Mass Customization in Healthcare: Insights and Future Research Directions

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Mass Personalization in Healthcare: insights and future research directions

1. Introduction

In the healthcare industry, the interesting question from operations management perspective is to identify and describe innovative management systems, models, tools and techniques that can be expected to appear under market conditions and provide opportunities for learning. A historical precedent is the Japanese automotive industry. The Japanese manufacturing success story very much centered around one company, Toyota. After the oil crises in the 1970s it emerged as a spectacularly successful company. It, however, took over a decade of research to identify the management innovations, now known as Lean production, that were the drivers of success and became the legacy of Japanese management. It took another decade to establish, that these methods were globally applicable in a variety of settings, not dependent on the culture or economic circumstances of their birthplace. We believe that healthcare industry in India now provides a setting similar to that of Japanese automobile manufacturing in the 1970s and 1980s.

We define innovation as something that is novel, can be replicated, and is beneficial both to the innovator and users (Chesborough 2003). A management innovation may, but does not necessarily include new superior products. It denotes new ways to organize and control different managerial functions. Management innovations are easier to identify, as their outcomes should be visible in a limited set of performance measures. These can be cost, throughput time, quality, growth, and flexibility.

Using Japanese Lean as a benchmark, it can be stated that management innovation requires a generally supportive environment: growth, unsaturated demand, availability of imported and adaptable technologies, and the availability of an ecosystem of suppliers, specialists, research, capital, and labor. Management innovations emerge as a painstaking process of trial and error that can be modelled and explained and hence can be expected to reside in a specific type of corporate environment.

Attempts to identify and explain management innovations should focus on demonstrated performance, as an innovation needs to be beneficial. Then it should be asked how it is achieved. The mechanisms at work and the levers that innovators have pulled should be described. If such mechanisms and interventions can be modelled and formalized with sufficient clarity, they can be applied elsewhere. In the end an innovation should be replicable with minor adjustments beyond its original context. Such an approach obviously would not be appropriate for technology- and product innovations, as they can be identified as novelties on their own merits before commercial success. Management innovation, on the other hand, seldom create anything entirely new and unheard off. Rather it is Shumpeterian new combinations of existing elements, and novel ways to solve long-known dilemmas and trade-offs.

Following this approach, we base this article on the following assumptions. First, the Indian service sector, healthcare in particular, exhibit favourable overall conditions. Economic growth makes increasingly sophisticated care affordable to large segments of the population.
Together with growing availability of health insurance demand can be expected to grow for a long time. In India advanced technologies as well as specialists educated within the country and overseas are widely available. Moreover, the Indian healthcare market is open for entrepreneurs to explore and innovate.

Second, we argue that the equivalents of Toyota can be found. Healthcare providers in India can be classified as government, charitable, profit maximizing, and for-benefit providers. Our literature review and field visits suggest that most of the process innovations in Indian healthcare industry are likely to be observed in for-benefit hospitals. They are mission-driven, growth oriented, and business-minded. Our focus here is on such hospitals, which as primary care providers operate under a different logic.

Third, we focus on a central operations management issue that is crucial in healthcare. In contrast to manufacturing, health services cannot be fully standardized. While many sub-processes can be significantly streamlined, the basic value chain is made of individual patients as the flow unit. Therefore most processes are by nature routine processes, where each flow unit requires an individual assessment and set-up (Lillrank, 2003, Bohmer 2009). From this follows the basic dilemma of how to combine resource efficiency and flow efficiency under the constraints of unit cost and quality. Any provider that can navigate its way through, or around this dilemma would make an innovative contribution. Based on the literature, we assume that the solution, broadly speaking, can be described in terms of mass customization in which service providers will be able to simultaneously cater to high volume and high variety. For health services, we prefer the term mass personalization as such services will involve personal attention and care.

This paper is organized as follows. First we define the operations management dilemma that innovators are expected to solve. Second, we briefly review the existing competencies that might be used to provide mass customized services. Third, we describe the governance models of incumbent players and argue that an emerging type, the for-benefit hospital, exhibits the conditions for innovations. Fourth, we discuss one such case, the Narayana Hrudayalaya hospital. We conclude with discussions and provide directions for future research.

2. Trade-offs in healthcare operations that fosters innovative thinking
To study healthcare operations, it is important to understand the trade-offs between resource efficiency and flow efficiency. Resource efficiency focuses on maximizing resource utilization. This is accomplished by the classical productivity drivers: division of labor, specialization, standardization and scale economies. By grouping smaller tasks so that batches of the same type of task can be performed repeatedly improves resource efficiency. Resource efficiency is measurable as capacity utilization and unit cost.

Flow efficiency focuses on the unit that is processed, i.e. a patient case, to ensure that it flows through the organization smoothly. It is measured by how much and for how long a flow unit is processed from the time a need is identified till the time it is satisfied. Theoretically the minimum throughput time is the time it necessarily takes to perform procedures, tissues to
heal and medication to take effect. Everything beyond that can be considered improvable waste (muda). In manufacturing, flow efficiency creates value by reducing the amount of work in progress, reducing delivery times and improving delivery precision. In healthcare resource and flow efficiencies are more tightly interlinked. Customer value is determined by both the what’s and the how’s, i.e. what is done for the patient and how it is done (Grönroos, 2000). Flow efficiency reduces patients’ suffering and discomfort, and prevents the medical condition from getting worse during the waiting time (Kujala et al, 2006).

The law of trade-offs state that no single production unit can provide superior performance in all dimensions simultaneously (Schmenner and Swink 1998). Variation and variety in demand and supply limits the possibility of combining high resource efficiency with high flow efficiency. Demand variation here means the differences within one variety. An individual patient may need more attention and a few more tests, while the next patient with the same medical condition may be a standard case that comes equipped with all necessary clinical information, requiring less than average time consumption. Variety means different patient types in terms of medical condition, age or other relevant factors, that are operationalized and measured as case mix. From the supply side one variety is met with one type of medical discipline or skill-set. High demand variety implies that patient processes are difficult to be accommodated into given time slots, which in turn hampers scheduling. From high variety emanates a resource management problem as different skill sets need to be allocated to meet demand. Consequently mass customization requires, quite obviously, high volume.

Hospitals usually focus on resource efficiency and design processes to maximize the utilization of doctors and the facilities. Flow efficiency inevitably suffers, as an individual patient will have to wait for the whole batch to be processed before his case moves further. Hospitals which focus on flow efficiency will design the processes from the patients’ perspective to reduce patient flow time. Resource efficiency suffers, as capacity may not be fully utilized.

Trade-offs create an efficiency frontier which will limit a hospital’s ability to pursue both resource and flow efficiency. Most hospitals will typically operate away from that frontier and will have the opportunity to improve by adapting best practices. Behind the frontier there is room for improvement on all dimensions. The hospitals which operate on the frontier are already “best in class” and therefore face trade-offs and need to focus on innovating. Another aspect is the ‘sand cone’ effect. For manufacturing companies, Ferdows and De Meyer (1990) illustrated that competitive capabilities seemed to accumulate in sequence, from quality to delivery to flexibility to cost. For a sand cone to grow in height it needs to grow its base. A process needs to be standardized and brought under statistical control before it can be speeded up.

Organizations will build capabilities cumulatively till they reach the performance frontier and face the trade-offs. Such trade-offs can be broken if the organizations are able to innovate. One potential mechanism to break trade-offs between resource and flow efficiencies is through mass customization. Mass customizers need to develop the ability to customize
products as well as achieve volume, cost, speed, and quality effectiveness at the same time (Kristal et al., 2010). In summary, the attempt to identify hospitals that have, or are in the position to create innovative mass personalized services can be expected to operate with large volumes, the base of their sand cone is sufficiently broad and there is a trajectory of improvement, and that they face trade-offs that are difficult to overcome.

3. Literature Review: capabilities required for healthcare service providers to excel in mass personalization

Healthcare organizations excelling in “mass personalization” are expected to have unique capabilities in demand management and capacity strategy, sourcing and inventory management, service process design, quality management, job design and resource profiling, and operations scheduling. Such hospitals will be able to cater to the high volume and high variety of patients if they design their processes to ensure minimal waste and by building quality into the process. This in turn will improve the ratio of the value-added time to the total time the patient spends in the system and improve flow efficiency. High volume will ensure high utilization and will improve resource efficiency. Similarly, mass personalizing hospitals will attempt to operate at optimal levels of inventory and will design appropriate sourcing contracts with suppliers who will be able to deliver within short lead time. To excel in mass personalization, all the above need to be combined to break the trade-offs between resource and flow efficiencies. We outline the capabilities below.

3.1 Demand management and capacity planning

A company’s ability to cope with demand uncertainties directly affects its ability to satisfy diversified customer demand (Fisher, 1997). Appropriate demand management decisions can have a positive affect on hospital cost performance and customer satisfaction (Li and Benton, 2003). Adopting appropriate capacity addition strategies can help hospitals in managing demand. Since capacity addition in facilities within hospitals (e.g. operation theatres, diagnostic laboratories) is possible only in discrete chunks, most hospitals essentially have fixed capacity for certain periods of time. But, wherever possible, additional capacity can be generated by adding more shifts or more manpower resources. Another form of demand management strategy which can be followed is yield management in which tiered pricing can be used to segment customers. But, there should be sufficient demand to cater to different segments. To make such a pricing strategy work, appropriate capacity can be dedicated to the different segments or generic capacity can be dynamically reallocated based on demand.

3.2 Supply Uncertainty Reduction

A company’s ability to cope with supply uncertainties affects its production efficiency, and indirectly impacts its ability to satisfy diversified customer demand by preventing supply-demand mismatches (Fisher et al., 1994). Hence, effectively managing both demand and supply uncertainties should impact the ability of an organization to deliver mass customized products and services. Trust-based relationships with suppliers reduce supply uncertainties by ensuring a reliable and flexible supply of materials at low cost, which is critical for mass customization. Supplier lead-time reduction helps reduce supply uncertainties. When supplier
lead times are shortened, companies become more responsive to customer demands, and can provide customized products and services more costeffectively due to lower levels of safety stocks required in the supply chain (Womack et al., 1990; Pine, 1993).

In the context of healthcare, long term relationships with pharmaceutical companies can ensure availability of medicines on a short notice thereby enabling the healthcare service provider to reduce its inventory carrying costs while still catering to a wide variety of patients. Similarly, long term relationships and contracts with medical equipment suppliers can help healthcare providers to provide specialized and customized treatment to patients at affordable cost, while thereby also helping to treat more number of patients.

3.3 Service process design

Many services are co-created by providers and customers, and thereby involve human interaction, emotions, and exceptions (Vargo and Lush, 2004). Co-creation implies that services are produced in open systems, subject to variation in quality and quantity of demand, as well as customers’ ability to participate in and contribute to value creation (Frei, 2006). From this follows, that results need to be divided into outputs (what is done to a patient), and outcomes (what happens to a patient’s medical condition). Healthcare outcome effectiveness improvement requires patient participation, which is a largely untapped source of productivity. Outcome –based effectiveness includes clinical decision making, patient involvement, alternative care paths, and sometime doing less than what would be technically possible. This goes against the motive of crude profit maximization by increasing billable procedures. Therefore outcome –based effectiveness is highly dependent on business models, and needs supporting revenue models, incentive systems, service processes, training, and clinical leadership. Service process design should also explore opportunities to standardize wherever possible without affecting patient satisfaction.

3.4 Quality management

Quality has been considered to be the competitive capability that should be developed first in the sequential progression towards the building of other capabilities (Ferdows and DeMeyer, 1990; Roth, 1996). Quality here is understood as conformance to specifications, guidelines and best practices (Donabedian, 2003). High quality thus means that an organization is actually able to execute what it intends. Hence, quality management can be considered to contribute to operational competence, and help companies implement mass customization effectively. Kristal et al. (2010) identifies top management leadership for quality, small group problem solving, information and feedback, process management, supplier involvement as six commonly used quality management practices which are consistent with the conceptual definition of quality management. The authors provide empirical evidence that quality management contributes favourably to the development of mass customization capability.

For health care providers, quality leads to higher rates of patient retention, positive word of mouth and higher profits (Peyrot et al., 1993; Zeithaml, 2000). Service quality measures used to benchmark the performance of hospitals also include flow efficiency measures for example lead time for appointment, waiting time for consultation, waiting time at diagnostics, retail pharmacy waiting time, waiting time for elective operation, turnaround time for laboratory reports, turnaround time for X-ray reports etc. (Chow-Chua and Goh, 2002). Surveys indicate that excessive waiting time is often the major reason for patients’ dissatisfaction in outpatient services (Huang, 1994), and reasonable waiting times are expected in addition to clinical competence (Jackson, 1991).
3.5 Job design and Resource profiling

An organization can meet its objectives by combined optimization of its technical and social aspects (Trist and Bamforth, 1951). Organizational design should also meet the demands of the external environment. Hence, it is important to consider this perspective while studying mass customization. Liu et al. (2006) shows that multiple work design practices like multifunctional employees, high standards of recruiting, task related training for employees, employee contribution willingness and continuous improvement and learning are positively related to mass-customization ability, indicating a strong support to the relationship between work design and mass customization. Self-directed work teams are key organizational enablers for mass customization (Hart, 1995). A competent and knowledgeable staff is more likely to design efficient processes and deliver services that meet customer needs and expectations (Sulek et al., 1995).

3.6 Operations scheduling

An adequate staff mix and effective staff schedule have a direct impact on the quality of service and the cost of service (Abernathy et al., 1973; Offensend, 1972; Siferd et al., 1994). Health service faces uncertainty in daily operations due to unpredictable times of arrival and demands of the patients. In the health care industry, patients arrive randomly and require direct and prompt services from health care providers. Therefore, daily demand for health care services is difficult to accurately predict (Li and Benton, 2003). A good staff mix and scheduling will help meet time varying demand while improving cost and quality performance (Offensend, 1972; Siferd et al., 1994). High volume coupled with large variety of surgeries will require frequent changeover from one surgery type to another with accompanied movement of equipments, surgery kits etc or will require large number of dedicated surgery suites which will increase cost. A hospital focusing on mass personalization will be able to schedule all the surgeries with the minimum number of surgery suites. For elective surgeries, well designed scheduling systems will ensure that required number of surgeries is scheduled while minimizing the waiting time for patients to be admitted for surgery. A good scheduling system will be able to accommodate the different types of surgeries on the same day thus increasing the mix flexibility which is required for mass personalization.

We outline the specific levers of all the above competencies which help in catering to high volume and high variety in Table 1.
### Table 1: Levers to cater to high volume and variety in healthcare

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<tr>
<th>Capabilities</th>
<th>Levers for catering to high volumes</th>
<th>Levers for catering to high variety</th>
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<tr>
<td>Demand Management</td>
<td>Capacity addition (facilities, equipment, manpower, shifts)</td>
<td>Tiered pricing, segmentation</td>
</tr>
<tr>
<td>Supply Management</td>
<td>Long term relationships, contracts</td>
<td>Shorter lead time</td>
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<tr>
<td>Service Process Design</td>
<td>Demand segmentation, focussed care pathways for defined patient groups</td>
<td>Modularization of service eg. tie-up with rehabilitation, or patient training</td>
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<tr>
<td>Quality Management</td>
<td>Reduce the amount of errors requiring rework. Standardized equipment and subroutines.</td>
<td>Reduced patient waiting time</td>
</tr>
<tr>
<td>Job Design and Resource Profiling</td>
<td>High standards of recruitment, task related training, continuous improvement, self-directed teams</td>
<td>Multi-tasking, cross-training</td>
</tr>
<tr>
<td>Scheduling</td>
<td>Well-designed appointment systems</td>
<td>Scheduling to accommodate various types of surgeries</td>
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4. Types of healthcare service providers in India

The question is, what types of hospitals would be, in terms of their governance models and strategies, positioned to innovate towards mass personalization.

In terms of size and specialty, the industry is fragmented into national, regional and local operators. The large hospital groups offer all types of services from primary to super specialty care at international standards. There are focussed hospitals, such as Aravinda Eye Clinic specializing on high-volume cataract surgery, and a sizable number of providers of traditional medicine.

From the perspective of governance the incumbent players in Indian healthcare industry can be divided into three categories: government, charities, and profit maximizing corporations. The government sector include teaching hospitals directly under the central government, such as The All-India Institute of Medical Sciences (AIIMS), state and local government –funded operations, as well as rural health schemes. Government hospitals are financed from public budgets and their staff enjoys the status of civil servants. Incentives are typical for professional organizations, possibilities to do research and gain professional status. As services are offered for free or at very low cost, government hospitals are overwhelmed with demand, giving them very little slack for innovations.

Charities are not-for-profit providers that typically raise their capital through donations, charge patients according to their ability to pay, and provide free services to the poor. Charities are often founded and driven by visionary leaders, such as Mother Teresa or Amma. While some charities, such as Amrita Institute of Medicine (AIM) in Kerala are technically sophisticated, charitable service providers are rarely able to expand significantly beyond their home states. Charities typically rely on their donor base for capital which limits their ability to grow.
Profit maximizing hospital corporations operate as ordinary businesses with economic incentives. These can be divided into large hospital groups operating national franchises, and independents, typically privately held doctor-led ventures. These units are run to maximize shareholder value. While viable businesses in their own right, profit maximizers are unlikely to provide solutions to the overall public health problems. Their pay-per-procedure revenue models will prompt them to focus on resource efficiency. Though, such hospitals have reduced the average length of stay across their portfolio but it is attributed to advancement in treatments and increase in minimally invasive procedures and not to process innovations.¹

A fourth type is emerging, combining elements of profit maximizers and charities. These are for-profit hospitals whose business models are focused on affordability, access, and volume. These suppliers, like the profit maximizers, strive for return on investment, avoid losses, and seek growth. Like charities they have explicit public health—based corporate missions with an emphasis on volume growth. They offer differential pricing (progressive pricing) based on patients’ ability and willingness to pay, thereby targeting patients from a range of income brackets. Being profitable they can tap into capital markets to fund aggressive volume expansion nationally and internationally. Such providers can be classified as for-benefit hospitals or The Fourth Sector (Meyer, 2012).

The question is, why would for benefits (FB) hospitals be inclined, motivated and capable of innovations in mass personalization?

Many FB hospitals are focussed on clinical specialties; Narayana Hrudayalaya (NH) on cardiac and Aravind on ophthalmology. Thus, they can attract huge patient volumes within a range of variety. Large volumes enable further specialization with full capacity untilization, which gives the opportunity to improve both flow and resource efficiency. Their mission prompts them to accept all types of patients, levels of acuity and ability to pay; and prevents them from either selectively choose high-paying patients, or concentrating entirely on the poor. In the case of Aravind, the poor patients prompt attention to flow efficiency, since they cannot afford to be away from work for long time. Therefore Aravind has been motivated to innovate both the patient recruitment and the surgical process for both flow and resource efficiency (Mehta and Shenoy 2011).

The FB hospitals do not rely on government handouts and charitable contributions. As their mission calls for volume expansion, growth needs to be either organic, or financed through capital markets. In both cases they need to make substantial returns on their operations, which in turn focuses attention on economic efficiency, achieved by resource or flow efficiency or both. In this sense, the FB hospitals are often quoted as examples of frugal innovations (Radjou et al., 2011).

Rapid volume growth enables steep learning curves. Expansion to new sites creates the need to describe, model, standardize, and optimize various processes and practices for rapid ramp-up. In summary, many of the factors that can be assumed to motivate and enable For-Benefit hospitals to innovate can be found in other governance types as well. However, the FB hospital provides a setting where many factors can be expected to overlap and reinforce each other.

Patients visiting FB hospitals want personalized care as many of their ailments cannot be treated at other hospitals at the price they can afford to pay. They may not attach high importance to flow time but they want personalized attention and assurances and hence will

¹ Apollo Hospitals Investor Presentation, August 2012
require series of visits with specialized doctors, sometimes spanning multiple specialties. Specialized and sometimes super-specialized doctors can be recruited if there are enough volumes to justify their staffing. Such doctors will also gain from experience of handling and treating large volumes of patients with a particular ailment. Typically, other types of hospitals may not encounter such high volume of specific types of ailments. Profit maximizing hospitals usually have high investments in sophisticated technologies which they promote as a differentiator. Accordingly, such hospitals are expected to design their processes with the objective of maximizing resource efficiency. Volume of standardized procedures and treatments will be high in such hospitals as well as specialized procedures which require usage of sophisticated technology. But, overall variety and complexity of patients handled by such hospitals are expected to be lower than those of “mass personalizing” for-benefit hospitals. Handling large volume and variety of patients typically will increase costs for the profit maximizing hospitals providing disincentive for such hospitals to increase variety at the expense of utilization of their sophisticated equipments.

5. Narayana Hrudayalaya Hospital, Bangaluru on the path towards mass personalization: Findings from field visits

Overview of Narayana Hrudayalaya (NH), Bangaluru

NH is founded by one of the India’s oldest construction company “Shankar Narayana Construction Company”. NH group currently has 5000 beds in India and aims to have 30,000 beds in the next 5 years in India to become the one of the largest healthcare player in the country. The Group is especially known to be the largest provider of pediatric cardiac care, treating children from 73 countries. Its 80 bed paediatric cardiac surgical Intensive Therapy Unit (ITU) at the Bangalore facility is the largest such unit in the world. NH has received due attention. Its founder and director, Dr. Devi Shetty was one of the recipients of The Economist’s “Innovator of the Year” in 2011. The Fast Company – magazine ranked it as number 36 on it’s the Fifty Most Innovative Companies in the World in 2012.

To an external observer the view of NH is as confusing as that of Toyota in 1973. An assessment an analysis of the hospital may start from the following observations.

- The average price NH charges for a standard bypass procedure is about Rs 1,30 000(2400 USD). While a fraction of the going rate in the U.S., the relevant comparison is with the average of Indian private hospitals, which is 5,500 USD (Khanna et al 2005).
- In terms of clinical quality, NH is a world-class, high quality hospital operator, as evidenced by Joint Commission accreditations.
- NH pays its staff at regular, competitive wage rates.
- NH has also been continuously profitable.
- NH operates in a competitive environment. Its hospital in Bangalore attracts patients from all over India and a sizable number of health tourists from overseas.

These five observations alone suggest that a significant management innovation has, and is taking place. It can’t be explained away with cheap or voluntary labor, compromises on quality, external subsidaries, or local monopoly.
NH exhibits several characteristics similar to charitable hospitals. It has a vision is to offer “affordable quality healthcare for the masses worldwide”. Objectives are to provide holistic, timely patient care; continually upgrade the knowledge and technology in patient care; and enhance customer relationships and provide an enriching experience. To this end NH’s operating principle is: “Healthcare is all about process, protocol and price.”

Like many charities NH tends to locate in the suburbs and industrial areas, where costs are lower and there is room to build a supplier community nearby. NH differs from charities and show similarities to profit maximizers primarily in its financial policies and growth strategies. NH has tight financial controls, and even monitors profit on a daily basis. NH has been continuously profitable. Growth is financed through retained earnings and capital markets. It grows through expanding into new locations.

NH can be seen as an example of an emerging hybrid corporate form. It is driven by a public health mission, which is operationalized as a large volumes, high growth, low cost, and reliance on profitability to finance expansion. Hence, we identified NH as one for-benefit hospital and undertook both secondary research and field visits coupled with interviews of key executives in the hospital, located in Bangalore. We interviewed MD, COO, Vice Presidents of NH group between January 2012 and January 2013. We collected data on cardiac surgeries conducted at NH, Bangalore between December 2011 and August 2012. Our analysis shows that during this period, it has performed 64 different types of cardiac surgeries out of which 16 types of surgeries were done more than once a week or more than 4 in a month, 10 types of surgeries were done more than 10 times in a month, and six more than 20 a month. Thus, NH seems to cater to a large variety of patients by treating as many of them as possible at the lowest possible cost while providing high degree of specialized services with the attention and care, rarely found in other hospitals. But, to make such “mass personalization” work, adequate processes need to be designed. NH has taken specific initiatives to improve its resource efficiency and is also currently working towards improving flow efficiency. We look at some of these initiatives below.

Initiatives taken at NH, Bangalore to cater to high volume and high variety

Demand Management

NH monitors profitability on a daily basis and the senior leadership decides on the number of free or discounted surgeries to be conducted. To execute such a plan, NH applies a charity – type pay-per-ability pricing policy. There are several price categories. Patients in need but without means are treated for free, while the objective is that most patients pay at least a break-even price, while those with means pay a premium. While patients in different price segments are offered different service levels in terms of amenities, there is no difference in basic clinical care. Such a strategy also helps smooth out demand on a day-to-day basis.

Supply Uncertainty Reduction

Dr. Devi Shetty of NH Hospitals firmly believes that the economies of scale achieved through volume of procedures completed helps in significantly reducing the unit cost of surgery to be significantly decreased. NH runs 500 blood tests on a machine each day which
reduces the unit costs. But, this does not mean that NH has to compromise on the quality of care provided. NH is able to negotiate better deals with manufacturers of sophisticated medical equipments. For some of its machines, NH pays the supplier a monthly rent and also pays for reagents that are used to run the machines. Manufacturers are willing to do this because demand for the reagents is enough to make profits for them high enough (Khanna et al., 2005).

NH used to buy surgical gowns from a leading multinational company. It used to cost Rs. 1800 per surgery. To reduce this cost, NH decided to perform a tear-down analysis of the gowns and realized that the only value-addition done by the large multi-national supplier was stitching the gowns. This company in turn sourced the raw material from another company. Considering the volumes of gowns needed and realizing that an opportunity exists to reduce the costs, NH formed a subsidiary company to stitch the gowns by using local women using the sourced raw material. This decreased the cost to Rs 800. NH is also a heavy user for custom made plastic tubes. It decided to buy the tubes and connectors separately and assemble it in-house. This reduced cost by Rs. 800.

NH is also working on consolidating vendors and has also started directly negotiating with suppliers to avoid distributors as distributors charge around 20 percent of the cost for logistics. This will not only reduce costs but also improve responsiveness and availability by reducing the order to delivery lead time. Direct import from overseas suppliers can also potentially reduce tax by 5 percent. NH has taken initiative to aggressively reduce its inventory days from current 30-32 days to around 20 days and to around 15 days in the long run.

Another initiative taken by NH for providing quality care at affordable cost is standardization of critical medicines across hospitals within the group. (70-80% has been standardized in terms of value as on June 2013) The hospital has created a formulary committee which decides on quality parameters of medicines. This exercise has resulted in identification of 120 molecules with same brand of medicine across group.

Such practices reduce uncertainties in supply, reduce inventory costs of medicines and keep costs low for patients, which in turn attract them to NH, thereby further increasing volumes. Such standardized procedure for selecting appropriate medicines across diagnostic groups as well as for multiple disease conditions as also help NH in treating a large variety of disease conditions at low cost.

Quality Management
NH has developed a Complaint Management System christened “Patient Employee Ailment Resolution and Learning System (PEARLS)” NH believes that “every complaint is an opportunity for improvement”. Under “Celebrate the compliant” initiative, recognition is given to the person who complains for being sensitive to any kind of abnormalities.

The system classifies complaints under five categories.
• Show-Stoppers – affecting/stopping the service delivery (acceptable turn-around time (TAT) < 5 min)
• Critical- impacting patient safety (acceptable TAT- 15 min)
• Non-critical- alternate arrangement available (TAT< 6 hrs)
• Minor- quality perception of hospital affected (TAT- 12 hrs)
• Normal- anything other than the above four (TAT- 24 hrs)

For undetermined complaints, which typically involve multiple departments, the complaints are discussed jointly and decisions taken. The above initiatives demonstrate a culture of customer centricity (both internal and external) and continuous improvement which are essential for mass personalization of services.

Reducing Average Length of Stay as a specific project at NH, Bengaluru

NH has currently identified average length of stay of inpatients as one measure which it needs to improve. Its patients, whose expenses are borne by state provided insurance schemes, have no intrinsic motivation to demand shorter length of stay as they don’t have to pay out-of-pocket. Similarly, patients whose expenses are borne out of private insurance schemes, also have limited motivation to get discharged early unless they have some pressing need to get back to normal life. Only, the patients who pay out-of-pocket demand shorter length of stay. But, having a longer length of stay leads to poor flow efficiency which in turn creates serious operational challenges. As length of stay of post-operative patients increase, NH may be either forced to delay the surgeries of some patients who are admitted, thereby further increasing length of stay or may not be in a position to admit some patients, thereby potentially resulting in loss of revenue. Moreover, NH may also incur financial losses if length of stay increases for patients who are on state insurance schemes which usually may not cover expenses for the entire length of stay. Thus, NH may not be able to meet its mission of treating as many patients as possible at lowest possible cost. As NH is also focussed on patient outcomes, it cannot discharge a patient and refer it to another hospital unless the patient has recovered to a large extent. Variety of surgeries conducted and varying levels of patient acuity further adds to variability in length of stay. Now, NH is in a crucial juncture where it realizes it needs to improve its length of stay. It has started taking concrete steps in that direction. Currently, at NH Bengaluru, a team of personnel under the leadership of a physician trained as a Lean expert has started mobilizing efforts on waste reduction and process improvements. The improvement events have been run as Kaizen Blitz and have showed significant improvements.

6. Discussion and directions for future research

Our interviews and field visits to Narayana Hrudyalaya indicate that it is attempting to provide personalized services to a large number and variety of patients. By doing so, it is expected to improve on both resource and flow efficiencies at the same time and hence break the trade-offs between those. There is limited empirical research on understanding the mass personalization capabilities in healthcare setting. Similarly, there is no reported research till
date to empirically validate the sandcone model and theory of competitive progression in the context of healthcare.

In this article we argue that management innovations happen in corporations and can be identified initially by performance measures, such as cost, throughput time, and quality. The role of academic research is to identify such innovations, describe and model them in terms of standard management concepts, models, and theories, and where necessary, develop new explanations. The scope of search can be narrowed by selecting companies whose governance structure and articulated missions, and strategies are supportive of innovations. NH fulfils the performance criteria of an innovative company. Our analysis shows that NH is aggressively building the capabilities that are needed in order to break the resource vs. flow efficiency trade-off. However, the question remains, what exactly are the mechanisms that are at work at NH, and what kind of system effects emerge from new combinations or traditional management competencies.

The most obvious explanation is volume and the effects of scale and scope. High volumes enable sub-specialization with sufficient capacity utilization and consequent learning curve effects. However, a preliminary analysis of time- and resource consumption in surgical procedures indicates that the surgeons at NH are not performing significantly faster than their colleagues in top Western hospitals. Also the pre- and postoperative length of stay tends to be longer at NH than in comparative settings abroad. There is the possibility, like with Toyota, that after everything has been said and done, and all the ‘known knowns’ of Operations Management have been laid clear, there still remains a ‘unknown unknown’ residual explanation that escapes our current methodologies.

We identify the following research questions as potential areas of research.

- What competencies are hospitals, which cater to high volume and high variety of patients, expected to demonstrate?
- How will the trade-offs between resource and flow efficiency be broken?
- What are the dimensions of competitive advantage for hospitals? Might there be dimensions that are crucial for healthcare but not found in other industries?
- Do hospitals need to follow a sequence of capability formation while providing mass personalized services? Do they need to improve resource efficiency followed by flow efficiency or vice versa?

There is a potential to empirically test the above hypotheses using data collected from hospitals as well as from surveys. Obviously, it will be beyond the scope of a single research to attempt to answer all the above research questions. Broadly, two streams of research can be generated to answer the above questions:

1. Competencies and capabilities required for mass personalization in healthcare; testing the role of the above in breaking trade-offs between resource and flow efficiency
2. Dimensions of competitive advantage of hospitals; linking the above dimensions to competencies and capabilities of mass customization, testing sandcone and theory of competitive progression in hospitals

We outline the steps required to conduct empirical research related to stream 1 below:

Step 1: Identify a set of variables for which data is to be collected to determine whether a hospital unit can be considered to be providing mass personalized services, that is, what kind of performance measures are needed to demonstrate, that mass personalization has really been achieved? For a general or multi-specialty hospital, the researcher also needs to determine the unit for eg. cardiac surgery or orthopaedic surgery where such analysis needs to be done.

Step 2: Choose appropriate measures of flow and resource efficiency depending on the unit of analysis. Some measures of resource efficiency can be nurses per bed, number of surgeons per surgery team, bed utilization rate while measures for flow efficiency can be length of stay

Step 3: Test which capabilities and competencies distinguish mass personalizing healthcare unit from others

Step 4: Test whether the hospital unit classified as providing “mass personalized” services are able to break trade-offs between resource and flow efficiency

Similarly, for stream 2 of the proposed research, steps will be as follows:

Step 1: Identify dimensions of competitive advantage for healthcare units

Step 2: Test whether the healthcare unit demonstrates sandcone model of capability formation (Ferdows and De Meyer, 1990) or competitive progression (Roth, 1996 a,b) while providing mass personalized services.

Other potential research area may be to develop capability-maturity models for healthcare service providers to embrace mass personalization and to test those across organizations.
Reference


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<tr>
<th>Capabilities</th>
<th>Levers for catering to high volumes</th>
<th>Levers for catering to high variety</th>
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<tr>
<td>Demand Management</td>
<td>Capacity addition (facilities, equipment, manpower, shifts)</td>
<td>Tiered pricing, segmentation</td>
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<td>Supply Management</td>
<td>Long term relationships, contracts</td>
<td>Shorter lead time</td>
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<tr>
<td>Service Process Design</td>
<td>Demand segmentation, focussed care pathways for defined patient groups</td>
<td>Modularization of service eg. tie-up with rehabilitation, or patient training</td>
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<tr>
<td>Quality Management</td>
<td>Reduce the amount of errors requiring rework. Standardized equipment and subroutines.</td>
<td>Reduced patient waiting time</td>
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<tr>
<td>Job Design and Resource Profiling</td>
<td>High standards of recruitment, task related training, continuous improvement, self-directed teams</td>
<td>Multi-tasking, cross-training</td>
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<tr>
<td>Scheduling</td>
<td>Well-designed appointment systems</td>
<td>Scheduling to accommodate various types of surgeries</td>
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Table 1: Levers to cater to high volume and variety in healthcare