowcharts, and performance dashboards to monitor progress, track key metrics, and identify areas for improvement.

6.Continuous Improvement:

- -Foster a culture of continuous improvement and innovation among hospital staff.
    - Encourage staff to identify and address problems, suggest improvements, and participate in quality improvement initiatives.

7. Measurement and Evaluation:

- -Establish key performance indicators (KPIs) and metrics to measure the effectiveness of Heijunka implementation.
- -Regularly monitor and evaluate performance data to assess progress towards goals and identify opportunities for further optimization.

8. Adaptation and Flexibility:
   - -Remain flexible and adaptable to changes in patient volume, resource availability, and external factors.
   - -Continuously refine and adjust Heijunka processes and strategies based on feedback, lessons learned, and evolving needs.
9. Stakeholder Engagement:
   - -Engage with patients, families, and other stakeholders to gather feedback and input on Heijunka initiatives.
   - -Involve stakeholders in decision-making processes and seek their perspectives on how to improve patient experience and satisfaction.

By following these steps and integrating Heijunka principles into hospital operations, healthcare organizations can optimize patient flow, improve resource utilization, and enhance the quality and efficiency of care delivery

X. Methodology of finding Research prospects

Determining whether a hospital has fully implemented heijunka requires a nuanced approach, as healthcare settings present unique challenges compared to traditional manufacturing environments. There can be scope of research for finding the waste management, removal of wait time for outpatient flow, work load management of staff and process flow. Here's how a researcher can assess a hospital's heijunka implementation:

10.1 Assess Core Principles:

a) **Levelling**: Analyze appointment scheduling data to see if patient volumes and types are leveled across time periods. Consider both within-day (morning/afternoon) and across-day (weekdays/weekends) variations.
b) **Standardization**: Evaluate the standardization of procedures, workflows, and resource allocation within departments and across specialties. Assess the use of best practices and protocols.
c) **Pull Systems**: Observe whether patient care utilizes kanban boards or similar visual tools to signal demand for specific services, avoiding unnecessary work-in-progress buildup.
d) **Visual Management**: Look for heijunka boards displaying the planned workload, resource allocation, and service types for different time periods. Assess their accessibility and utilization by staff.

e) **Continuous Improvement**: Investigate the existence of ongoing efforts to identify and eliminate waste, improve flow, and enhance patient experience. Consider staff engagement in improvement initiatives.

10.2. Gather Information:

a. Interviews: Conduct interviews with hospital administration, department heads, and staff to understand their understanding and application of heijunka principles.
b. Data Analysis: Analyze patient flow data, scheduling records, wait times, staff workload data, and resource utilization metrics to identify patterns and assess progress towards levelling and optimized flow.
c. Site Visits: If possible, observe actual workflows in relevant departments, looking for visual management tools, standardized practices, and evidence of pull systems in action.

Sample : A multi speciality Hospital with different departments.

Study Variables		
Name	Types of variables	Measurement
Lean Service Practices	Independent Variable	involve assessing the adoption of tools such as value stream mapping, 5S, and standardized work procedures.
Work place Environmental practices	Independent Variable	including factors such as waste management, energy efficiency, and overall sustainability initiatives.
Lean Social Practices	Independent Variable	employee engagement, teamwork, and communication effectiveness.
Operational Efficiency	Mediating Variable	resource utilization, throughput time, and productivity gains resulting from Lean Six Sigma initiatives.
Cost Effectiveness	Dependant Variable	analyzing cost reductions, cost avoidance, and return on investment achieved through process improvements.
Patient care Management	Dependant Variable	Measure the quality and effectiveness of patient care management processes, including factors such as patient satisfaction, waiting times, medical errors, and adherence to clinical protocols.

10.3. Consider Challenges and Adaptations:

a. Patient Variability: Acknowledge that patient health conditions and treatment needs can be unpredictable, requiring flexibility in applying heijunka principles.

b. Multidisciplinary Teams: Understand that collaboration between different specialties requires coordination and communication strategies within the heijunka framework.
c. Long-Term Perspective: Recognize that fully implementing heijunka is a continuous journey, requiring ongoing adaptation and improvement based on ongoing data analysis and feedback.
d. Emergency Services: Recognize that emergency departments necessitate unique approaches to flow management, aiming for rapid response while considering ethical and safety concerns.

Based on the assessment of the core principles, gathered information, and consideration of specific challenges and adaptations, you can build a comprehensive picture of the hospital's heijunka implementation. However, it's essential to avoid a binary "yes/no" answer. Instead, focus on understanding the level of commitment, progress made, and areas for further optimization. Remember, successful heijunka implementation in healthcare is an ongoing process requiring continuous adaptation and refinement.

XI. Case of implementing Heijunka and understanding the existence of waste

“Heijunka” is a Toyota Production System term defined as production leveling or smoothing. The experience of staff at Virginia Mason and in the work with health care clients proves that heijunka is essential to delivering the highest-quality, most patient-focused care what the hospital can provide.

Patients benefit from care processes that flow seamlessly between teams and departments. Also when processes flow continuously, less effort and fewer resources are required — not because staff intentionally cut them, but because they have defined what is truly required to perform best work, in the most exceptional way, each and every time for the patients. The key to understanding the benefits of heijunka is a willingness to go see the actual processes and identify all of the reasons why they are not flowing continuously.

When processes start and stop often, and when they flow at different rates between steps, we know that waste is present. So the research question is how do we go from where we are to where we desire to be so that we can deliver world-class care to patients?

11. Unveiling Waste and Streamlining Test Results at Virginia Mason

a. The Challenge: Virginia Mason's outpatient internal medicine department faced a problem: long wait times for normal test results. Patients received abnormal results quickly, but normal results took two weeks, leading to frustration and numerous calls for status updates. This disrupted clinic operations and delayed patient care.

b. Identifying the Bottleneck: To address this issue, Virginia Mason adopted a process improvement approach. Teams participated in workshops and were encouraged to identify waste in the current system using Taiichi Ohno's seven wastes framework. This exercise revealed numerous issues documented on sticky notes, highlighting the inefficiencies in the test result process.

c. Understanding Patient Needs: Furthermore, Virginia Mason prioritized patient needs. By talking to patients directly, they discovered a strong desire for quicker access to normal test results. Data confirmed this, showing over 50% of clinic calls were status inquiries, some from patients just two hours after appointments.

d. The Impact of Delays: These frequent calls significantly disrupted clinic flow. Providers faced constant interruptions, leading to longer wait times for both new and existing patients. The entire patient experience suffered due to the delay in normal test results.

e. The Path to Improvement: Virginia Mason recognized the need to improve the overall lead time, from specimen collection to communicated results. By eliminating patient wait times, they aimed to reduce disruptive calls and free up care teams for their core duties. The solution lied in streamlining the test result process and smoothing out the workflow, ultimately improving access to quality care.

f. Unveiling the Root Cause: A value stream map, (VSM) a visual representation (VR)of the current process, revealed significant wait times between processing steps for different tests. Some tests had quick turnaround times, while others took considerably longer. This unevenness was a major contributor to the overall delay in receiving normal test results.

In pursuit of heijunka

Our attention was drawn to what the patients wanted us to do rather than what we felt was necessary. We made the decision to give out each regular result as soon as it was received rather than batching results any longer. Following receipt of all ordered test results, the provider team would follow up with the patient if an additional summary of testing was needed. We experienced fewer pauses for status updates and had more than enough time to do the new summary work after all of the irregularities and extra work associated with batching test results were removed. In order to improve our patient access, we put the ideas of continuous flow to use and discovered the importance of reporting data promptly. Additionally, we were able to devote more time to meaningful patient interaction by eliminating waste and the workload.

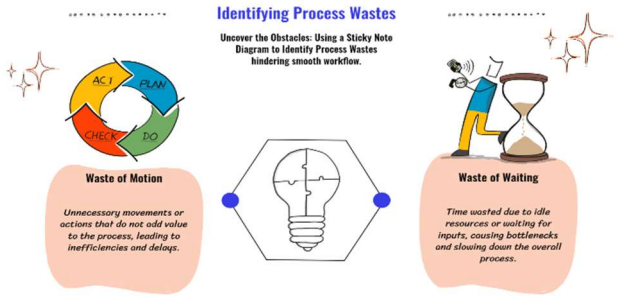
Our early attempts to incorporate heijunka into our routine clinic procedures led us to believe that level production was the key to enhancing our patients' health and wellbeing. We observed the importance of being on the front lines and locating the obstacles preventing us from having a constant, consistent flow.

Heijunka Improves Patient Care at Virginia Mason Hospital

- **The Problem:** Virginia Mason's outpatient department struggled with long wait times for normal test results. Patients received abnormal results quickly, but had to wait two weeks for normal ones. This caused frustration and a high volume of calls for status updates, interrupting doctors and further delaying appointments.
- **The Solution:** Virginia Mason implemented heijunka, a concept from lean manufacturing that focuses on leveling production. They applied it to their test result process.
- **How it Worked:** Instead of batching all results and sending them out together, the hospital sent normal results as soon as they were available. This eliminated unnecessary work and wait times.
- **The Outcome:** By implementing heijunka, Virginia Mason saw significant improvements. Doctors received fewer interruptions for status updates, freeing up time for patient care. Additionally, eliminating batching allowed for efficient completion of result summaries when needed. Overall, patient flow improved, leading to better access to care and a more positive experience.

Virginia Mason Hospital identified long wait times for normal test results as a major disruption to their outpatient clinic. By understanding patient needs and applying lean principles to eliminate waste in the process, they were able to streamline test result delivery and significantly improve clinic flow. This resulted in reduced wait times, fewer interruptions for staff, and a more positive patient experience. This case study highlights the potential of heijunka in healthcare settings. By identifying and eliminating waste in processes, hospitals can improve efficiency and patient satisfaction. Furthermore, focusing on patient needs, as Virginia Mason did by prioritizing timely results, is crucial for delivering high-quality care.

Taiichi Ohno's Seven Wastes are connected to each barrier, and eliminating these wastes will bring you closer and closer to continuous and level output. Stated differently, after you recognise the significance of smooth



XII. Discussion & Conclusion

In conclusion, Heijunka presents a powerful approach for hospitals to tackle the challenge of long wait times and enhance service efficiency. By adapting this lean principle, hospitals can create a more leveled patient flow, minimizing congestion and delays. This translates to significant benefits for all stakeholders:

- **Patients:** Reduced wait times improve their experience and satisfaction, leading to better healthcare outcomes.
- **Hospitals:** Heijunka optimizes resource allocation, promotes cost savings, and improves overall operational efficiency.
- **Staff:** Smoother workflows and reduced stress contribute to higher job satisfaction for healthcare professionals.

The case of Virginia Mason Hospital serves as a testament to the effectiveness of Heijunka in achieving smoother patient flow. By implementing Heijunka and its associated tools like the Heijunka box and by focusing on minimizing variations in patient flow, hospitals can create a more patient-centered environment and deliver higher quality care.

Further research and exploration of Heijunka's applications in various hospital settings can lead to even more refined implementation strategies. Ultimately, embracing Heijunka principles holds immense potential for transforming hospitals into more efficient and patient-centric institutions.

Future researches shall study in more details each business service sector to where lean has been (or can be) applied. Areas such as health, government (public administration), logistics, offices, teaching, retail and others have been applying lean practices. One can now do a specific study in each of these areas and translate the benefits from one service area to another. Perhaps even propose an implementation methodology, for each specific area and/or to “services in general”.

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