

Joint replacement: Reimagining patient experience with behavior-driven service design



Abstract

Despite significant advances in joint-replacement surgery in recent years, up to 20% of patients remain dissatisfied with the outcomes¹. Reasons for dissatisfaction range from technical factors such as improper implant and surgical techniques, to patients' functional status before surgery, and pre-existing health conditions.

Dissatisfied patients discourage others from opting for surgeries. Hence, patients who may need immediate joint replacements delay the procedures, and continue to live with disabilities, which eventually not only decreases their life expectancies, but also burdens the healthcare ecosystem. Timely intervention, however, resolves issues sooner and better. Over the years, technological advances in implant design have reduced the variability in surgical techniques. Moreover, digital solutions have been developed and deployed to enhance the surgery experience and aid in recovery, for better post-operative patient reported outcomes (PROs). These are promising solutions, but they address only certain aspects of the recovery process including tele-consultation, patient education and community engagement.

This paper argues the need for a digital solution that tracks recovery patterns through a holistic blend of physiological, physical, behavioral, and clinical monitoring, to drive improved PROs and better patient satisfaction. The authors also propose to integrate principles of service design and behavioral sciences throughout the episode of care, to address the needs of patients and other stakeholders in the joint-replacement ecosystem.

The growing demand for joint replacements

Arthritis affects the knee, hip, hands and spine in almost 7% of the world's population, amounting to over 500 million people--a disproportionate amount of them being women². It is often associated with decline in mental health, increase in all-cause mortality, and inability to self-manage chronic conditions such as diabetes and hypertension. Of the number of advisable interventions, the best known and popular solution is total joint replacement. The most common of these procedures

[1] Nakano, N., Shoman, H., Olavarria, F. et al. Why are patients dissatisfied following a total knee replacement? A systematic review; *International Orthopaedics (SICOT)* 44, 1971–2007 (2020); Published July 2020; <https://link.springer.com/article/10.1007%2Fs00264-020-04607-9>; Accessed July 2, 2021

[2] Global Burden of Disease Collaborative Network; *Global Burden of Disease Study 2019*; <http://ghdx.healthdata.org/gbd-results-tool>; Accessed July 2, 2021

are replacements of the knee, hip and shoulder. The success rate--as reported by several joint-replacement registries--is over 82%, whereby the total-knee replacements survive even after 25 years³. In general, the following factors govern the success of these procedures:

- Surgical process
- Recovery and rehabilitation
- Restoration of daily activities
- Managing patient expectations
- Addressing physical and mental health conditions

However, in certain cases, clinician-reported outcomes vary from patient-reported outcomes. Factors that influence negative PROs even for clinically successful procedures include ineffective pain relief, poor hospital experience, old age, preoperative comorbidities, and inadequate social support.

A multidisciplinary and multi-stakeholder approach towards patient care

We believe that much of the mismatch in patient expectations can be addressed by applying behavioral sciences, particularly from clinical and health psychology, psychotherapy, and rehabilitation sciences. To do that effectively, we will need to closely analyze the responses of all stakeholders including the orthopedic surgeon, physiotherapist, caregivers, and the patient, throughout the episode of care. We therefore need a multi-stakeholder and a multidisciplinary approach to improve patient satisfaction.

The role of behavior science

Patients' health history and behavior, including their expectations, preconceived notions, lifestyle and socio-economic factors affect PROs. Patients with pre-existing conditions are also likely to report significantly higher pain. In addition, conditions such as anxiety and depression are likely to emerge post surgery, and impact pain perception and recovery outcomes over time. On the other hand, patients who adhere to prescribed medications and therapy routines report better outcomes.

Role of the service-design approach

A patient's journey in surgery care should be considered in totality with the journeys of the other stakeholders. An effective episode of care demands an empathetic and humane approach. A service experience design approach (Figure 1) enables conceiving a solution that meets expectations of all stakeholders in a holistic and empathetic manner.

[3] The Lancet; How long does a knee replacement last?; Published February 2019; [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(18\)32531-5/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(18)32531-5/fulltext); Accessed July 2, 2021

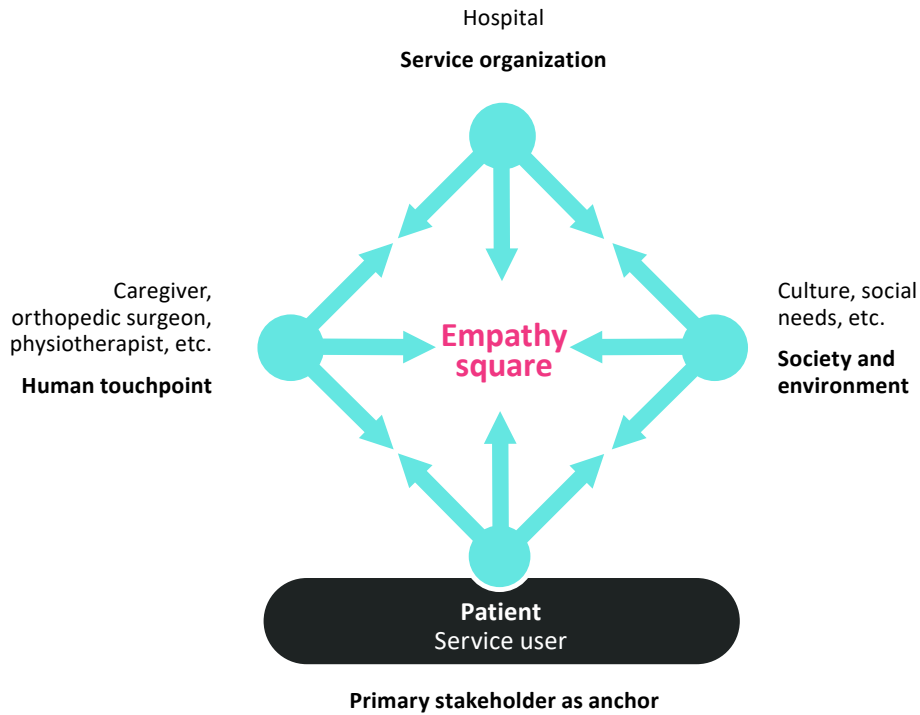


Figure 1: A service experience design framework, an “Empathy Square”, outlines a unified approach towards patient journey involving all stakeholders

The service experience design methodology (as seen in Figure 1) encourages a rigorous, holistic and scientific approach to understand patient expectations, experiences and challenges they face, before, during and post surgery. As shown in an example in Figure 2, the methodology helps to identify the support that patients may need at every stage of the journey.

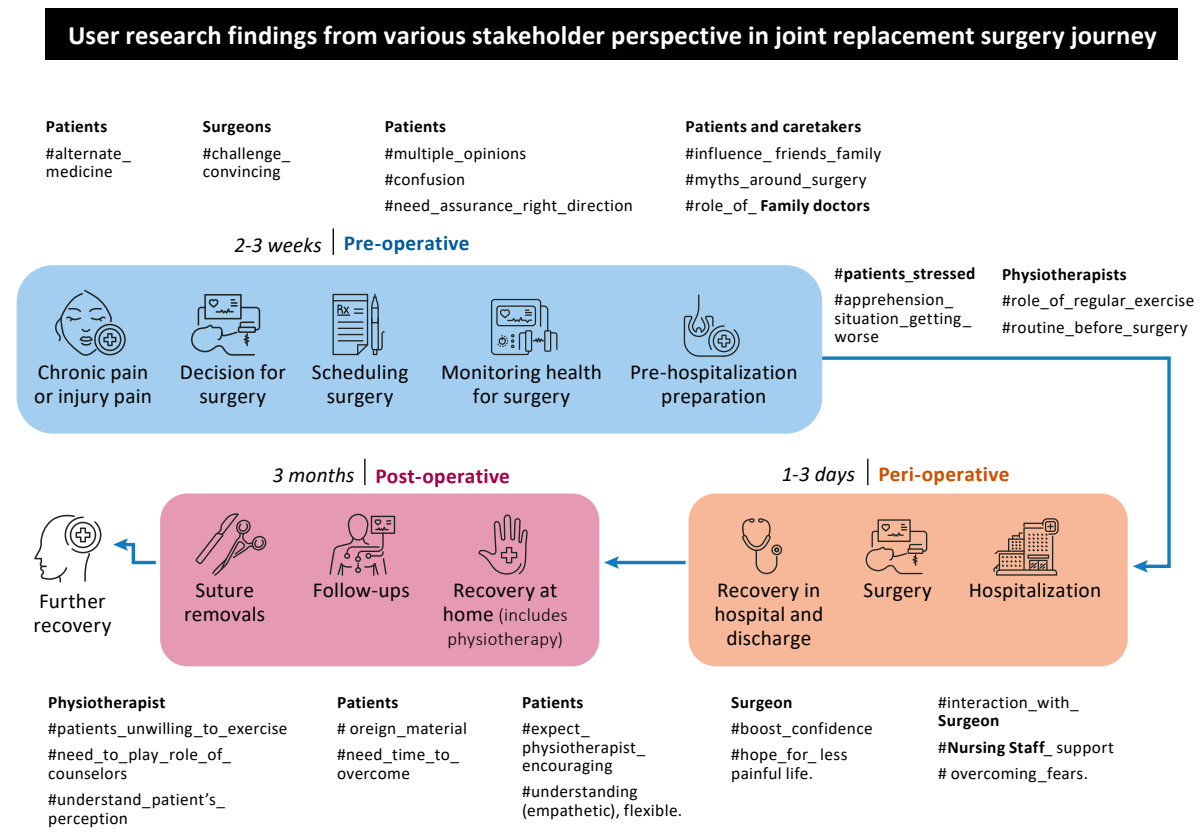


Figure 2: A snapshot of patient journey identified through the service experience design methodology

Similarly, we can gather information from surgeons about the patient and ecosystem (longitudinal and emergent) at every stage of the journey. We can learn from the caregivers about the help and support they require for playing an active role in episodes of care. Concerns and constraints of all relevant stakeholders must be taken into account to conceive an empathetic solution, which also meets business needs (Figure 3).

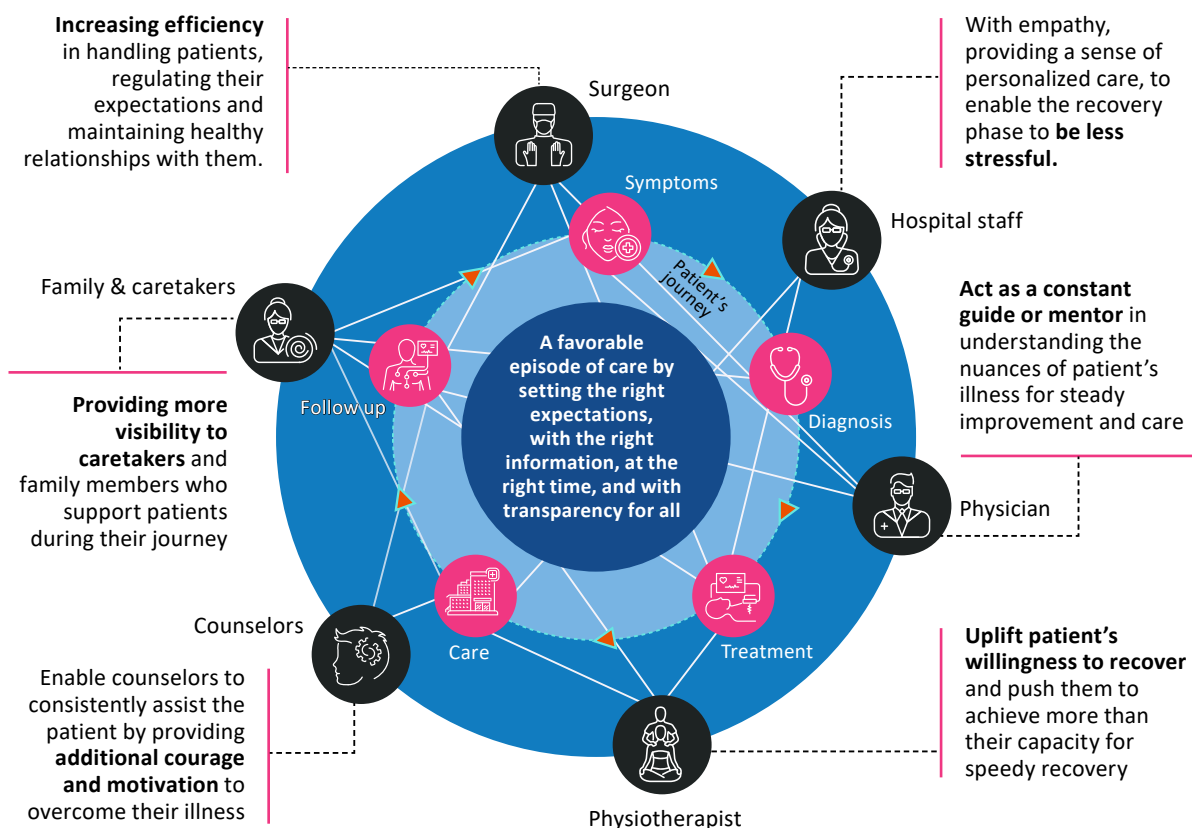


Figure 3: Stakeholders in an episode of care during joint replacement

Building an integrated digital-health solution

Digital technologies can capture and address patients' clinical, physical and behavioral parameters throughout the episode of care, in an objective and unobtrusive manner. The service experience design methodology ensures that needs of all stakeholders are clearly understood before designing the solution. Preliminary findings reveal the need for a digital solution to focus on the use of wearable devices and smart phones by patients, and digital dashboards by physicians. These will enable frequent capture of psycho-physiological data from patients, and provide analytics to physicians. With this approach, a typical implementation of a digital-health solution consists of elements such as:

Wearable devices and sensors: To monitor range of motion (RoM) and gait in real time--before and after surgery.

Digital assistance apps: To collect information about patients' expectations on surgery outcomes, experience of pain, and mental-health states before and after surgery. These also help to continuously monitor progress, enable behavioral interventions for stress and anxiety, and

ensure adherence to rehabilitation regimen. Moreover, patients can be educated on the dos and don'ts through articles and videos on their health conditions, surgery and rehabilitation. These are also effective tools for patients to interact with clinicians for queries, guidance and appointments. Additionally, features of community support aid patients to digitally connect with other patients with similar ailments to exchange best practices on recovery.

Clinicians' portal: To assess activity levels, gait and RoM, and to monitor PROs pre-surgery. This also aids to monitor RoM, wound and pain post surgery, and the level of adherence to the patient's rehabilitation regimen.

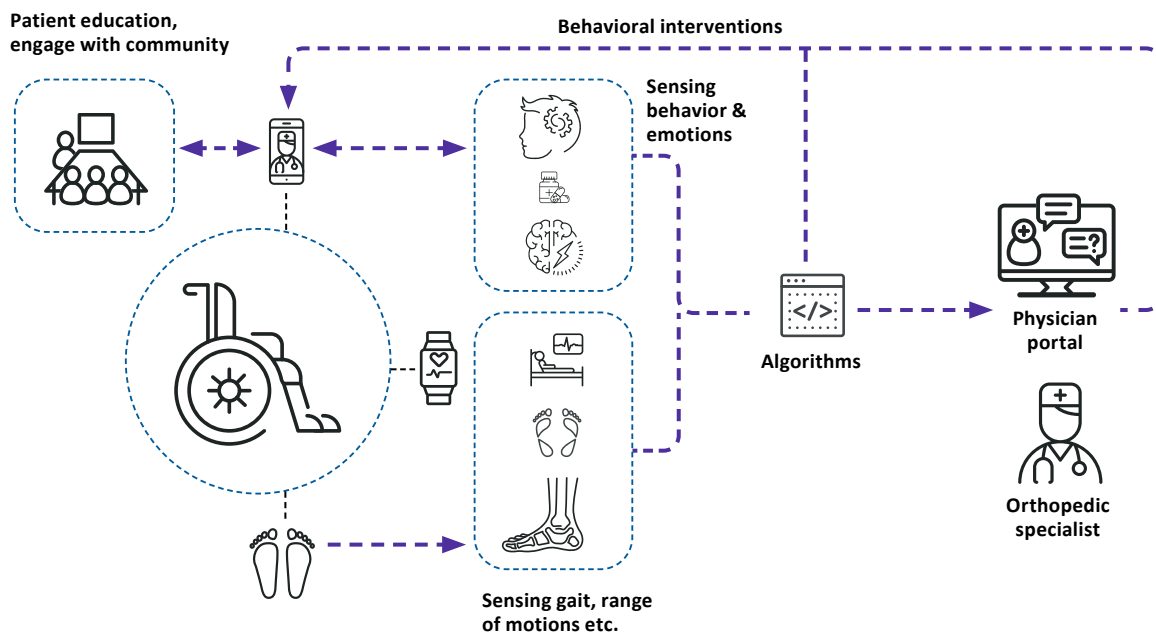


Figure 4: Key capabilities of a solution for joint replacement episode of care

Such a solution (Figure 4) offers surgeons near real-time access to precise information, without frequent in-person patient evaluation. In the pre-surgical phase, such information helps surgeons establish an objective baseline for outcome evaluation. It also enables timely interventions post surgery, when a patient's clinical progress or adherence to a rehabilitation regimen is below par.

For patients, it provides a convenient means to report RoM, pain and anxiety. It also provides accurate recovery status, education, and personalized behavioral interventions. Such a holistic solution can reduce the need for in-person interactions between patients and clinical staff, and make necessary in-person interactions far more focused and efficient.

Driving large-scale adoption

We believe that such a digital-health solution will provide hospitals and surgeons with complete, timely and patient-centric information to help treat patients far more effectively. This has the potential to significantly improve patient satisfaction. While joint replacement is one example, the concept has considerable potential to enhance outcomes of several other surgical procedures. Clinical validation and adherence to relevant regulatory guidelines will be a prerequisite for large-scale adoption of such solutions. A word of caution, though such solutions must address concerns of privacy, safety and efficacy, and adhere to best practices such as the WHO's guidelines for digital-health solutions.

Images courtesy: Andrejs Kirma from the Noun Project, Gan Khoon Lay from the Noun Project, Priyanka from the Noun Project

About the authors

Dr. Murali Poduval

Dr. Murali Poduval is a Senior Consultant in the Life Sciences Engineering Group. He has over 25 years of experience in orthopedic surgery, specializing in joint replacement, deformity correction, and related technologies. Dr. Poduval holds a Master of Surgery in Orthopedics from GS Medical College, and a Post Graduate Diploma in Management from LN Welingkar Institute of Management (WE School), in Mumbai, India.

Rajiv Thanawala

Rajiv Thanawala is an Innovation Evangelist at TCS. He has over 30 years of experience in software development and innovations. His current interests include digital therapeutics and behavioral health. Thanawala holds a Master's degree in Computer Science from Ball State University, Indiana, USA.

Dr. Mayuri Duggirala

Dr. Mayuri Duggirala is a Senior Scientist at TCS Research. She has over 10 years of experience in applied psychology and organizational behavior. Her current focus includes wellbeing and employee engagement. Duggirala has a Master's degree and Ph.D. in Management from IIT Madras, a Master's degree in Psychology from Andhra University, and a Bachelor's degree from St. Xavier's College, Ahmedabad, India.

Dr. Ravi Mahamuni

Dr. Ravi Mahamuni is a Principal Scientist, leading design research at TCS Research. He has more than 25 years of experience across diverse fields such as technology, management, and design. He has a Ph.D. in Service Design from IIT Guwahati, an Executive MBA from Symbiosis Institute of Business Management in Pune, and a Bachelor's degree in Electronics Engineering from Shivaji University, Kolhapur, India.

Harshad Kulkarni

Harshad Kulkarni is an Associate Consultant in the Life Sciences Engineering Group, and leads the Medical Electronics function as part of the Digital Health Solutions Group, at TCS. He has over 15 years of experience in the development of embedded products. His areas of interests include product design and digital therapeutics. Kulkarni holds a Bachelor's degree in Electronics Engineering from Dr. Babasaheb Ambedkar Marathwada University in Aurangabad, India.

Contact

Visit the [Research and Innovation page](#) on www.tcs.com

Email: innovation.info@tcs.com

About Tata Consultancy Services Ltd (TCS)

Tata Consultancy Services is a purpose led transformation partner to many of the world's largest businesses. For more than 50 years, it has been collaborating with clients and communities to build a greater future through innovation and collective knowledge. TCS offers an integrated portfolio of cognitive powered business, technology, and engineering services and solutions. The company's over five lakh consultants across 46 countries help empower individuals, enterprises, and societies to build on belief.

Visit www.tcs.com and follow TCS news [@TCS_News](#).

All content/information present here is the exclusive property of Tata Consultancy Services Limited (TCS). The content/information contained here is correct at the time of publishing. No material from here may be copied, modified, reproduced, republished, uploaded, transmitted, posted or distributed in any form without prior written permission from TCS. Unauthorized use of the content/information appearing here may violate copyright, trademark and other applicable laws, and could result in criminal or civil penalties.

Copyright © 2021 Tata Consultancy Services Limited