



ANALYSIS

QUALITY IMPROVEMENT

Adapting Lean methods to facilitate stakeholder engagement and co-design in healthcare



OPEN ACCESS

Quality improvement approaches drawn from industry can go beyond traditional concepts of value and deliver improvements in healthcare services, argue **Iain Smith and colleagues**

Iain Smith *visiting researcher*, Chris Hicks *professor of operations management*, Tom McGovern *professor of business history and management*

Newcastle University Business School, University of Newcastle upon Tyne, Newcastle upon Tyne, NE1 4SE, UK

Healthcare systems internationally face quality and productivity challenges and calls have been made for them to focus on delivering better value.¹⁻³ However, in healthcare, value is a debated concept. Value is often viewed in terms of health outcomes per spend for a given population⁴ or in terms of clinical efficacy, focusing on interventions with a robust evidence base and reducing the use of interventions of low benefit.² But it can also be considered at the level of the microsystem, and systematic quality improvement (QI) approaches can help provide better value through action on quality, safety, and productivity.¹

The Lean method is one approach that is being increasingly used to enhance value in healthcare.⁵⁻⁷ In the UK, for example, NHS Improvement (which regulates NHS care providers) has embarked on a programme to embed Lean in English NHS trusts—some with support from the Virginia Mason Institute, a US based healthcare consultancy,⁸ and others with support from an NHS Improvement consulting team.⁹ Lean has drawn criticism for assuming that production efficiency techniques can apply directly to healthcare^{10,11} and for lacking methods to integrate clinical knowledge and expertise with patients' preferences and needs in defining value.¹² We examine how it can be used to engage stakeholders in both defining value and designing systems and processes to deliver value.

What is Lean?

Lean is derived from the practices of Japan's automotive industry, specifically the Toyota production system.¹³ It is a systematic improvement approach that conceptualises work as processes that can be continuously improved by emphasising customer value and eliminating waste.^{6,13} Although it was developed for industry, it has been used successfully to improve

quality and safety in acute, primary, and mental healthcare contexts (**box 1**).

Box 1: Examples of Lean in healthcare

- Western Sussex Hospitals NHS Foundation Trust has developed its patient first improvement system based on Lean principles. The system has been credited as contributing to the trust being rated outstanding by the Care Quality Commission.^{14,15} It is also credited with improving timeliness of patient observations, fall rates, response rates for friends and family tests, and theatre start times, as well as many more small improvements that make a difference to the everyday experience of patients or staff.^{16,17}
- NHS England's General Practice Development Programme has saved thousands of hours of clinical time by applying Lean principles through its "time for care" and "productive general practice" programmes. This involved identifying and implementing high impact changes to reduce waiting times and increase available GP time. Examples include redirecting patients not requiring a GP appointment to see other healthcare professionals such as nurse prescribers.¹⁸
- A cross-organisational collaborative in North East England used Lean methods to improve dementia care and nurse-led liaison mental health services for older adults. This included rapid improvement events that resulted in changes that reduced wait times, readmission rates, and length of hospital stay and made qualitative improvements such as increased confidence of staff and calmer ward environments.¹⁹

The goal of Lean is to improve customer value.^{13,20} Defining value in customer terms is the first step. The Lean ideal is then to design systems and processes that deliver customer value without waste, delay, or errors. This is achieved through iterative application of the Lean principles (**box 2**), which set out the steps for continuous improvement towards the ideal.^{13,22}

Box 2: Five core principles of Lean in healthcare²¹

Value—Understanding value from the customer's perspective (usually the patient)

Value streams—Identifying all the steps (both helpful and unhelpful) in the pathways of care that patients experience as they move through the system

Flow—Working along care pathways to align healthcare processes to facilitate the smooth flow of patients and information

Pull—Creating processes that direct value towards the patient such that every step in the patient journey pulls people, skills, materials, and information towards it, as needed

Perfection—an ideal to be pursued through the ongoing continuous improvement of processes

Contextual and cultural differences must be taken into account when importing improvement approaches from other industries.²³ Differences must be well understood to adapt the approach to the specific requirements of the new context.²³ Therefore, delivering value for healthcare using a Lean approach requires understanding of how Lean views customer value, how this concept should be translated to the healthcare context, and practical methods for engaging stakeholders in defining and delivering value.

Translating Lean value principle to healthcare

Lean value definitions typically emphasise a commercial, production perspective. Customer value is related to manufacturing processes that convert raw materials into finished products, such as a car, ready for sale.²⁴ Customers will not pay for defective vehicles, so to deliver value these processes must be performed correctly first time.⁷ Production activities that are not adding value are deemed to be waste and targeted for elimination.¹³

US advocates applying Lean to healthcare have tended towards definitions of value in terms of the customer's willingness to pay²⁰ and its corollary that "anything in the process that the customer would be unwilling to pay for is waste."²⁵ Although this logic may be appropriate for the US system of hybrid payment healthcare, it is less relevant in national health insurance systems like the NHS.²⁶⁻²⁸

Unlike manufacturing, healthcare services are generally intangible and are characterised by simultaneous production and consumption.²⁹ Value is not created through transformative production steps in a remote factory. Rather, the value of the service is co-created with the customer (or end user)²⁹⁻³¹; patients are not customers at the end of a production process but right in the middle of it throughout their pathways of care. Some believe that the principles of Lean have therefore been misunderstood and a more service oriented view is required that assumes value in healthcare is co-produced with patients.^{26 30}

Although it may seem obvious that the patient should be considered the customer and value defined from their perspective,³² there are other customers and stakeholders in healthcare whose needs and value perspectives must also be considered.^{32 33} Young and McClean³³ proposed a framework to help do this by defining three critical dimensions to healthcare value—clinical, operational, and experiential. The clinical dimension of value relates to delivering effective care that achieves the best clinical outcome.^{33 34} The operational dimension relates to the effectiveness of care relative to the cost of care.^{2 4 33} The experiential dimension relates to how patients experience the care they receive and can be related to their interactions with staff as well as the care environment.^{2 20 33} The various healthcare stakeholders (such as patients and carers, clinical and

non-clinical staff, managers, and regulators) may place different emphasis on these dimensions of value.³³

Lean QI methods to engage healthcare stakeholders

Arguably, most applications of Lean to healthcare have been limited by a largely operational view of value, where the focus has been on reducing costs rather than a more holistic, multistakeholder view.^{11 33} However, through various workshop formats, Lean does have methods that enable definition of value and enhance customer participation.³⁵

Lean rapid improvement events are already commonly used in healthcare to make incremental changes to processes.^{6 36} Other Lean workshops include value stream analysis, which focuses on end-to-end pathways at high level to define strategic improvement plans,³⁷ and the production preparation process (3P), which focuses on developing new products and production facilities.²⁵ These Lean workshop formats differ in emphasis but all offer the opportunity to involve patients and service users in identifying value adding activities and eliminating waste.³⁵ The question is how can people leading health service improvement use these methods in practice?

Box 3 presents an example from the NHS in North East England, which adopted Lean using knowledge from Virginia Mason.⁴⁵ The Lean 3P method was used to involve stakeholders in simultaneously designing healthcare facilities and service systems.^{38 43 44 46} The example illustrates challenges to participation that may be generally applicable (specifically the perception that patients are unable to contribute because of a lack of knowledge or ability).

Box 3: Using Lean 3P in healthcare: the design of space project

The design of space project used the Lean 3P method to help NHS stakeholders such as patients, clinicians, and architects design two endoscopy units, a maternity unit, and a paediatrics unit in North East England.³⁸

Previous reports of applying Lean 3P to design healthcare facilities have limited patient involvement to consultative walkthroughs³⁹ or not included them.⁴⁰ Furthermore, earlier research into stakeholder participation in the design of healthcare facilities identified scepticism from professional designers about the ability of patients to contribute.^{41 42} Negative beliefs about users' ability included feelings that they are "meddling" in areas they know nothing about⁴¹; practical barriers in interpreting drawings and perceiving them spatially in three dimensions⁴¹; and concerns regarding understanding of professional issues such as construction costs and material options.⁴²

The project showed that Lean 3P design workshops can provide an effective process for engaging a wide range of stakeholders⁴³ and a structured approach for corporate and clinical staff to work together with patient representatives.⁴⁴ The Lean concept of end-user value contributed to the design process by drawing out the perspectives (clinical, operational, and experiential) of multiple stakeholders in terms of what mattered most to them. Stakeholders were engaged in activities that stimulated discussion and debate and encouraged sharing of their requirements and preferences. In particular, the process gave patient and service user voices greater influence in designing the pathways and how delivery would be facilitated by the layout of the physical environment—for example, the location, layout, and size of treatment rooms. They were also able to contribute to the design of facilities for partners, family members, and carers; creation of family friendly environments; and an emphasis on sound privacy.

Simple Lean tools, such as spaghetti charts, were used to engage stakeholders in mapping out the pathway (value stream) and flows that patients and staff would follow. Flows were also designed to minimise the burden on patients (in terms of movement and anxiety) and direct staff and equipment towards the patient to deliver care.

The 3P method engaged stakeholders to articulate and share their value perspectives. Most importantly, this included service users, who shared their experiences and views on how these could be improved. Their experience was combined with staff experience to design care pathways (value streams) to deliver the desired user value. Staff contributed clinical experience and professional knowledge to ensure this could be done safely and effectively. The treatment rooms and other facilities were located

to ensure steps in the pathway lined up with the physical layout to facilitate good flow. The service user, carer, and staff flows were mapped and simulated at each cycle of the design process. Information on how pathways would work was discussed by stakeholders, which helped facilitate improvement.

To improve the overall experiences of care, participants applied a service oriented approach in which “every step in the patient journey [pulls] people, skills, materials and information towards it, one at a time, when needed.”²¹ This helped stakeholders design more innovative models of care that could respond flexibly to changing circumstances. Services could then be “pulled” towards patients as required (for example, by bringing a clinician to a patient in a treatment room rather than moving the patient to the clinician in a different location, reducing patient movement). Through multiple cycles of design, the Lean 3P method helped participants move towards an optimised service model and design.^{44 46}

Effective collaboration

The example shows that QI approaches such as Lean can be adapted to include important dimensions of service led value and quality, such as patient experience and satisfaction. In translating such methods to healthcare, it is important to identify both the primary customer and other service stakeholders to define value and target improvement. The 3P method facilitated conversations across multiple stakeholder groups (including patients, clinicians, and managers) that considered value in a more holistic way. For example, the clinical dimension of value involved stakeholders considering the effectiveness of treatments; the operational dimension involved stakeholders considering the efficiency and productivity of service delivery; and the experiential dimension involved stakeholders considering patients’ preferences and needs. Stakeholders, including patients, articulated and shared their value perspectives, tested their ideas, and co-designed healthcare facilities and systems to deliver users’ requirements. Stakeholder conversations about the different dimensions of value could also be facilitated in other workshop formats such as rapid improvement events and value stream analysis.

When patients are asked to participate in QI initiatives, their role needs to be relevant and have a practical impact. Proper collaboration early in the change process can help avoid the unintended consequences of overlooking experiential details that matter to patients. To achieve this, the qualitative nature of patient experience must be recognised and given equal priority to that of healthcare professionals.⁴⁷ It is therefore important to involve patients, clinicians, and managers early in the improvement initiative and select methods that allow them to work together on improvement. This includes facilitating conversations between stakeholders about what matters to them and creating opportunities for practical and tangible improvement activities such as small scale tests of change, working through the plan-do-study-act cycle, or creating prototypes together. In this way, QI approaches such as Lean will begin to fulfil their potential to deliver greater value in healthcare.

Key messages

- Quality improvement approaches used in industry, such as Lean, consider value from a customer perspective, focusing on productivity
- Healthcare requires a more holistic, multistakeholder view of value to target improvement that benefits patients as well as clinicians and management
- Lean also has methods that enable healthcare stakeholders (including staff and patients) to engage in the definition of value and the design of processes
- Early involvement of all stakeholders through these methods can optimise the outcomes

We thank Cat Chatfield for helpful comments on earlier drafts.

Contributors and sources: This article is based partly on research carried out by IS towards a PhD with Newcastle University Business School. The methods included participant observation in Lean 3P workshops; interviews with workshop participants; and analysis of 3P workshop documentation and physical artefacts. IS was responsible for the planning, conduct, and reporting of the work described and for writing the article. CH and TM have extensive experience of the implementation of Lean tools and philosophies in the manufacturing, service, and healthcare sectors. They provided support in the design, planning, conduct, and reporting of the work and the revision of the article.

Competing interests: We have read and understood BMJ policy on declaration of interests and declare the following interests: IS works as a quality improvement professional in the NHS. No payments were received in connection with this paper.

Provenance and peer review: Commissioned; externally peer reviewed.

This article is one of a series commissioned by *The BMJ* based on ideas generated by a joint editorial group with members from the Health Foundation and *The BMJ*, including a patient/carer. *The BMJ* retained full editorial control over external peer review, editing, and publication. Open access fees and *The BMJ*'s quality improvement editor post are funded by the Health Foundation.

- 1 Ham C, Berwick D, Dixon J. *Improving quality in the English NHS: A strategy for action*. King's Fund, 2016.
- 2 Gray M. Designing healthcare for a different future. *J R Soc Med* 2016;109:453-8. 10.1177/0141076816679781 27923898
- 3 NHS England. *Five Year Forward View*. NHS England, 2014.
- 4 Porter ME. What is value in health care? *N Engl J Med* 2010;363:2477-81. 10.1056/NEJMp1011024 21142528
- 5 Andersen H, Røvik KA, Ingebrigtsen T. Lean thinking in hospitals: is there a cure for the absence of evidence? A systematic review of reviews. *BMJ Open* 2014;4:e003873. 10.1136/bmjopen-2013-003873 24435890
- 6 Mazzocato P, Stenfors-Hayes T, von Thiele Schwarz U, Hasson H, Nyström ME. Kaizen practice in healthcare: a qualitative analysis of hospital employees' suggestions for improvement. *BMJ Open* 2016;6:e012256. 10.1136/bmjopen-2016-012256. 27473953
- 7 Kim CS, Spahlinger DA, Billi JE. Creating value in health care: the case for lean thinking. *J Clin Outcomes Manag* 2009;16:557-62.
- 8 NHS Improvement. NHS partnership with Virginia Mason Institute. 2016. <https://improvement.nhs.uk/resources/virginia-mason-institute/>.
- 9 NHS Improvement. Seven trusts take part in our lean programme. 2018. <https://www.england.nhs.uk/2018/04/seven-trusts-take-part-in-our-lean-programme/>.
- 10 Hartzband P, Groopman J. Medical Taylorism. *N Engl J Med* 2016;374:106-8. 10.1056/NEJMp1512402 26760082
- 11 Schonberger RJ. Reconstituting lean in healthcare: from waste elimination toward 'queue-less' patient-focused care. *Bus Horiz* 2018;61:13-22. 10.1016/j.bushor.2017.09.001
- 12 Poksinska BB, Fialkowska-Filipek M, Engström J. Does Lean healthcare improve patient satisfaction? A mixed-method investigation into primary care. *BMJ Qual Saf* 2017;26:95-103. 10.1136/bmjqs-2015-004290 26864659
- 13 Womack JP, Jones DT. *Lean thinking: banish waste and create wealth in your corporation*. Simon & Schuster, 1996.
- 14 Jones B, Horton T, Warburton W. *The improvement journey: why organisation-wide improvement in health care matters, and how to get started*. Health Foundation, 2018.
- 15 Care Quality Commission. Quality improvement in hospital trusts. Sharing learning from trusts on a journey of QI. 2018. https://www.cqc.org.uk/sites/default/files/20180911_QI_hospitals_FINAL.pdf
- 16 Care Quality Commission. Western Sussex NHS Foundation Trust quality report 2016/17:34. <http://www.westernsussexhospitals.nhs.uk/wp-content/uploads/2014/08/WSHFT-Quality-Report-2016-2017.pdf>
- 17 Western Sussex NHS Foundation Trust. The patient first. Trust annual review 2017-18. <https://www.westernsussexhospitals.nhs.uk/wp-content/uploads/2018/07/WSHT-Annual-Review-2018-Lo-res.pdf>
- 18 NHS England. General practice development programme. 2015. <https://www.england.nhs.uk/gp/gpfr/redesign/gpdp/>.
- 19 Atkinson P, Mukaetova-Ladinska EB. Nurse-led liaison mental health service for older adults: service development using lean thinking methodology. *J Psychosom Res* 2012;72:328-31. 10.1016/j.jpsychores.2011.11.018 22405230
- 20 Toussaint JS, Berry LL. The promise of Lean in health care. *Mayo Clin Proc* 2013;88:74-82. 10.1016/j.mayocp.2012.07.025 23274021

- 21 Westwood N, James-Moore M, Cooke M. *Going Lean in the NHS*. NHS Institute for Innovation and Improvement, 2007.
- 22 Scoville R, Little K. *Comparing Lean and quality improvement. IHI white paper*. Institute for Healthcare Improvement, 2014.
- 23 Macrae C, Stewart K. Can we import improvements from industry to healthcare? *BMJ* 2019;364:l1039. 10.1136/bmj.l1039 30898765
- 24 Ohno T. *Toyota production system: beyond large-scale production*. Productivity Press, 1988.10.4324/9780429273018 .
- 25 Pisek P. *Accelerating health care transformation with Lean and innovation: the Virginia Mason Experience*. CRC Press, 2014.
- 26 Radnor Z, Osborne SP. Lean: a failed theory for public services? *Public Manage Rev* 2013;15:265-87. 10.1080/14719037.2012.748820 .
- 27 Radnor ZJ, Holweg M, Waring J. Lean in healthcare: the unfulfilled promise? *Soc Sci Med* 2012;74:364-71. 10.1016/j.socscimed.2011.02.011 21414703
- 28 Osborne SP, Radnor Z, Kinder T, Vidal I. The SERVICE Framework: a public-service-dominant approach to sustainable public services. *Br J Manage* 2015;26:424-38. 10.1111/1467-8551.12094
- 29 Osborne SP, Strokosch K. It takes two to tango? Understanding the co-production of public services by integrating the services management and public administration perspectives. *Br J Manage* 2013;24:S31-47. 10.1111/1467-8551.12010 .
- 30 Batalden P. Getting more health from healthcare: quality improvement must acknowledge patient coproduction. *BMJ* 2018;362:k3617. 10.1136/bmj.k3617 .
- 31 Osborne SP, Radnor Z, Strokosch K. Co-production and the co-creation of value in public services: a suitable case for treatment? *Public Manage Rev* 2016;18:639-53. 10.1080/14719037.2015.1111927 .
- 32 Blackmore CC, Kaplan GS. Lean and the perfect patient experience. *BMJ Qual Saf* 2017;26:85-6. 10.1136/bmjqs-2016-005273. 26945039
- 33 Young TP, McClean SI. A critical look at Lean thinking in healthcare. *Qual Saf Health Care* 2008;17:382-6. . 10.1136/qshc.2006.020131 18842980
- 34 Darzi A. *High quality care for all: NHS next stage review final report*. Stationery Office, 2008.
- 35 Radnor Z, Walley P. Learning to walk before we try to run: adapting Lean for the public sector. *Public Money Manag* 2008;28:13-20.
- 36 Mazzocato P, Savage C, Brommels M, Aronsson H, Thor J. Lean thinking in healthcare: a realist review of the literature. *Qual Saf Health Care* 2010;19:376-82. 10.1136/qshc.2009.037986. 20724397
- 37 Martin AJ, Hogg P, Mackay S. A mixed model study evaluating lean in the transformation of an Orthopaedic Radiology service. *Radiography* 2013;19:2-6. 10.1016/j.radi.2012.09.005 .
- 38 Prior G, Smith IM. *Developing a 'design of space' intervention using lean thinking: final report for the Health Foundation shared purpose programme*. North East Transformation System, 2016:1-31.
- 39 Pelly N, Zeallear B, Reed M, Martin L. Utilizing integrated facility design to improve the quality of a pediatric ambulatory surgery center. *Paediatr Anaesth* 2013;23:634-8. . 10.1111/pan.12195 23701030
- 40 Nicholas J. An integrated lean-methods approach to hospital facilities redesign. *Hosp Top* 2012;90:47-55. 10.1080/00185868.2012.679911 22671435
- 41 Hignett S, Lu J. An investigation of the use of health building notes by UK healthcare building designers. *Appl Ergon* 2009;40:608-16. 10.1016/j.apergo.2008.04.018 18632088
- 42 Caixeta MCBF. A conceptual model for the design process of interventions in healthcare buildings: a method to improve design. *Architectural Engineering and Design Management* 2013;9:95-109.10.1080/17452007.2012.738040 .
- 43 Hicks C, McGovern T, Prior G, Smith I. Applying lean principles to the design of healthcare facilities. *Int J Prod Econ* 2015;170:677-86. 10.1016/j.ijpe.2015.05.029.
- 44 Smith I. The participative design of an endoscopy facility using Lean 3P. *BMJ Qual Improv Rep* 2016;5:1-6. 10.1136/bmjquality.u208920.w3611 27493744
- 45 Hunter DJ, Erskine J, Hicks C, et al . A mixed-methods evaluation of transformational change in NHS North East. *Health Services and Delivery Research* 2014;2:1-185. 10.3310/hsdr02470 25642553
- 46 Smith I. Operationalising the Lean principles in maternity service design using 3P methodology. *BMJ Qual Improv Rep* 2016;5:1-9. 10.1136/bmjquality.u208920.w5761 27933146
- 47 de longh A, Erdmann S. Better healthcare must mean better for patients and carers. *BMJ* 2018;361:k1877. 10.1136/bmj.k1877 29773551

Published by the BMJ Publishing Group Limited. For permission to use (where not already granted under a licence) please go to <http://group.bmj.com/group/rights-licensing/permissions><http://creativecommons.org/licenses/by-nc/4.0/>. This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.