

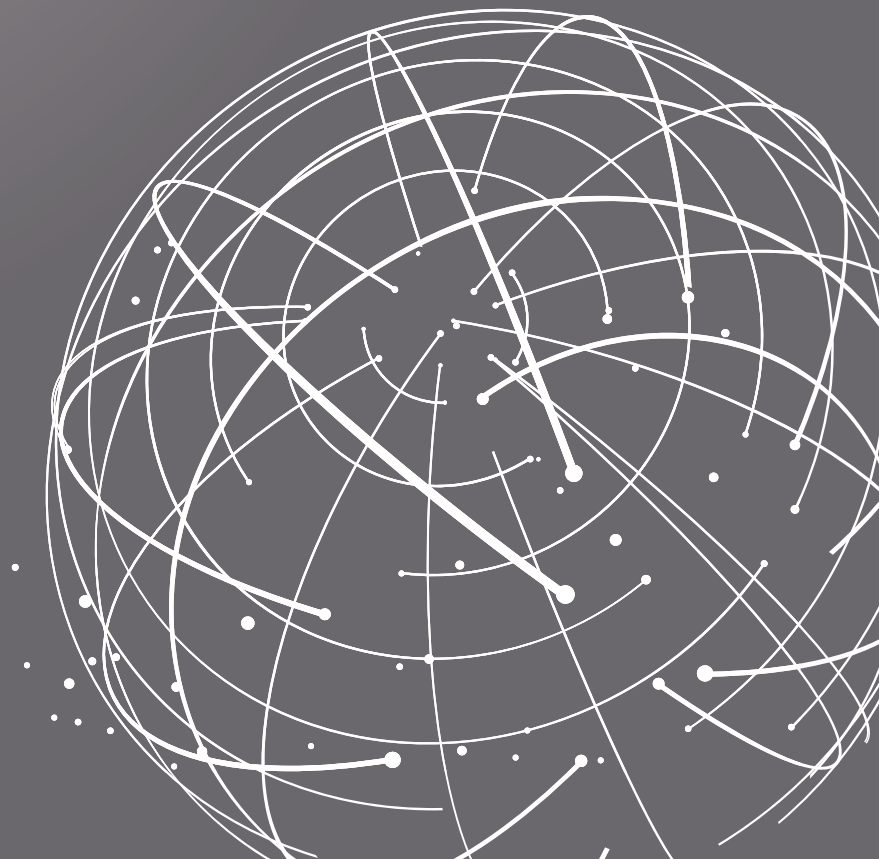


THE HUMAN-CENTERED HEALTH SYSTEM

TRANSFORMING HEALTHCARE WITH DESIGN

Report of the WISH Design in Healthcare
Forum 2018

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FOREWORD

As healthcare leaders, we are relentlessly focused on improving the quality of life in the communities we serve. As citizens, it is hard to ignore the global shifts in how people engage with organizations, governments and each other. Consumers have increasingly sophisticated expectations for products and service experiences, and an amplified voice due to increased connectivity through social media. Healthcare organizations and governments must keep up with the people they serve.

We have heard the often-cited seventeen years from 'bench to bedside' for an innovation to make it to the front line in healthcare, yet other industries innovate rapidly. Long and costly processes for developing improvements and innovations, coupled with tight regulation, contribute to this lag. Human-centered design is a method, used by every industry, that leverages empathy and prototyping as mechanisms to accelerate the innovation process. This report proposes a design methodology for improvement and innovation, employing design practices to arrive at a human-centered health system.

Some of the biggest challenges in healthcare systems arise not from lack of good intent, but rather the complexity of aligning the interests of competing or siloed stakeholders. Design plays a uniquely important role in healthcare as it accounts for the needs of multiple system stakeholders, brings focus to existing challenges, and inspires solutions grounded in people's lived experiences. This report seeks to equip policymakers and leaders with a solid understanding of design principles that will help them to put patients at the center of care, ultimately improving the services that we provide.



A handwritten signature in black ink, appearing to read 'A. v. Darzi'.

**Professor the Lord Darzi of Denham,
OM, KBE, PC, FRS**

Executive Chair, WISH, Qatar Foundation
Director, Institute of Global Health Innovation,
Imperial College London



A handwritten signature in black ink, appearing to read 'AS'.

Aaron Sklar
Co-founder, Prescribe Design

EXECUTIVE SUMMARY

The field of design spans an array of professional disciplines – from architecture to human factors to visual design – but is underpinned by two core practices: empathy and prototyping. Empathy involves seeing the world through the eyes of the people involved – a patient, clinician, caregiver or other important system stakeholder – to gain a deep understanding of their needs. Prototyping involves rapid iteration processes, which incorporate user feedback to ultimately arrive at a flexible solution.

These practices are the foundation of person-centered design and underpin the three categories of design most applicable to healthcare:

- **Professional design**
Skilled designers with varied expertise work together in teams to create a user-centered experience
- **Co-design**
The practice of partnering with patients in design activities, so that the patient becomes an active part of the design team
- **Design thinking**
A structured approach for people who do not identify as designers to focus on their users, gain insight from a completely different perspective and address insights with creativity.

Healthcare providers and policymakers can employ these tools to design a human-centered health system, ensuring that people are the focal point of all care solutions. Human-centered, or patient-centered, care is increasingly viewed as an essential element of high-quality care. This model results in engaged patients and carers, leading to greater satisfaction, outcomes, and efficient resource allocation.

This report sets out a plan of action, supported by successful case examples, for healthcare leaders to embed design principles to support a human-centered health system.

Make a visible commitment to human-centeredness

Incorporate the experiences and insights of patients, citizens and the workforce in policymaking, design activities, process improvement, and innovation initiatives. All projects which result in a service experience or health outcome for a patient should involve input from both patients and providers.

- 1. Mandate empathic design research activities.** A common pitfall in innovation initiatives is to rush to the development stage as quickly as possible. A central tenet of the Double Diamond process (see Figure 3), and design in general, is to ensure that sufficient time is spent in the discovery stage. Starting with empathic methods for understanding the needs of the people involved will increase the effectiveness and impact of the ultimate solution.
- 2. Involve and incentivize patients and the public.** Throughout the design process, there are continuous opportunities to engage with patients, care providers and members of the public. Their insight and contributions must be valued at the same level as other subject matter experts.
- 3. Partner with patients to co-design.** In harnessing the increasing level of sophistication of healthcare consumers, we must proactively create partnerships with patients and citizens and actively support grassroots movements such as Nightscout, #WeAreNotWaiting, E-patients and D-patients.

Teach design thinking principles to every staff member

All health system workers should receive exposure and training in two essential practices of design: empathy and prototyping.

- 4. Mandate empathic design research and prototyping training for accredited healthcare professionals.** All healthcare professionals should be trained to recognize the value of human-centered design. Professionals should have a basic understanding of the core concepts of design and be exposed to a portfolio of human-centered design initiatives. Widespread adoption of design thinking can lead to a transformation of problem solving throughout the sector.
- 5. Incorporate human-centered design training for the entire workforce.** In shaping a successful human-centered health system, ideas and inspiration can come from a variety of sources. Training programs should include all members of staff and could include practical exercises such as partnering with quality improvement and innovation teams.
- 6. Facilitate bottom-up problem solving.** Create opportunities for clinicians and members of the workforce to highlight problems seen on the front line and participate in design processes to solve them.

Invest in targeted design expertise

In addition to embedding design thinking within general workforce training, policymakers should consider establishing dedicated human-centered design teams.

7. Embed design teams in government and healthcare organizations.

Dedicated teams build momentum for innovation initiatives through building a track record and institutional knowledge. Successful examples of such teams include the UK's Government Digital Service (GDS), the Kaiser Permanente Innovation Team, the Design Institute for Health at Dell Medical School, and the Helix Centre embedded inside Imperial College Healthcare NHS Trust, among others.

8. Sponsor design challenges in healthcare. Declaring design challenges sets an inspiration agenda. These challenges bring together interdisciplinary teams in a focused environment or timeframe to achieve a collaborative result. Some of these initiatives can be open to the public and leverage crowdsourcing mechanisms, while other efforts can take the form of co-ordinated events that bring together teams with high focus and energy.

9. Sponsor a Community of Practice. Human-centered design is likely to be happening in distributed pockets of any healthcare organization. Connecting these efforts and magnifying their reach will bring a positive momentum that will spill across the organization and the communities being served.

SECTION 1. DEFINING DESIGN

"Design is the first signal of human intention."

William McDonough

The practice of 'design' has many interpretations. Although design is often understood as aesthetic improvement, the full definition as it has been applied in healthcare is much more expansive and includes everything from increasing the effectiveness of disease education tools and informatics systems to rethinking workflow and communication processes. Design can do a great deal more than improve how something looks or feels. It can simplify complex problems, reduce friction in a system, and create truly engaging solutions. Design and designers bring well-established processes for solving challenging, systemic problems.¹ Well-designed systems make products and services easier to use.

"Design has always been about understanding underlying human needs, and then taking an iterative approach to creating new solutions for those needs by manipulating and adapting what surrounds us."²

The field of design is made up of myriad professional disciplines, many of which are visualized in Figure 1. While each discipline is varied, all human-centered design is underpinned by two essential practices:

- **Empathy** involves seeing the world through the eyes of the people involved: a patient, clinician, caregiver or other important system stakeholder. Design research is a set of methods that enables the designer to empathize with users. While countless methods exist, design research often takes the form of firsthand observation of users, shadowing users in their daily lives and interviewing users one-on-one or with a partner. The goal of design research is to uncover users' needs, motivations and behaviors and differs greatly from traditional approaches to learning about users, such as market research. Market research, surveys and focus groups are methods to identify existing trends about a particular issue, while design research seeks to uncover the unarticulated needs that serve as inspiration for new ideas. To empathize deeply with people, designers look for stories and ask open-ended questions, later synthesizing observations to identify latent needs, motivations and behaviors. Designers strive to connect the dots that people may not even know matter to them.
- **Prototyping** involves the iterative process of making ideas tangible. In the design of products or systems, prototyping enables teams to test their assumptions and insights. Prototypes are, by definition, low-commitment

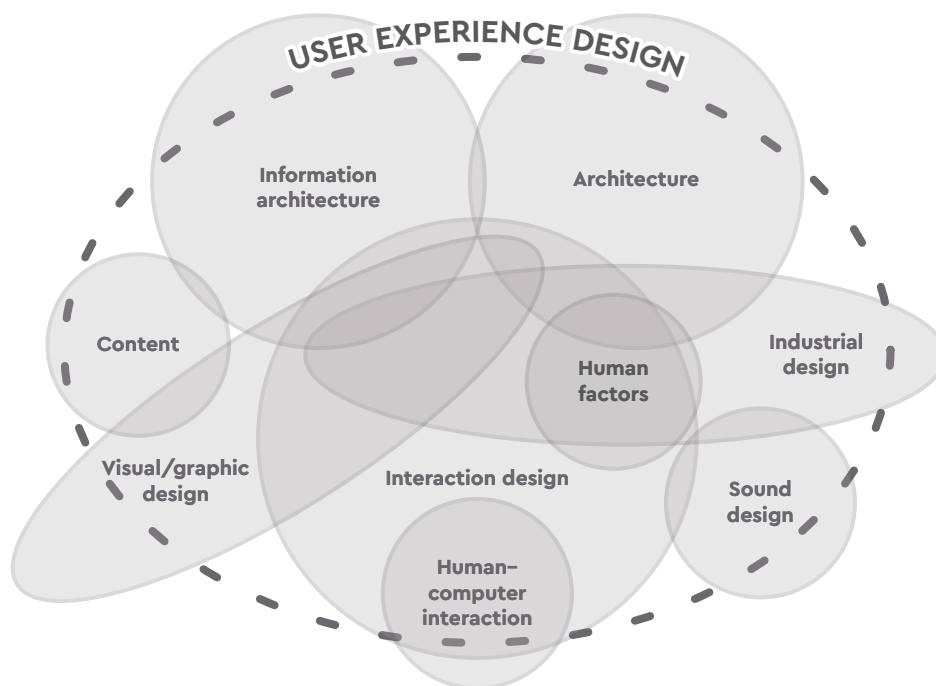
and low-cost, enabling teams to work quickly and adjust before arriving at a final solution. Prototypes can take any form: from a hand-drawn sketch to a cardboard structure to a paragraph of text describing an idea. In the design process, a series of prototypes can be built over a few days or even hours. It is an ongoing learning process (rather than solely goal-oriented), and is the start of an agile, flexible final solution. Most importantly, prototypes are meant to be shared with users for feedback and constant iteration.

Design is a diffuse practice³ undertaken by people and teams across a spectrum from professionally trained designers to patients and caregivers who are expert in living with a health condition.⁴ There are three categories of design activity that this report covers: professional design, co-design and design thinking.

Professional design

The professional practice of design involves the joining together of various disciplines and people with knowledge or expertise. The design field includes a broad range of disciplines. For this healthcare context, we focus on the disciplines surrounding interaction design (which must not be confused with purely digital interactions). An interaction is a transaction between two entities, typically an exchange of information, but it can also be an exchange of goods or services. Figure 1 illustrates how professionally trained designers in various disciplines overlap, and critically, how the design of a user's experience requires the input of a multitude of professionals.

Figure 1. Disciplines surrounding interaction design



Source: Adapted from Saffer (2010)⁵

There are countless practices of professional design. Figure 1 captures many of these.

- **User experience design** is the sum of countless design decisions made by a diverse group of designers and stakeholders to provide meaningful and relevant experiences to users.⁶
- **Information architecture** is the practice of deciding how to arrange the parts of something to be understandable.⁷
- **Architecture** is the art and technique of designing and building, as distinguished from the skills associated with construction.⁸
- **Visual/graphic design** is the art and practice of planning and projecting ideas and experiences with visual and textual content. The form it takes can be physical or virtual and can include images, words or graphics.⁹
- **Industrial design** is a process of design applied to products that are to be manufactured through techniques of mass production.¹⁰ Industrial design focuses on the appearance of a product, how it functions, how it is manufactured and the value it provides for users.¹¹
- **Human factors** examines the relationship between human beings and the systems with which they interact¹² by focusing on improving efficiency, creativity, productivity and satisfaction, with the goal of minimizing errors.¹³
- **Interaction design** is the design of the interaction between users and products, often involving elements like aesthetics, motion, sound and space.¹⁴
- **Human-computer interaction (HCI)** is a multidisciplinary field of study focusing on the design of computer technology and, in particular, the interaction between humans (the users) and computers. While initially concerned with computers, HCI has since expanded to cover almost all forms of information technology design.¹⁵
- **Sound design** incorporates the use of sound to evoke emotion or action in a product or service.

In common practice, designers work together in teams and bring together the appropriate disciplines to fit the challenge at hand.

Co-design

The practice of partnering with patients and other system stakeholders in design activities is referred to as co-design or patient centered participatory design.¹⁶ In stark contrast to design being the exclusive responsibility of professional design experts, co-design allows users to become part of the design team as 'experts of their experiences'.¹⁷ Evidence suggests that better outcomes for people with long-term conditions can be achieved with a partnership between an engaged, empowered or activated patient and an organized, proactive healthcare system.¹⁸ Co-design initiatives are an example of such partnerships.

Advances in communications and technology platforms across industries have given citizens a greater set of expectations for the interactions they have with services. While industries such as financial services, transportation and education have changed (in many cases forced by consumer demand), healthcare has remained stagnant from a user experience perspective. This stagnation has led to a growing movement of patients taking the design of their care into their own hands.

Patients are increasingly impatient with the slow pace of innovation and change in the medical device and pharmaceutical markets and are demonstrating that they are not waiting for the industry to catch up with them by experimenting on their own.¹⁹ This means that patients – despite not having formal design training in the disciplines in Figure 1 – are designing tools to manage their own care. This movement of patients as designers takes place under the banner of a social media hashtag #WeAreNotWaiting and began with parents of children with type 1 diabetes looking for a way to continuously monitor their children's glucose in real time.²⁰ There are a growing number of self-described 'E-patients' who are highly engaged in their healthcare and in advocating for their needs. Another inspiring group are D-patients,²¹ who happen to be trained designers and who use their professional skills to shape their own healthcare experiences. While the first instinct of a healthcare system may be to shut down or regulate these initiatives, healthcare systems can channel patient and caregiver expertise to develop solutions that better fit people's lifestyles and needs.

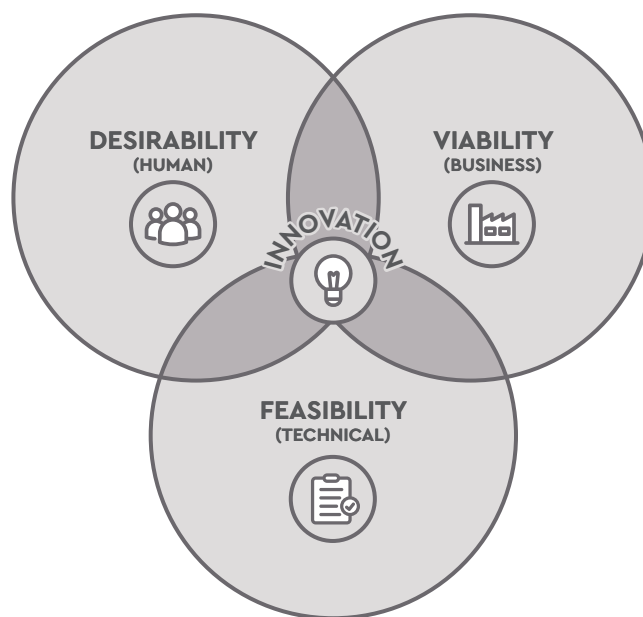
Design thinking

Design can involve more than the creation of new products or services. The 'design thinking' movement introduced the behaviors that professional designers employ to be applied to all sorts of systemic problems.

“Design thinking is a human-centered approach to innovation that draws from the designer’s toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success.”²²

The design thinking movement created a structured way for people who do not identify as designers to focus on their users, gain insight from a completely different perspective and address insights with creativity. Design thinking has gained traction across myriad industries and has widespread applicability in healthcare.

Figure 2. IDEO’s elements of design thinking and innovation²³

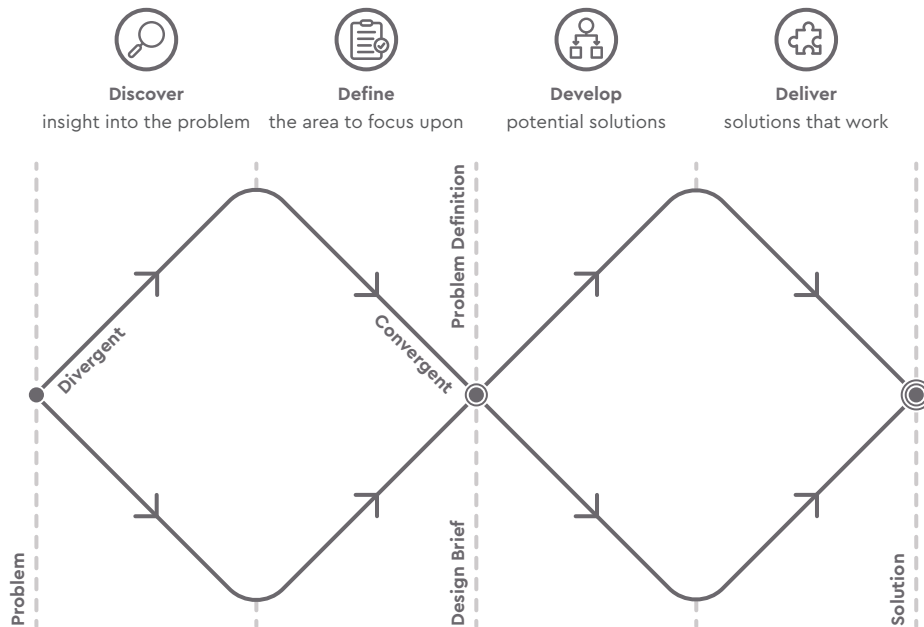


The design process

There are many different approaches to design, co-design and design thinking. What they all have in common is a phased approach to empathy, prototyping and iteration. The Design Council – a UK charity recognized as a leading authority on the use of strategic design – set out to understand how the world’s top design teams manage design in their organizations. The Design Council Double Diamond framework outlines four distinct phases – discover, define, develop and deliver. The Double Diamond maps the divergent and convergent stages of the design process, showing the different modes of thinking that designers use.²⁴

Four stages of the Design Council Double Diamond Framework

Figure 3. The Design Council Double Diamond Framework



Stage 1: Discover

A design project starts with a focus area – an articulated problem or body of evidence. The goal of the first phase of the project is to collect as much diverse information as possible about the problem area, largely by empathizing with people. Primary and secondary research is used to immerse a designer or design team as deeply as possible into the context of the problem. Design research methods used in this phase include stakeholder mapping, process mapping, qualitative interviews, direct observation and ethnography.

Stage 2: Define

After conducting primary and secondary research into the problem and gathering information from a variety of stakeholders, designers seek to make sense of all of the possibilities identified in the Discover phase. In some cases, the focus area is redefined, expanded or contracted based on observations or insights. The goal of the Define phase is to create a clear understanding of the fundamental design challenges underlying the agreed focus area.

Stage 3: Develop

Once the focus area has been defined and agreed by key project stakeholders, designers or design teams move to generate multiple solutions that they can quickly prototype, test and iterate. The Develop phase is focused on making ideas tangible for additional learning. By taking a low-commitment approach to generating ideas, designers or design teams are free to experiment and explore a wide range of solutions. The goal of the Develop phase is to connect observations or insights to tangible solutions and get feedback from real users into those solutions.

Stage 4: Deliver

The final stage of the Double Diamond requires the informed decision-making of key stakeholders to set a professional design team to work on the delivery of a final solution. This phase focuses on the nuanced details (for example, visual/graphic design, product design, information architecture, etc.) to set a project up for success. The Deliver phase comprises intensive rounds of user testing and iteration. This process ensures that value is proven and prevents wasting resources. The goal of the Deliver phase is to create the final solution that can be piloted, run through an evaluation trial or launched.

SECTION 2. THE HUMAN-CENTERED HEALTH SYSTEM

A vision for the human-centered health system

A human-centered health system embeds design thinking in everything it does, putting people at the heart of every decision. In essence, human-centered – also known as patient-centered, or person-centered – care views patients as “equal partners in planning, developing and assessing care to make sure it is most appropriate for their needs.”²⁵ It supports a culture of continuous engagement with patients and caregivers, clinicians and the workforce to iteratively solve problems.

Human-centered health systems improve quality, patient and workforce experience, and efficient allocation of resources.

Quality

On the basis of several definitions in the literature, WHO defines quality of care as “the extent to which health care services provided to individuals and patient populations improve desired health outcomes. In order to achieve this, health care must be safe, effective, timely, efficient, equitable and people-centered.”²⁶ Taking these elements as baseline characteristics of any healthcare solution, design goes a step further to require that all projects which will result in a service experience or health outcome for a patient should involve patients themselves. Patient-centered care has been shown to improve quality in myriad ways, and is increasingly seen as an element of quality in and of itself.²⁷ Engaged patients typically learn more about their conditions and are empowered to seek the most appropriate services for their needs.²⁸ This increased activation also leads to improved patient satisfaction, outcomes, and self-management, which can reduce the demand for health services.²⁹

Patient and provider experience

The human-centered health system approach places enormous value on delivering high-quality experiences – and in turn, increased engagement – for both patients and staff. Evidence suggests that policies and interventions aimed at strengthening patients' roles in managing their healthcare can contribute to improved outcomes and improved satisfaction scores.³⁰ Design can be a powerful tool to empathize not only with patients but also with the care providers with whom patients most frequently interact.

While much of the discussion on human-centeredness in healthcare is around patient-focused interventions, human-centered design can (and should) be applied with healthcare professionals as well. The increasing adoption of digital tools in healthcare in recent years – in particular, the Electronic Health Record (EHR) – has brought the usability of systems into the spotlight. Analyses of facilitators and barriers to physicians' use of EHR systems suggest that usability is a major theme³¹ and that understanding user behavioral models is important to achieving effective use.³² Many systemic and technological changes in the last decade have placed an undue burden on clinicians and other care providers, which can result in poor quality of care overall, or poor experience for patients. A focus on patient-centered care, however, has been shown to improve job satisfaction and reduce emotional exhaustion among professionals.³³

Cost effectiveness and savings

Controlling costs in the human-centered health system hinges on patients becoming effective and informed managers of their health and healthcare.³⁴ Human-centered health systems should strengthen the patient-clinician relationship, promote communication about the things that matter, help patients know more about their health, and facilitate the patient's involvement in their own care.³⁵ An activated, engaged patient can improve disease management, and in turn deliver cost savings – particularly for patients with chronic disease.³⁶ Design plays a critical role in empathizing with patients to then introduce solutions which activate and engage patients while remaining cost effective. Equally, design works to deliver more efficient and effective systems for the workforce.

Design is one of the key tools to deliver human-centered care. Design can drive value in this complex industry, while keeping people at the center and providing a framework for sustainable improvement and innovation. A human-centered health system should not expect to see results by siloing design activity in a single department or team. The human-centered health system needs to change the paradigm by embedding design thinking in everything it does.

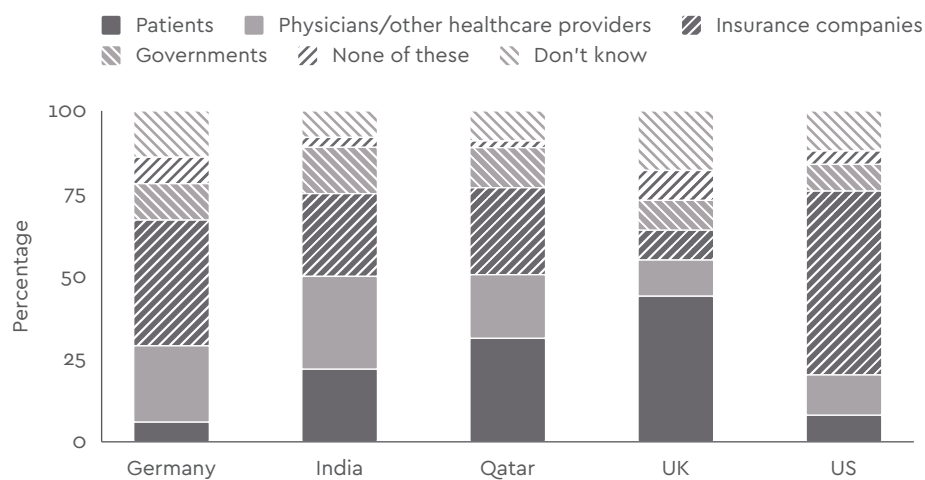
A human-centered health system starts with people

In an impassioned article in 2009, Don Berwick – President Emeritus and Senior Fellow at the Institute for Healthcare Improvement, and self-described 'extremist' – envisions a human-centered healthcare system like this:

"The experience (to the extent the informed, individual patient desires it) of transparency, individualization, recognition, respect, dignity, and choice in all matters, without exception, related to one's person, circumstances, and relationships in health care."

The principles underpinning design – empathy and prototyping – lend themselves to putting the patient's needs and welfare at the center. Design processes are set up to fail unless they take on board the building blocks of human-centered care that Berwick proposes. Critically, those leaders looking to build or adapt to a human-centered health system must consider both sides of the care equation: patients and providers. Balancing efforts to not only deliver high-quality experiences for patients but to also consider the processes, systems and tasks required of the workforce will be a key challenge in delivering human-centered care, and one that will be approached differently by different healthcare systems. While many health systems and providers have begun placing an emphasis on human-centered care, there is much work to be done in this space.

Figure 4. Which one group, if any, do you think the healthcare system most benefits?

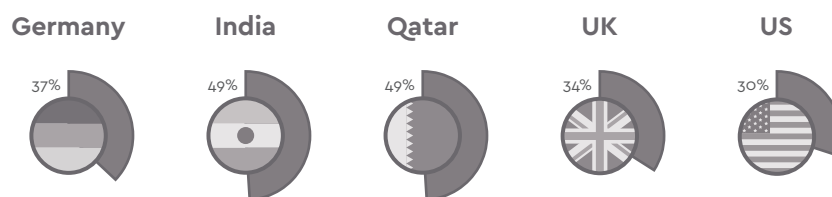


In a multinational survey of 6,490 people across five countries (conducted by YouGov and commissioned for this report), respondents, with the exception of those from the UK, overwhelmingly indicated that other actors (physicians, providers, insurance companies and governments) – not patients – benefit most from the healthcare systems (see Figure 4).

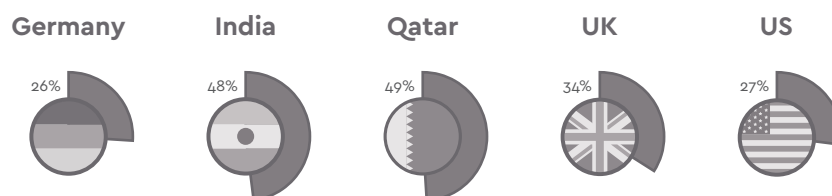
It is important to note that shortcomings in the healthcare system do not necessarily arise from lack of good intent. Rather, they stem from the significant difficulty of aligning the interests of competing stakeholders, meeting complex and rapidly evolving circumstances, and overcoming entrenched ways of working within existing structures. Design plays a uniquely important role in health as it accounts for the needs of stakeholders, brings focus to existing challenges, and inspires suitable solutions. In particular, the behaviors employed in design – empathy and prototyping – allow healthcare decision-makers and providers to place people at the center of the service.

Figure 5. Patient views of healthcare improvement

The healthcare service can be improved through my personal interactions with my doctor



The healthcare service can be improved through encouraging me to take more of an active role in my healthcare (eg providing tools for me to monitor my health at home)



Source: YouGov, 2018

Often in process improvement or problem-solving methods in healthcare, focus is placed on system needs rather than the person in need. Forces of commodification and emphasis on technology solutions have led to a breakdown in person-centered experiences for those receiving care as well as for those who give it. Empathic and iterative design processes create solutions that work for all stakeholders involved. They can help administrators, clinicians, and

policymakers build a greater understanding of the needs of patients, providers, or stakeholders, increasing the relevance and efficacy of solutions. This person-centered approach is also supported by patients, as shown in Figure 5.

Prototyping is a key ingredient in ensuring sustainable, human-centered solutions. The healthcare industry spends billions of dollars annually on products, services and programs. Employing design processes such as the Double Diamond allows organizational leaders to keep their processes iterative, meaning they are constantly testing and re-working ideas before they get too far down the timeline. The ability to pivot easily, change direction and improve is key to creating optimal solutions while also keeping costs low.

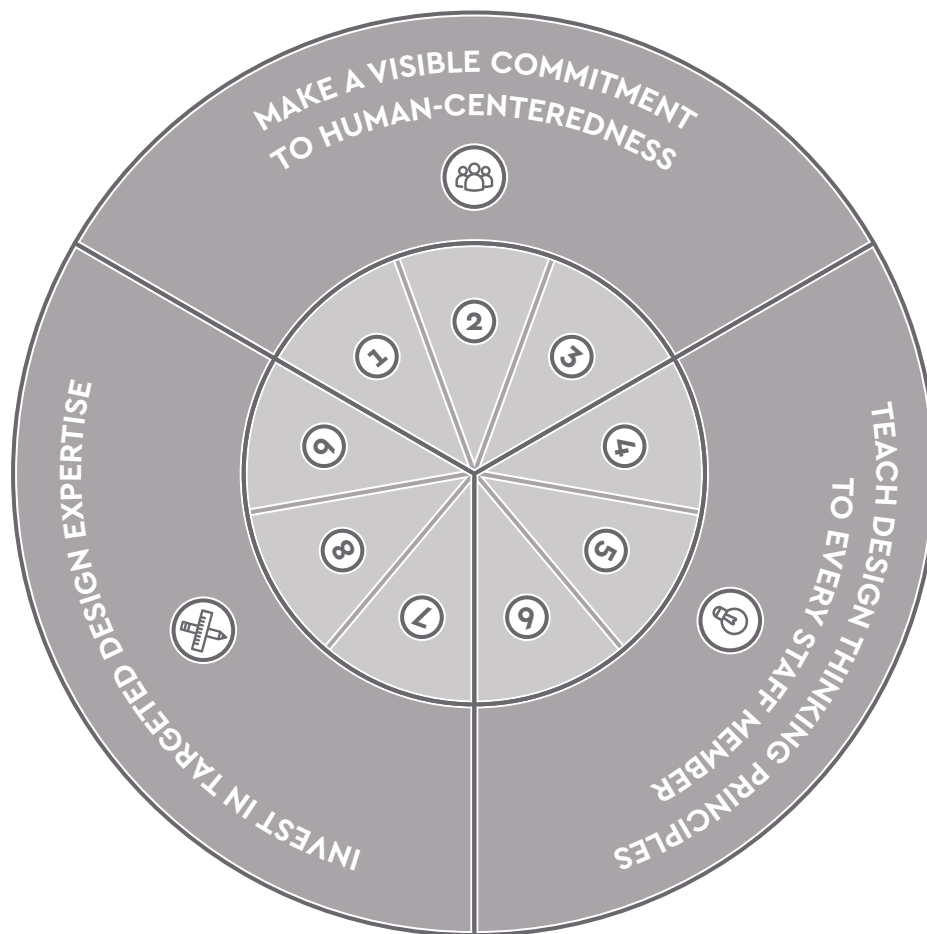
The usability of a product, service or healthcare intervention is critical to realizing the intended outcome. As users become more fluent in the use of digital technologies for personal use, they expect high-quality user experiences from their healthcare services. The International Organization for Standardization (ISO) has a published standard for both hardware and software components of interactive systems³⁷ which aims to ensure the usability of a system is of a high standard. The critical feature of this, and other approaches to user-centered design (or usability engineering), is the emphasis on determining users' needs of the system, understanding the context in which the system will be delivered, and designing products from the ground up rather than basing them on developers' preconceptions or rigid procurement briefs.³⁸ Design methodologies are the key to satisfying such user needs.

Most importantly, well-planned, people-centered solutions can also drive better health outcomes, improved patient experiences, lower costs and increased engagement.

SECTION 3. AN ACTION PLAN FOR THE HUMAN-CENTERED HEALTH SYSTEM

Embedding design principles to create a person-centered health system is not an easy task. However, it is doable and it can be affordable, and even revenue generating. Design activities should not only focus on the needs of patients, but also enhancing experiences for frontline staff and the workforce at large. Health system leaders should consider the following priority actions.

Figure 6. Human-centered health system action plan



Make a visible commitment to human-centeredness

Incorporate the experiences and insights of patients, citizens and the workforce in policymaking, design activities, process improvement and innovation initiatives. All projects which result in a service experience or health outcome for a patient should involve input from both patients and providers.

- 1. Mandate empathic design research activities.** A common pitfall in innovation initiatives is to rush to the development stage as quickly as possible. A central tenet of the Double Diamond process (see Figure 3), and design in general, is to ensure that sufficient time is spent in the discovery stage. Starting with empathic methods for understanding the needs of the people involved will increase the effectiveness and impact of the ultimate solution.
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- 3. Partner with patients to co-design.** In harnessing the increasing level of sophistication of healthcare consumers, we must proactively create partnerships with patients and citizens and actively support grassroots movements such as Nightscout, #WeAreNotWaiting, E-patients and D-patients.



Teach design thinking principles to every staff member

All health system workers should receive exposure and training in two essential practices of design: empathy and prototyping.

- 4. Mandate empathic design research and prototyping training for accredited healthcare professionals.** All healthcare professionals should be trained to recognize the value of human-centered design. Professionals should have a basic understanding of the core concepts of design and be exposed to a portfolio of human-centered design initiatives. Widespread adoption of design thinking can lead to a transformation of problem solving throughout the sector.
- 5. Incorporate human-centered design training for the entire workforce.** In shaping a successful human-centered health system, ideas and inspiration can come from a variety of sources. Training programs should include all members of staff and could include practical exercises such as partnering with quality improvement and innovation teams.
- 6. Facilitate bottom-up problem solving.** Create opportunities for clinicians and members of the workforce to highlight problems seen on the front line and participate in design processes to solve them.



Invest in targeted design expertise

In addition to embedding design thinking within general workforce training, policymakers should consider establishing dedicated human-centered design teams.

- 7. Embed design teams in government and healthcare organizations.** Dedicated teams build momentum for innovation initiatives through building a track record and institutional knowledge. Successful examples of such teams include the UK's Government Digital Service (GDS), the Kaiser Permanente Innovation Team, the Design Institute for Health at Dell Medical School, and the Helix Centre, embedded inside Imperial College Healthcare NHS Trust, among others.
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- 9. Sponsor a Community of Practice.** Human-centered design is likely to be happening in distributed pockets of any healthcare organization. Connecting these efforts and magnifying their reach will bring a positive momentum that will spill across the organization and the communities being served.

The action plan described above is our vision for a human-centered health system – transforming healthcare with design. To be clear, this transformation has already started, yet for some organizations and communities these recommendations may initially seem surprisingly bold. Be assured that these design practices and commitments are becoming increasingly common and mainstream. If your community or organization is not yet ready to take on the bigger actions, we encourage you to choose a subset of these recommendations to get started with. In getting started, you will build momentum for the bolder moves to catch on and you will be laying the groundwork as the wave of design thinking expands across the healthcare ecosystem.

SECTION 4. SUCCESS STORIES

The following case studies provide concrete examples of how health system leaders and design teams have employed human-centered design to improve health. There is no example yet of a truly human-centered health system, but these programs illustrate how design can be employed in practice to improve quality of care, patient experience and value for money. Each of these success stories represents a unique aspect of the healthcare system. Our vision of a human-centered health system is inspired by these success stories of design being applied across such a varied set of challenges and solutions.



CASE STUDY

Clinical decision support for pediatric emergencies

Design practices

1. *Industrial design*; 2. *Interaction design*;
 3. *Human-computer interaction*; 4. *Human factors*;
 5. *Visual/graphic design*
-

Significance

Medication administration is one of the most error-prone practices in hospital, and mistakes occur multiple times a day within a single healthcare system. The patients most vulnerable to these errors are children, where medication errors are three times more common than in adult medicine. Even though very few errors are detected, an error is estimated to occur once in every 10 drug administrations in emergency units. During resuscitations, the rate is even higher – up to one in four drug administrations are thought to be incorrect.

Challenge

Giving drugs safely to children requires doctors and nurses to make a series of difficult calculations. The pressure of the emergency environment when caring for critically ill patients, often in the middle of the night, combines to make complex arithmetic highly unreliable. Weight variation in children adds a significant potential for large miscalculation errors.

Design solution

A team from the Helix Centre was embedded in the pediatric critical care environment at St Mary's Hospital in London, UK, in order to understand the human and technical aspects of giving drugs to children. The team's design research resulted in the development of a computerized decision support system designed to help doctors and nurses prepare and administer drugs safely when working under pressure. Once provided with the child's weight, age and clinical information, the software determines the safe dosing parameters for any given drug and a suitable method of administration. Supported by on-screen instructions, a personalized syringe label is printed on-demand, illustrating the safe preparation and administration instructions for the medication.

Outcome

The team decreased the number of serious errors by 60% in novice users. The team has secured follow-on funding to bring the proof-of-concept to the next stage.



CASE STUDY

Reducing anxiety around self-administering injections

Design practices

1. *Industrial design*; 5. *Visual/graphic design*;
 6. *Product design*
-

Significance

WHO estimates that there are 347 million people worldwide (approximately 8.5 percent of the adult population) with diabetes and that by 2030 it will be the seventh leading cause of death. In 2004 an estimated 3.4 million people died from the consequences of diabetes and over 80 percent of these deaths occurred in low-income and middle-income countries.³⁹

Challenge

Approximately 50 percent of patients with chronic disease do not take their medications as prescribed.⁴⁰ A common recommendation for the management of type 2 diabetes calls for insulin therapy, delivered by a patient-administered injection. Although most providers agree that insulin is an efficacious approach to the management of type 2 diabetes, many still consider insulin therapy as the last resort. A common barrier to taking insulin is the perception that insulin injections are painful.⁴¹

Design solution

Eli Lilly collaborated with the design firm IDEO on Trulicity, a dulaglutide injection pen designed as a patient-centered personal medical device. Stemming from design research observations that self-administering injection-based medication caused anxiety among patients, the Trulicity pen automates the insertion and retraction of the needle so that the user never sees the actual needle. A wide base enables the pen to be held securely against the injection site, and the device automatically regulates the dose and depth of the needle.⁴² An auto-injection feature aims to take the anxiety out of self-administering insulin.

Outcomes

The patient-centered solution was shown to have increased adherence to medication regimes, improving HbA1c scores. After 26 weeks of treatment, Trulicity reduced HbA1c by between 0.71 and 1.59 percentage points at the lower dose, and by between 0.78 and 1.64 percentage points at the higher dose. This was considered to be clinically meaningful, and there was evidence that the benefits were maintained during long-term treatment.



CASE STUDY

Reducing hospital readmissions with avatar-based communications

Design practices

*2. Interaction design; 5. Visual/graphic design;
7. Information architecture*

Significance

According to data from Medicare in the US, from 2009 to 2012 the median risk-standardized 30 day hospital readmission rate for heart failure was 23 percent.⁴³

Challenge

To prevent hospital readmission for patients with chronic heart failure (CHF).

Design solution

The Sensely app uses an avatar-based 'conversation' with heart failure patients to lead them through daily check-ins. The patient's responses are analyzed and organized and if necessary, an alert is sent to their clinician. The app was designed with compassion in mind, aiming to reproduce the familiarity and warmth of a real person through the app. Every morning, each CHF patient receives a reminder on their phone to take their check-in via phone or text. After starting the app, 'Molly', the digital avatar, initiates the conversation by asking an open question such as "How are you feeling today?" and then follows up with instructions on taking their blood pressure and weight, and a series of other questions. Molly converses with the patient in a friendly tone so that patients don't associate the app with a tedious medical process.

Outcome

When rolled out in select UK locations, nearly two-thirds (63 percent) of the completed 'Ask NHS' symptom checker outcomes led to a recommendation to contact a call center by phone, 14 percent to schedule a GP appointment, 12 percent to follow self-care advice and 12 percent to call emergency services. The cost per digital self-care transaction is a fraction of that of traditional advice-line telephone services.



CASE STUDY

Increasing engagement with woman-initiated HIV prevention

Design practices

5. *Visual/graphic design*; 8. *Service design*;
9. *Communication design*; 10. *Behavior design*

Significance

In sub-Saharan Africa, the burden of HIV/AIDS falls disproportionately on young women. Every day, more than 1,000 women between the ages of 15 and 24 are infected with HIV, and HIV/AIDS is the leading cause of death for women of reproductive age.⁴⁴

Challenge

Significant investment has gone into developing microbicide products for HIV prevention among young women. However, adoption and consistent use of these products has been a persistent problem.

Design solution

A partnership between USAID's Center for Accelerating Innovation and Impact (CII) and Dalberg's Design Impact Group (DIG) worked with healthcare organizations in Uganda and South Africa to engage local stakeholders in design processes to increase engagement with the Dapivirine Ring. From the beginning, the design team brought in local healthcare teams and young women to be a part of the design process. Through primary research, the group developed descriptive profiles of the various types of users they would be designing for. This method of creating descriptive profiles is called persona development and is used to continually connect product development with end user needs, motivations and behaviors. In addition to persona development, the design team uncovered challenges faced by women related to sexual health and hardships that go along with limited access to resources. Armed with this understanding, the group began to design creative solutions to overcome barriers and obstacles to effective HIV prevention practices.

Outcome

At the end of the design phase, the group launched 12 solutions in local communities across four different categories: education, service delivery, user tools and community outreach. They are currently engaging NGOs and policymakers to roll the solutions out more broadly.⁴⁵



CASE STUDY

Making diabetes management fun for children and parents

Design practices

1. Industrial design; 2. Interaction design; 5. Visual/graphic design; 7. Information architecture; 11. Rapid prototyping

Significance

A child with type 1 diabetes will usually inject insulin four (or more) times a day with an insulin pen.⁴⁶ Healthcare communications are typically uninteresting documents or forms that can be unengaging for children. With type 1 diabetes, regular insulin injections are critical and there can be a challenge for parents to engage their children in long-term condition management.

Challenge

Diabetes management between parent/caregiver and child can be fraught with challenges. While parents may intend to properly manage their child's condition, the child may think (for example) "it's annoying to get lots of text messages from your mom about diabetes stuff when you are a teenager with type 1 diabetes."

Design solutions

HealthDesignByUs is a community collaborative of a range of patients and experts connected to the University of Michigan in the US. The group is passionate about patient-centered participatory design. As part of the collaborative's efforts to run interdisciplinary, patient-included workshops, a challenge was set to make communication easier between parents and diabetic children. The workshop invited a range of participants to take part in the entire design process and arrived at a solution to use lighthearted and fun diabetes emoticons as a communication tool. Patients and caregivers were active participants throughout the design process, which resulted in illustrations, user interface mock-ups, and smartphone applications.

Outcomes

Qualitative surveys on the effectiveness of Diabetemoji Stickers⁴⁷ include reports from children that the emoji system was a much better communication method than "annoying texts from my mom about my diabetes".



CASE STUDY

Supporting people to create plans for emergency care and treatment

Design practices

*2. Interaction design; 5. Visual/graphic design;
7. Information architecture*

Significance

Nearly half of all deaths in the UK occur in hospitals. Despite such a large proportion of people dying there, only a tiny fraction actually want to. Discussing death in a hospital can be incredibly difficult, especially following an emergency admission. Patients and families expect to get better and doctors can find it hard not to try everything to save them.⁴⁸

Challenge

Helix Centre – an embedded design team at St Mary's Hospital in London, UK – was tasked with tackling challenges in emergency care planning, and ultimately wider discussions around end-of-life care treatments.

Design solution

The professional design team conducted design research with clinicians and staff in all areas of hospital care. In following the 'paper trail' from admission through to discharge, the team recognized that one process in particular, the Do Not Attempt Cardiopulmonary Resuscitation (DNACPR) form, was particularly fraught with problems. In qualitative interviews, clinicians, patients and families told the design team that the use of a DNACPR form often led to confusion and distress around what treatments were going to be used in an emergency.

The team collaborated with the UK Resuscitation Council and a working group of over 30 national organizations to redesign the way in which difficult conversations about life-sustaining treatments are conducted and recorded, with a new form and process called the Recommended Summary Plan for Emergency Care and Treatment (also known as ReSPECT). The team combined design research insights, along with information architecture and graphic design expertise, to co-design a new plan and process that brings the patient to the center of emergency care decisions.

ReSPECT features a visual device used to demonstrate that there is often a compromise between sustaining life and providing comfort and dignity. ReSPECT helped to clarify this process for patients, to make it accessible and easy to understand.

In addition to the form, the team developed a prototype web application to provide accessible training and support to clinicians using the ReSPECT process. This prototype was then developed further, and delivered to professional audiences. The digital tool enables healthcare professionals to learn about the new process with interactive training scenarios and discussion tips.

Outcome

The design team's goal was to improve conversations between healthcare professionals, the patient and their loved ones, and create a comprehensive document that could capture healthcare decisions. Since launching in February 2017, ReSPECT has been implemented in eight NHS Trusts, with over 140 organizations expressing interest across the UK and Ireland.



CASE STUDY

Streamlining tools for laparoscopic surgery

Design practices

1. Industrial design; 4. Human factors; 6. Product design

Significance

The minimally invasive approach has revolutionized surgical care, significantly reducing postoperative pain, recovery time and hospital stays, with marked improvements in cosmetic outcome and overall cost-effectiveness. It is now used around the world and in all major fields of surgery, compelling changes in training programs in order to assure quality control and patient safety.⁴⁹

Challenge

Surgeons need to clean laparoscopes – tube-like camera devices that allow clinical teams to see inside a patient during minimally invasive surgeries – during surgery. A surgeon had noticed the frustration on his mentors' faces when they had to take out the lens from the patient for cleaning during a surgical procedure, noting how disruptive the process was. Convinced there had to be a better way to reduce the risk of infection to the patient, he asked, "It's the 21st century – why are we still cleaning surgical tools manually?"

Design solution

Observing the problem firsthand, the clinical team used design approaches to create a self-cleaning laparoscope. The Laparoscope automates the clean-up process for surgical tools, reduces time spent on surgeries, and facilitates the process by making it easier for the surgeon to operate. Students have the further benefit of its internal laser point, adding to the tool's educational prospects.

Outcome

In qualitative interviews with surgeons, the team heard that the design solution saves time, reduces stress, and increase safety during surgeries. The clinical team was featured at WISH's 2016 Young Innovators Competition in Qatar and was a finalist on the Qatar Foundation's TV show Stars of Science. The team won the International Federation of Inventors' Associations (IFIA) Best Invention Medal in 2018 during the International Invention Fair of the Middle East 2018 (IIFME).



CASE STUDY

Systemic approach to quality eye care for low-income rural populations

Design practices

1. Industrial design; 6. Product design; 8. Service design; 12. Space design; 13. Business design

Significance

70% of India's population live in rural areas, where there is a shortage of basic healthcare workers. Even when healthcare services and resources are readily available, the majority cannot afford them.

Challenge

To provide basic access to eye health services to rural and poor populations in India.

Design solution

In 1976, Dr Venkataswamy founded the Aravind Eye Care System to combat needless and avoidable blindness in India. When he opened his first eye care hospital, it had 11 beds. However, through innovation and the steady application of design thinking, his network of care centers today consists of 3,400 beds and has served over 32 million patients.

From the start, Dr Venkataswamy integrated design thinking processes into the most pressing needs and challenges he faced, starting with access to basic screening. As he increased the ability to screen, it revealed other challenges to care delivery. For example, after screening, the center was unable to afford to provide cataract surgery for those in need. So Dr Venkataswamy developed an industrial design and manufacturing shop in the basement of one facility to work on reducing the cost of intraocular lenses. At the time they embarked on this journey, intraocular lenses cost €74.24. Within a few years the Aravind team was able to reduce the cost of intraocular lenses to €1.48, drastically reducing the cost of cataract surgeries and making them more accessible to those who could not afford to pay.

After overcoming barriers to screening and surgery costs, the Aravind Centers next applied their design processes to increasing the efficiencies of surgeons performing cataract surgery. To remove the administrative burden and provide pre- and postoperative care, Aravind began training women in the community

to be technicians. They developed a two-year program to train technicians, who would be able to remove 60 percent of the workload from surgeons, freeing them up to perform more surgeries. Finally, they focused their attention on the operating theaters to reduce the time between surgeries for physicians. By rearranging the surgical tables and microscopes, they were able to increase surgeon efficiency even further.

Outcome

Through years of innovation, Aravind redesigned clinics (space design), surgical tools (industrial design) and team workflows (service design). Today, Aravind Ophthalmology clinics are able to conduct cataract surgery for €18.56 on average while conducting surgery free of charge for those who cannot afford to pay. They have designed the most cost-effective intraocular lenses on the market, which also adds revenue through sales in over 120 countries. Their system is so efficient that a single surgeon is able to conduct 2,000 cataract surgeries each year compared to 400 ophthalmology surgeries per year by other surgeons in India and only 200 per year in the US.



CASE STUDY

A person-centered approach to dementia care

Design practices

2. Interaction design; 4. Human factors; 5. Visual/graphic design; 12. Space design; 15. Architecture

Significance

By 2030, the number of people suffering from dementia around the world is expected to hit 76 million. This will cause an estimated 85 percent increase in dementia-related healthcare costs worldwide. By 2050, dementia-related costs in the US alone will be \$1.2 trillion. Today, a private room at a US nursing home costs an average of \$90,500 annually. In addition to costs, the Dutch Alzheimer's Association found that nursing-home residents in the Netherlands go outside for an average of just 96 seconds per day.

Challenge

The social stigma surrounding mental illness isolates those suffering from such diseases. Additionally, caregivers play a crucial role in managing mental illness, forcing family members to leave jobs or pay for round-the-clock care. Furthermore, nursing homes are often linked to poor quality of life for residents: patients are often mistreated, report low morale, and treatment is rarely holistic and does not include things like taking residents outside or to new environments.

Design solution

The town of Hogewey, a 100-acre fully designed village replica in the Netherlands,⁵⁰ has created a secure and safe environment for Alzheimer's and dementia patients to live seemingly normal lives. Using an unparalleled level of empathy, Dutch designers have built this town specifically for those suffering from Alzheimer's and dementia. The town has caretakers and security cameras, and has removed the concept of money. Houses in the town resemble homes of the 1950s, to stay consistent with patients' last proper memory function. It is subsidized heavily by the Dutch government and families pay based on income level, but total monthly cost never exceeds \$3,600.

Outcome

The village has operated at close to full capacity since it opened in 2009. Residents at Hogewey require fewer medications, eat better, live longer, and appear more joyful than those in standard elderly-care facilities.⁵¹



CASE STUDY

Building confidence around making healthy food choices

Design practices

*2. Interaction design; 5. Visual/graphic design;
7. Information architecture; 10. Behavior design*

Significance

According to the UK government's obesity strategy, nearly a third of children aged two to fifteen are overweight or obese. The drivers leading to child obesity include social, environmental and economic factors, meaning that a preventative approach to obesity cannot be built by the formal health sector alone.⁵²

Challenge

Managing obesity involves patients engaging in multiple lifestyle and behavior change interventions over time. Solutions need to support long-term change rather than set patients up to fail by demanding immediate drastic changes.

Design solutions

The Healthy London Partnership worked with leading London design studio Uscreates to address the social, environmental and economic factors contributing to childhood obesity. Uscreates explored how place-based commissioning models could draw in partners from outside the formal health service, activate local communities and create sustainable interventions across deprived areas in London. The team conducted design research and discovered that time-poor parents were more influenced by convenience than health in their food choices and needed to develop their confidence in making healthy choices. This led to the design of MakeKit: an affordable and confidence-building healthy-eating recipe pack which highlights the use of fruit, vegetables and whole wheat ingredients and promotes low-salt, low-sugar and low-saturated fat diets.⁵³

Outcomes

The team's use of design research methods led to the gathering of important insights that drove the development of the social enterprise but also enabled them to build critical community relationships in the process. As a result of MakeKit, 83% of survey respondents reported to have more confidence in cooking healthy meals, 83% reported being highly likely to refer a friend or family member to the kits and 50% reported being inspired to get more involved in their community.

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