U.PORTO
FEUP FACULDADE DE ENGENHARIA
UNIVERSIDADE DO PORTO

U.PORTO
FEP FACULDADE DE ECONOMIA
UNIVERSIDADE DO PORTO

Design Thinking as an Approach to Innovation in Healthcare at the Bottom of the Pyramid

Deepak Jain

Dissertation

Master's in Innovation and Technological Entrepreneurship

Supervised by

Prof. Katja Tschimmel

2022

Acknowledgements

This dissertation concludes a two-year journey to complete the Master of Innovation and Technological Entrepreneurship at the Faculty of Engineering, University of Porto. Writing this dissertation required a lot of perseverance and persistence to overcome setbacks. However, it also was an opportunity to satisfy my curiosity, allowing me to develop all kinds of skills, and in the end, it brought immense joy. Looking back at this process brings a very satisfying sense of accomplishment.

First, I want to thank my supervisor, Prof. Katja Tschimmel. She inspired me about Design Thinking in one of her electives during my studies. While I developed my ideas into this dissertation, Prof. Tschimmel gave me feedback on countless drafts, discussed and refined my thoughts, and much more.

When pursuing this research, I was genuinely interested in Design Thinking and innovation in healthcare. This interest has been the main motivation to enhance my knowledge in this domain. The initial stage of the research and data collection process was challenging. However, under the guidance of Prof. Tschimmel, I was able to navigate the process.

Finally, I would like to thank everyone who supported me during this journey. I also want to thank all the interviewees and other contacts in academia and practice for their invaluable contributions.

Abstract

Many innovations in the healthcare sector, particularly in emerging countries, aim to deliver low-cost, high-quality care. This review aims to advance an overview of how Design Thinking (DT) has been used in the healthcare industry. Based on the critical analysis of the literature review, by acknowledging the gaps of the previous research studies that did not apply a DT framework to provide affordable healthcare at the bottom of the pyramid, we intended to establish whether doctors in Indian Healthcare apply DT within their field, at the BoP level. Furthermore, this study explores if the potential use of DT provides affordable healthcare in this context. We interviewed 15 surgeons in Indian Healthcare using content analysis. The findings suggest that DT has certain applicability but is not at the core of the Indian Healthcare system. We could not find a well-known framework in doctors' discourses. However, we extracted some components that had been later assembled into a potential framework that has to be further tested. This framework could be useful to assess the development of DT when used as a self-reporting measure to provide affordable healthcare. Future research should address these issues and further test these results.

Keywords: Design Thinking, Healthcare, Innovation, Human-centred and Bottom of the Pyramid, Framework

Index

Index of Tables

Index of Figures

Acronyms and Symbols

DT	Design Thinking
BoP	Bottom of the Pyramid
LT	Lean Thinking
BMI	Business Model Innovation
NH	Narayana Health
PHIM	Public Health Innovation Model

Chapter 1: Introduction

Healthcare is a universal human need that has been subject to various improvements. Technological advances often shape the quality of health services. However, emerging economies face numerous challenges in providing the best services to their clients (Walton & Matthees, 2017). Leading private hospitals in emerging markets consider the patient's emotional experience rather than just the clinical perspective while reducing costs (Kim et al., 2017). The global healthcare industry is undergoing profound transformations with broad-based economic and demographic challenges. To establish and sustain businesses in this evolving context, organizations need to be able to create novel solutions for multifaceted difficulties.

Organizations need to cultivate the ability to resolve complex and unusual problems, meet unexpected challenges, and adopt an innovative mindset and business model to thrive in a competitive and challenging environment like the healthcare industry. These issues require an innovative mindset and a willingness to change and adapt to the business environment. To stay relevant, businesses need to develop broad-scaled, creative, inter-disciplinary, and human-centred solutions to complex and unusual problems in healthcare provision and management.

With the shift in focus and a new outlook, new markets for services are opening in emerging economies. These markets offer opportunities and require companies to engage with complex, multifaceted problems that cannot be addressed with traditional management tools. Conversely, organizations that use the principles of the Design Thinking (DT) approach and cultivate an innovative mindset have an advantage over their competitors in a socio-economic context that calls for novel problem-solving strategies. Despite its relevance, studies addressing Design Thinking and business model innovation are still poorly represented in the healthcare sector, an environment where a human-centred approach is undervalued (Hwang & Christensen, C. M. 2008).

1.1 Motivation

Health and wellbeing have a tremendous impact on our economy and society. Emerging economies, such as India, are experiencing rising privatization in the healthcare sector. Increasing costs have led to significant demand for affordable healthcare. However,

providers are compelled to offer affordable and quality healthcare due to increasing competition. Hence, organizations continuously adopt innovative practices and human-centric approaches to remain competitive and relevant.

While Design Thinking and innovation are often mentioned within healthcare, their importance is often overlooked or has limited exploration, especially in bottom-of- the-pyramid marketplaces. Although the economic environment reports a need for effective business models, researchers have not been able to consistently analyse the impact of the application of Design Thinking and business model innovations on affordable healthcare in subsistence marketplaces. The absence of a consistent number of studies contributes to the impossibility of exploring affordable healthcare in complexity. Thus, the proposed study will primarily contribute to the development of research related to Design Thinking and its related components on affordable healthcare in subsistence markets. This research will help researchers develop a more in-depth understanding and approach for future research by addressing significant issues on this topic. By adding further clarity to this field, we can also increase the effectiveness of preventive interventions.

1.2 The Objective of the Research

Many innovations in the healthcare sector, particularly in emerging countries, deliver low-cost, high-quality care. However, only a few innovations achieve these efficiencies through new management structures, technology deployment, or business models. Therefore, the primary goal of this project is to explore this matter further and more deeply understand this topic by addressing the following questions: **Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?**

Furthermore, our intended contributions to this study are twofold. First, we provide a general outline of the literature on whether healthcare providers apply Design Thinking to provide affordable healthcare. Second, we analyse the impact of Design Thinking and business model innovations on affordable healthcare in subsistence marketplaces by comparing and contrasting these models. This analysis helps contribute to the existing body of knowledge in management science, places future research on solid bedrock, and constitutes a framework for such research.

1.3 Structure of this Document

The document is structured as follows. First, in the introduction, we briefly develop the topic, followed by the motivation and scope of the work. In the second chapter, a literature review is presented. We will briefly review the background concepts such as Design Thinking and the affordable healthcare market in India from different socio-cultural contexts. We proceed to discuss the business models required for affordable healthcare. We also compare and contrast Design Thinking and traditional approaches. Subsequently, a critical analysis of the selected papers was presented along with the research gap upon which this report was based. Finally, in the third chapter, an appropriate research design will develop this research. Semi-structured interviews were conducted to explore the doctors' voices on Design Thinking. The final point we address on our topic is the results' analysis, discussions, conclusions and limitations.

Chapter 2: A literature review of Design Thinking in Healthcare

Introduction

Many healthcare advances, especially in developing nations, focus on providing high-quality, affordable care. However, few companies really implement new management structures, technological advancements, or business strategies to achieve these efficiencies. To answer the initial research question, the project's primary objective is to go deeper into this issue and obtain a better insight into the subject.

Initial Research Question: **How do healthcare providers apply Design Thinking to deliver affordable healthcare at the bottom of the pyramid (BoP)?**

2.1 A Summary of the Search Trials

This review aims to advance an overview of how Design Thinking (DT) has been used in the healthcare industry. We began with a search of the Web of Science and Scopus databases. The search was limited to publications in the English language from January 2003 to December 2021. We considered this time frame to suggest the beginning of the 21st century and new evolving technology, including new Design Thinking approaches. A combination of both databases was selected to offer a comprehensive search. The search strings that were used are illustrated in Table 1.

Table 1. Summary of Search Trials

SCOPUS	Web of Science
Search Combination #1 TITLE-ABS-KEY ("Healthcare" AND "Design Thinking") This search resulted in 177 documents.	**Search Combination #1** "Design Thinking" (All Fields) and "Health Care" (All Fields) This search resulted in 105 papers (Web of Science, 2022).
Search Combination #2 TITLE-ABS-KEY ("Design Thinking" AND ("Health Care" OR "Healthcare"))	

SCOPUS	Web of Science
This search resulted in 277 documents, significantly higher numbers than combination #1.	
Search Combination #3 TITLE-ABS-KEY ((“Design Thinking” OR “Human-centred design”) AND (“Health Care” OR “Healthcare”)) This search resulted in 567 significantly larger numbers than combinations #1 and #2. Hence, we decided to expand the keywords.	
Search Combination #4 TITLE-ABS-KEY ((“design think*” OR “user-cent* design” OR "user cent* design” OR “human-cent* design” OR “human cent* design”) AND (“innovation” AND “health*”)) This search resulted in 349 documents (Scopus, 2022), significantly lower and more relevant than combination #3. Hence, search combination #4 shall cover all relevant keywords of the research area. Further initial data analysis was performed using R and functions from the Bibliometrics library to explore them.	

2.2 Assessment of the Search Results

The final search results revealed that the keywords used were adequate. It was crucial to identify the keywords that reflected the research topic's key concepts and combine them for an effective search. Furthermore, we optimized the search by using certain limits in databases, such as the timeframe. Reviewing/evaluating the search results was time-consuming. However, it remained a key step in the process. Because initial search results did not yield an adequate number of papers, a second search was useful in databases such as Web of Science and Scopus to achieve the desired result.

For the initial literature review, the search combinations #4 from Scopus and #1 from the Web of Science yielded 349+105, a total of 454 papers. Having conducted a comprehensive search on both databases, we considered this an adequate number for review. Furthermore, a small number of duplications were removed after an initial assessment. Subsequently, the relevance of the peer-reviewed articles was assessed by reading the keywords and abstract. The detailed process is explained in Fig.1. PRISMA diagram.

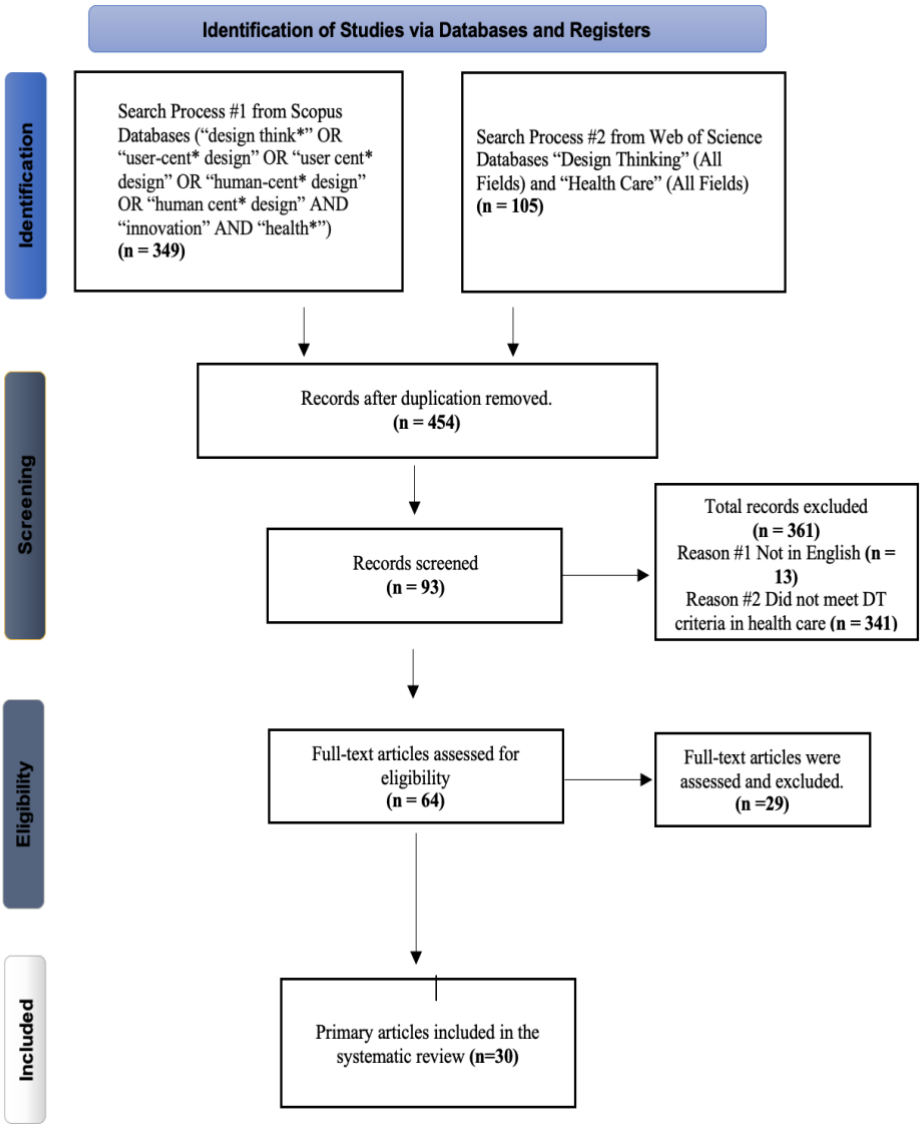

Figure 1. PRISMA Diagram for Screening Articles

2.3 Theoretical Framework

2.3.1 Seminal Papers

While researching the proposed topic and reading the selected papers, we noticed that some papers were cited repeatedly in research papers and review articles. The list of papers below is highly cited and can be referred to as "seminal" or "classic" work. A co-citation analysis tool was used to identify these seminal papers systematically.

Table 2. Selected Seminal Papers

Author(s)	Article Title	Journal	Publication Year
Green et al. (2014)	Towards a design process ontology	The Design Journal, 17(4), 515-537.	2014
Brown (2008)	Design Thinking	Harvard Business Review, 86(6), 84.	2008

Given that there is not a single cogent, comprehensive theory of designing, Green et al. (2014) investigate and rationalize design process ideas as a framework to identify areas where improvements could be added. This approach could be particularly useful for this proposed research topic.

Furthermore, a design process ontology, or a terminological framework, emerges. This framework can accommodate significant developments in design process modelling and identify other significant factors that affect design outcomes. The ontology class hierarchy embeds a wide range of contexts due to the design domain and an Input-Process-Output classification. For example, in the Process class, Motivation, Scale, Path, and Design Process Structures are significant subclasses. However, this paper also identifies some research challenges resulting from the Design ontology.

Brown (2008) was published in Harvard Business Review, one of the most well-known journals covering practice in management science. The author, Tim Brown, is the CEO of IDEO. This example is one of the earliest works of Design Thinking in the healthcare

sector. Traditionally, Design Thinking is undertaken towards the end of the product and service development cycle. Hence, much emphasis has been placed on designing products to be aesthetically pleasing or improving brand perception through effective marketing rather than a user-centric approach.

Nevertheless, in the current environment, innovation is not limited to products but also processes and services. This study offers several examples of how the discipline works. One prominent example is when Kaiser Permanente, a series of frontline hospitals in the United States of America, collaborated with IDEO to redesign shift changes in four Kaiser hospitals. The study began with a close observation of shift changes, and rapid prototyping and brainstorming. This process resulted in streamlined procedures that greatly simplified the exchange of information between shifts. The result was significant; the nurses had more time to care for patients and better-informed patient care, and the nursing staff were significantly content. However, this study is closely related to the proposed research question in different geographic locations and significantly different audiences. In conclusion, this paper should be considered seminal piece of work for the proposed study.

2.4 Design Thinking

Despite various views on Design Thinking (DT), there is still widespread agreement on certain fundamental principles. Brenner and Uebernickel (2016) identified three key aspects of DT: mindset, toolbox, and process. Several key principles characterize a Design Thinking mindset. A mix of divergent and convergent thinking is one of the core principles, and strong attention to both evident and hidden demands of consumers and users and prototyping (Brenner & Uebernickel, 2016). According to Brenner and Uebernickel (2016), Design Thinking integrates micro and macro processes. The micro-process refers to the following steps: empathizing, defining needs, ideating, prototyping, and testing. The macro part of the process comprises milestones embodied in prototypes that meet certain criteria. The toolbox component of Design Thinking involves applying various methodologies and procedures from various disciplines: Design, informatics, psychology, and engineering.

More specifically, Design Thinking can be described as a set of innovative practices with a human-centred design ethos. i.e., innovation based on a thorough understanding of people's needs, wants, desires, likes, dislikes, and everyday behavioural minutiae, by way of

direct observation (Brown, 2008). Design Thinking is about adopting appropriate design methods to meet people's needs and create a consistent business strategy while using feasible technological tools and adding customer value and market opportunity (Brown & Wyatt, 2010).

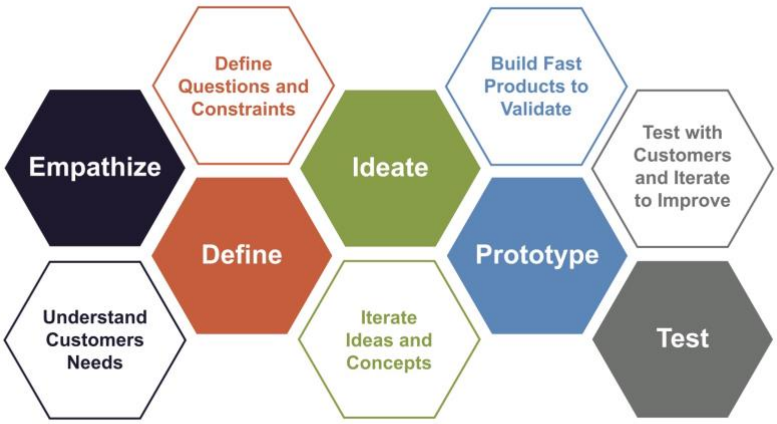

Figure 2. Design Thinking Model: This image is adopted from the Stanford d-school

Source: (web.stanford.edu, 2022)

2.4.1 Design Thinking & Traditional Approaches

Traditional problem-solving and Design Thinking are distinct approaches utilised in solving problems. The medical setting presents multiple challenges compared to other sectors. Thus, it is vital to consider whether Design Thinking can benefit the sector more than traditional approaches, especially in making healthcare affordable at the bottom of the pyramid. Woolery (2019) claims that Design Thinking has depicted greater empathy toward community needs, developed solutions with greater end-user satisfaction, and produced cost-effective processes, more resource-efficient procedures, and a clearer understanding of problems than traditional problem-solving approaches (Abookire et al., 2020). Considering that Design Thinking is a new approach, it is immensely well-known and integrated within most health facilities. But, according to Mishra and Sandhu (2021), traditional approaches are still widely utilized in hospitals compared to Design Thinking.

2.5 Healthcare in Emerging Economies (India)

Healthcare in emerging economies is characterized by a paucity of needed treatments, high costs, health insurance coverage, or a lack of appropriate growth funding for innovators. As a result, several specific barriers exist that limit the existence and efficiency of healthcare within such environments. For instance, only about 40% of the population of India (400 million) had active health insurance coverage by 2018 (IRDAI, 2017). The Government of India launched ambitious health insurance as indicated by the National Health Policy 2017. This means-tested national health insurance scheme had the long-term goal of ensuring universal healthcare insurance. The program aims to upgrade primary healthcare infrastructure across India and provide secondary (specialist consultation) and tertiary care (hospitalization) for free.

Another important factor contributing to dissatisfaction is the lack of adequately trained medical staff (IFC, 2007). This factor, in turn, also results in a lack of trust in healthcare workers (Kiguli et al., 2009). Besides poverty and emergent infectious diseases, trust impediments significantly limit the extent of proper collaboration within healthcare facilities. In addition, the large disparity between the public and private sectors in healthcare creates numerous challenges for patients and businesses. Technological innovation receives more attention in the public sector than process or business model innovation. Process innovation is limited because of the lack of labour flexibility, limiting the implementation of task-shifting models. Long repayment timelines, opaque tendering processes, and corruption make partnering with the public sector difficult for innovators. Healthcare innovation development is limited by a scarcity of experienced entrepreneurs and managers alongside a nascent support ecosystem. Therefore, there are opportunities for new models that improve access to health information and medical professionals while also assisting patients navigating the system, such as technological-based models.

Similarly, despite various challenges, India has emerged as a lucrative market for expansion. However, gaining a foothold in the healthcare sector of an emerging economy requires innovative solutions to unusual business problems. "In recent years, global trends such as globalization, population ageing, technological advancements, and patient involvement have significantly influenced national healthcare ecosystems, prompting them to innovate their industry architecture in a quest for financial sustainability and a shift towards a more encompassing and long-term view towards health" (Ghosal et al., 2015, p. 17).

2.6 Business Model/Process Innovation

The business model is usually thought of as an overarching concept encompassing various constituent parts of a business. Compared to other forms of innovation, Business Model Innovation, or BMI, is relatively 'intangible.' Another reason BMI is considered challenging is because it may require foundational changes in conflict with brand promises, brand expectations, or elements of organisational identity.

Researchers have devoted considerable attention to the failure of Business Model Innovation and identified certain barriers to innovation. These barriers result from organisational awareness, search, systems, logical, and cultural limitations. These difficult-to-identify barriers can be countered with openness, networking, and an affirmative mastery of complex situations and 'wicked' problems. (Von den Eichen, Freiling & Matzler, 2015). Some of the factors that inhibit business model innovation are rigid corporate culture (Stampfl, 2014), internal competition between old and new business models (Frankenberger et al., 2013), search-related factors, and the inability to overcome the dominant industry logic in idea generation, system-related factors, lengthy and inefficient decision-making during the innovation process, external customer rigidities; misalignment with external partners.

Despite the growing popularity of design thinking, there is limited knowledge of firms' application of DT, and no single authoritative view exists on what Design Thinking is. Evidence of the efficacy of Design Thinking in achieving business model innovation is largely anecdotal, and empirical evidence is lacking (Hassi & Laakso, 2011).

2.6.1 Business Models for the Provision of Affordable Healthcare

Business models have emerged as a popular category of analysis because it provides a holistic picture of the business while remaining focused on how value is created in the real world. Business models describe the functionality of an organization with its products and services (Bouwman et al., 2008). They also admit the importance of re-adjusting the model, if necessary, due to the changing conditions, technologies, competitors, and customer demands (De Reuver et al., 2009).

In trying to understand and articulate these attributes of real firms delivering affordable healthcare services within business models, we addressed this puzzle through various healthcare units. We have chosen three Healthcare Units which are representative of the Indian healthcare context to address affordable healthcare using various business models: Dr Agarwal's (innovative, strong vision going global), Narayana Health (hybrid pricing and strong rural network), and Arvind Eye Hospitals (low-cost model). Table 3 presents a summary of business models in affordable healthcare.

Table 3. Summary of Business Models in Affordable Healthcare

Provider's name	**Speciality**	**Year Founded**	**Location**	**Legal Status**	**Business Model**
Dr Agarwal's	Eye diseases	1957	India Global	Private for-profit	-Innovative technologies -Strong vision and management
Narayana Health	Multi	2000	India	Private for-profit	-Innovative technologies and management practices -Hybrid pricing model -Strong rural network
Arvind Eye Hospitals	Eye care	1976	India	Private for-profit	-Low-cost model

2.7 Perspectives on DT and Healthcare in different countries

Our focus within this investigation was to delineate the Healthcare sector and explore how providers apply Design Thinking with a particular interest at the bottom of the pyramid (BoP). An in-depth literature review of 30 articles revealed that many authors have written about Design Thinking from different perspectives (Annex-A). As a result, the most important perspectives in this study were classified into multiple region-based categories – USA, UK, Asian countries, Europe, Australia, Africa, and global perspectives. Given that the number of studies reporting on affordable healthcare at the BoP was considerably lower than the rest of the studies, we decided to draw on our particular interest in these studies without attaching different categories. The literature review concludes with a

discussion of the gap in the literature. Thus, a foundation is laid for further empirical research on Design Thinking and business model innovation for affordable healthcare in emerging markets.

2.7.1 Perspectives on DT and Healthcare in the USA

Several discreet contributions to implementing a Design Thinking Model in US Healthcare can be observed in the research literature. Brown (2008) proposes a Design Thinking model to improve product and process development innovation. Although it does not consider empirical trends, it encompasses a cyclical interpretation of the design thinker's system dynamics for interpreting human behaviour. Moreover, Chokshi and Mann (2018) suggest a comprehensive model for digital innovation in the medical field without a concrete implementation strategy or any consideration of empirical trends. Brennan et al. (2010) formulate a standard and identity management approach for personal health information systems using design-centred prototypes or computer applications.

There is also a focus on the rationales one can apply in Design Thinking. In an intuitive research model, McDonagh and Thomas (2010) suggest a rationale for design thinkers to formulate Design Thinking factors. Similarly, De Ana et al. (2013) and Silver et al. (2017) formulate an innovative rationale for aligning the Design Thinking process with the spiral innovation process, focusing on an educational approach to design healthcare. Niccum et al. (2017) also approached medical education by following a thematic interpretation of the design thinker's system dynamics for Innovation and Entrepreneurship (I/E). Furthermore, Vechakul et al. (2015) develop a rationale for social innovation for community engagement using the Design Sprint model and a critical overview approach.

On the other hand, their study's research design focuses on public health problems and lacks universal application. This point also applies to the contribution of Lister et al. (2019) when they introduce the Public Health Innovation Model (PHIM) for strategic integration of innovation in public health. Although it also elaborates on the principles of cross-collaboration, community buy-in, and rapid prototyping for enhanced user experience, the study does not relate to the practical application of the PHIM model.

The issues in the Design Thinking process with community engagement and the process for identifying challenges are enunciated by Coons et al. (2016). Interestingly, human-centred research, collaborative and varied cooperation and fast prototyping are considered

by Roberts et al. (2016) when approaching complex healthcare problems with Design Thinking. The healthcare challenges in the US are significantly different from those in BoP markets. Zuber and Moody (2018) make another interesting contribution. The authors propose empathy mapping to guide the design of decision-making processes for improving innovation. This innovative rationale is for design thinkers to formulate Design Thinking factors. Dopp et al. (2019) also propose a challenging approach, introducing a glossary of various user-centred categories of the system design process using hypothetical medical intervention. The illustrated terms are related to applying tasks and processes, organizational culture, collecting data and analysis, designing methodologies and tests to target users, developing personas, and enhancing collaboration, or prototyping. Holeman and Kane (2019) have an ambitious objective for global health equity. They focus on the formulation of the design concept to integrate digital technology into global healthcare.

In brief we could say that these models are ambitious and innovative, focusing on both the products and users. These approaches should be considered relevant first steps in envisioning a framework for Design Thinking in healthcare.

2.7.2 Perspectives on DT and Healthcare in the UK

Design Thinking and healthcare in the UK seem to focus mainly on adding innovation into people's social life by finding the best tools to approach this area of interest. Although there is no unique approach to address this matter, researchers add their personally notable contributions in this area. In the Greenhalgh et al. (2010) study, the authors introduce a socio-technical framework to analyse the user-centred design techniques for patient adoption and use. A major omission of the study is not establishing fundamental and defined criteria for this model. De Couvreur and Goossens (2011) propose an open, innovative approach to studying the cognitive needs of patients in the healthcare setup and illustrate the use of personal assistive artefacts. The main contribution of this paper combines modern digital approaches (e.g., crowd sourcing, user, and peer content) while bringing together a variety of specialists (e.g., occupational therapists, patients, and other stakeholders, in addition to experts in design.). To highlight various design issues in developing special assistive technology, O'Rourke et al. (2014) disclose a method for customizable special access technology and draw attention to poor device design, a major issue in integrating better user-centred experiences when developing devices. The cost-benefit analysis of low-cost devices is not elaborated, limiting the information on special

access technology development in research work. Valentine et al. (2018) presents a strategic framework for building a Design Thinking culture in health care for social innovation. According to the authors, design for social innovation involves mindfulness, in-depth listening, critical observational thinking, mental and physical agility, humility, and resilience. It also calls for a group effort or a dynamic, networked community of individuals rather than an individual one. The study uses design theory for the social care model and limits behaviour influence, strategic mapping, and behavioural structuralism loopholes for the healthcare model.

2.7.3 Perspectives on DT and Healthcare in China, Japan, and India

Uehira and Kay (2009) underlined that the application of Design Thinking increased the quality of patient care in Japanese hospitals. The authors suggest ample opportunities behind user-centric innovations in Japanese healthcare settings while offering insights into the hospital patient experience. The lobby has a significant role in the patient experience as a whole. Negative patient experiences like waiting and getting around are not appropriately addressed. Patients go from anxious to irritated to bored as their hospital-visit frequency rises. The patient's desire for interaction with the environment while waiting is influenced by the severity of their sickness and the amount of their activity. Kiosks with maps and waiting time information help others and cater to the immediate demands of concerned patients. The physical atmosphere of the hospital is varied by modular design pieces that are changed periodically. They give context to the regular interactions between sales employees and client hospitals. The research objectives of this study do not consider the healthcare design settings compared with other product development processes.

The health of the ageing population in China was considered by LeRouge et al. (2013) when articulating that the conceptual Design of this population can be used as an input for the development of Consumer Health technologies (CHT). The user-centred design gives a user-centred model for the special care needs of diabetic patients in China. Besides the fact that the research does not fulfil the objective criteria of a Design Thinking system, it is solely focused on the Chinese population without considering diabetes trends globally. Narayanamurthy et al. (2018) propose a lean-thinking (LT) model and develop a framework for LT implementation in health centres. Location-specific approaches, such as India, are used to measure the performance before and after implementing lean methods at

a specific hospital. The long-term consequences of LT implementation in healthcare and a suggested framework for implementation should be tested in different healthcare settings.

2.7.4 Perspectives on Design Thinking and Healthcare in Europe, Australia, and Africa (Australia, Norway, and Kenya)

A team of Australian researchers (Woods et al., 2018) suggested an innovative participatory user-centred approach for designing and developing a mobile health (mHealth) application. In developing the application, the authors collected from the participants their viewpoints based on user-experience, key attributes, and priority functions that they consider important for this application. This approach fostered engagement with multiple stakeholders and interdisciplinary working groups but did not solve complex and integrated design processes in various healthcare settings.

Eines and Vatne (2019) used focus group interviews and tested an innovative Design Thinking approach in a nursing home in Norway. Four discourse themes emerged from the interviews: discussions concerning the employees' participation were raised when innovative approaches were employed to find solutions, discussions on competency recognition, discussions about scepticism - separating oneself from the initiative, and discussions about the lack of involvement and information. The authors draw attention to the need for a collaborative team when using Design Thinking throughout the many stages of the innovation process.

Viljoen et al. (2021) suggest a multi-layered solution using elements of design principles elements to design a prototype and, subsequently, a solution in the Case of Noncommunicable Diseases in Kenya. The major contribution of the authors supports community users in the BoP market by applying the DT principle within a mobile-based healthcare application. Their proposed solution needs further validation to be used on a large scale.

2.7.5 Global perspectives on DT and Healthcare

As a result of a reunion held in the IOC (International Olympic Committee) context, it was delineated to identify knowledge areas for implementing the user-centred Design in treating chronic diseases (Matheson et al., 2013). Attendees agreed to a plan to prevent and manage

chronic illness. It consisted of the following points: 1. All therapeutic efforts to prevent and treat chronic illness should focus on behavioural modification. 2. Create real centres to design, research, and enhance chronic illness prevention strategies. 3. Create preventative programs using human-centred design principles, quick prototyping, and several iterations.4. Expand the expertise of specialists in sports and exercise medicine (SEM) to create fresh approaches to prevent and manage chronic illness that emphasize exercise, food, and lifestyle changes. 5. Organize resources and use networks to grow and disseminate preventative activities. The approach did not incorporate the hands-on Design Thinking model for treating chronic diseases, but it did discuss methods for implementing the user-centred Design to treat chronic diseases. Additionally, the participant consensus was not oriented toward implementing Design Thinking to treat non-communicable diseases. Similarly, due to a European-level project, McLoughlin et al. (2013) propose a user-led innovation process to form a co-production mechanism in developing telecare systems for the elderly. This study was completed in two pilot locations: Italy and the Czech Republic. The focus was to develop an information system model to integrate the human-centred Design with telecare systems for the elderly. The research paper identified that engagement of those who provide service to users and end-users had been a significant problem in the process. The qualitative approach limits the generalization of the results. The study also neglects the modular elements, such as the subject population's abnormal human perception of digital literacy. In a review entitled 'Design Thinking Healthcare Intervention Approaches,' Altman et al. (2018) explore Design Thinking approaches in health intervention methods. Although it formulates a critical appraisal method to benefit design-thinking approaches over traditional healthcare interventions, the study does not define an implementation pathway.

Furthermore, a systematic review by Oliveira et al. (2021) proposes DT in a three-phase approach, with each phase's objectives customized. While using DT principles for innovative approaches in low-resource situations, the study suggests a framework for addressing the development and innovation of healthcare by finding a balance between contextual factors. The authors conclude that future interventions should combine Design and health and follow rigorous standards.

2.8 A Synthesis of the Literature Review

This review aimed to advance an overview of how Design Thinking (DT) has been used in the healthcare industry. The primary goal was to explore this matter further and gain a deeper understanding of the topic by addressing the research questions. More specifically, we intended within this investigation to delineate the Healthcare sector and explore how providers apply Design Thinking with a particular interest at the bottom of the pyramid (BoP). An in-depth literature review of 30 articles revelated that many authors have written about Design Thinking from different perspectives (Annex-A).

After considering the literature review in Annex-A, it is clear that Design Thinking has significant advantages for the bottom of the pyramid and the general healthcare sector. Unlike traditional problem-solving techniques, the approach empathizes with patients and ensures that their medical needs are met. Thus, it is vital to critically analyse if all medical facilities should integrate Design Thinking into affordable healthcare services. Most of the analysed studies used a generalized approach within a qualitative methodology without much consideration for empirical steps within the field, different challenges from BoP markets, or applicable design implementation.

The studies in the literature review did not assume causality. Most of them do not consider the health trends or they do not give a defined pathway of implementation. The analysed articles do not fulfil the objective criteria of a Design Thinking system in the healthcare system. The majority of them do not give a defined pathway of implementation or consider evaluating human settings and socio-cultural elements in the analysis. We could also take into consideration a larger variety of samples in the studies to come.

Although the quantitative methods are considered more robust in the scientific research, many of the papers expressed a preference for the qualitative approach and even developed a rationale for using qualitative methods when exploring Design Thinking models within the healthcare field (e.g., Brown, 2008; Niccum et al., 2017). The capacity of qualitative research to explore more in-depth particularities of Design Thinking seems to surpass quantitative data approaches. However, we could not identify a strong comprehensive Design Thinking framework regarding healthcare, especially at the BoP level. The need for a consistent vision in adopting Design Thinking and innovation models within an effective framework in BoP healthcare settings is still a desideratum to achieve. On the other side, we do consider the valuable groundings established by the recent study of Oliveira et al.

(2021) which suggest that future interventions should combine Design and health as well as follow rigorous standards.

Chapter 3: Methodological Approach

Introduction

The research question is directed by using a qualitative research approach best suited to guide the investigation. Although quantitative methods are frequently considered more robust methods (Smith, 2009), given the larger number of variables that might interfere in a qualitative study, they might not always include insightful perspectives of study. The examination of the way doctors employ Design Thinking is evident in the use of interpretive design approaches and techniques like interviews to interpret participants' emotions and inner thoughts (Haidar, Arif & Abbas, 2020). Being qualitative in nature, the study doesn't adopt a realistic ontology dominated by physical principles of cause and effect (Smith, 2009). Interpretivist thinking is more interested in subjective reality by following more profound variables of study and aspects associated with a context, and by considering that humans, given their more-in depth production of meanings, cannot be investigated in the same way that physical phenomena can (Alharahsheh & Pius, 2020).

3.1 Research Question and Objectives

Based on the critical analysis of the literature review, by acknowledging the gaps of the previous research studies that did not apply a Design Thinking framework to provide affordable healthcare at the bottom of the pyramid (BoP), we can now formulate our research question(s):

Do healthcare providers apply Design Thinking (DT) to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

The primary goal of this section is to establish whether doctors in Indian Healthcare apply DT within their field, at the BoP level. Furthermore, this study explores if the potential use of DT provides affordable healthcare in this context.

The second objective focuses on how DT is applied if it is found to have implications in this respect. The particularities we will consider are the elements of DT and most of all the presence of a framework and its components.

The achievement of the third objective will be found in exploring the insights from interviews with surgeons in Indian Healthcare through employing content analysis. Then,

the outcomes are discussed, and conclusions are made based on the relevant aspects that will emerge from here.

This study will be an explorative study by identifying new information and updating previous ones. DT in Indian Healthcare at the BoP level is still a recent topic of study that needs to be explored and developed further. This explorative study uses primary research data which are gathered directly from surgeons working in Indian Healthcare settings.

The qualitative research will also add its contribution by exploring Indian doctors' voices about DT in semi-structured interviews. The interviews have allowed that participants in the study open and for us to gain crucial insights into this matter. We considered that 15 interviews are an adequate number to gain some variability and to obtain proper insights and volume of information.

3.2 Research Design

Design science research focuses on designing and developing artifacts that contribute to theory and practice (Venable, 2006). Health care systems require continuous innovation to meet the needs of patients and providers. These stakeholders are not always considered when designing new interventions or system processes. The consequences are unused products because human context, need, or fallibility is not considered. As a result, intervention development and implementation have experienced decades-long gaps. Therefore, incorporating user feedback and needs into the development process using Design Thinking can help close that gap.

Design Thinking emphasises empathy for users, working in collaborative multidisciplinary teams, and using "action-oriented rapid prototyping" to develop solutions. It is an iterative process, with innovation emerging only after several cycles of ideation, prototyping, and testing. Thus, it differs from the traditional linear, top-down design of health interventions.

3.3 Participants

The participants of this study were fifteen medical doctors (surgeons) in a few Healthcare Organizations in India. About half of the participants were cardiac surgeons whereas the rest of the participants are senior eye surgeons. The presented organisations are all hospitals specialized in eye care or multi-specialized. Providing health care for many

patients and having tradition in the field, they are located in Indian cities or even extended their activity outside India.

Table 4. Interviewee Effective and Their Position in the Organization

Organization	Number of interviews + Interviewee position	Area	Focus	Number of beds	Founded in	Location	Country
Aravind Eye Hospitals	#1 senior eye surgeon #2 eye surgeon #3 senior eye surgeon within top management position	Hospital care	Eye care	4000	1976	Chennai	India
Dr Agarwal's	#1 eye surgeon #2 senior eye surgeon within management position #3 senior eye surgeon #4 senior eye surgeon (regional head of clinical services) #5 senior eye surgeon (regional head of clinical services)	Hospital care	Eye care	–	1957	Chennai and Coimbatore	India, Ghana, Mauritius, Mozambique, Nigeria, Kenya, Rwanda, Tanzania, Madagascar, Uganda, and Zambia
Narayana Health	#1 senior cardiac surgeon #2 cardiac surgeon #3 cardiac surgeon within management position #4 senior cardiac surgeon #5 senior cardiac surgeon within top management position #6 cardiac surgeon #7 senior cardiac surgeon	Hospital care	Multi	5859	2000	Bangalore	India and Cayman Islands

The organizations that agreed to take part in the interviews have a large experience in healthcare and are listed in the table below.

Aravind Eye Hospitals have the longest tradition in the field whereas Narayana Health are the most recent ones. It aims to deliver quality healthcare that people can afford in all of India, maintain consistently high profitability and generate long-term value for its shareholders, even though large segments of the population lack paying capacity (Sharma, 2013). Corresponding to the profit -maximising, the external aspect of the NH business model is an intra-organizational work-culture of efficient frugality that emphasises serving the poor. This approach corresponds to profit-maximising. The NH business model successfully combines innovative technologies and management practices with an efficient delivery system.

Dr Agarwal's is an eyecare chain in the private sector in India with a large global presence (Sharma, 2020). The Dr Agarwal Eye Hospital Group has established its grounds in the ophthalmology field by focusing on innovation and using new advanced modern procedures (Sharma, 2020). It has a well-organised group of doctors who are members of the Clinical Board, which is responsible for strategic planning for patient outcomes, patient safety, and adequate education and training to learn new skills in the job. To train young, aspiring surgeons, the group also offers postgraduate and various fellowship programs. Offering a diversity of specializations, these hospitals are representative for Indian healthcare.

Semi-Structured Interviews

Given the benefits of DT, we decided to construct an interview guide in which we employed the main iterative steps of the DT process: empathy, ideation, prototyping, and testing (Groeger et al., 2019). It was developed using the knowledge gained from the previous review. These questions were reviewed by specialists in healthcare and DT to be developed in a form that would be pertinent and understandable for professionals working in the healthcare field that might be aware or not of DT. We have adjusted the questions so that they would be digestible for professionals in healthcare. For example, instead of using 'mindset' in the Ideation section, we preferred 'set of beliefs' to be more convenient for our audience.

The semi-structured interview guide included 10 questions organized in 3 sections:

empathy – understanding customers' needs, working in a collaborative context

ideation – using creativity at work, sets of beliefs, generating ideas, finding solutions, innovation

prototyping and testing – clients' satisfaction, obtaining feedback, prototyping of new solutions, user testing.

Table 6 are the interview questions that were addressed to the participants:

Table 5. Interview Guide

(1) EMPATHY
How do you proceed for understanding your customers and their needs?
Can you describe your working experience in a collaborative context/with a multidisciplinary team?
(2) IDEATION
Do you apply creativity in your work? How?
Which are the sets of beliefs you usually apply in your work?
How do you generate ideas and assemble them into tangible solutions?
Do you consider using a holistic approach to innovation?
(3) PROTOTYPE AND TESTING
When do you know that your clients are satisfied?
How do you obtain feedback from your customers?
Do you use prototyping of new solutions in your healthcare field?
Do you improve your ideas through user testing?

The interview guide contained the 10 questions above and the participants were invited to discuss their own experiences in their organizations in response to the questions. To assume validity in our research we have used member check by double checking with the participants in the study the accuracy of their answers (Koelsch, 2013). Additional questions were asked if there was a need to clarify the meaning of the participants' thoughts. Furthermore, all of the acquired data was confidential and was only utilized for the current study. The names of the doctors are pseudonyms to protect respondents' confidentiality.

Qualitative methods can be ideal for opening delicate topics, such as health care practices in the hospitals, or for exploring perspectives that other way would remain undisclosed (Queirós, Faria & Almeida, 2017). The majority of the questions in the interviews are open ones. Unlike structured interviews, semi-structured ones offer more possibilities to acquire information from others as well as a more detailed description of a person's experience (Mueller & Segal, 2014). Therefore, it is a suitable technique for exploring the discourse of surgeons. This type of interview offers more freedom in terms of conversation subjects, as there are no pre-determined guidelines boundaries to be explored.

Chapter 4: Results and Discussion

Introduction

We analysed the data starting from DT steps (empathy, ideation, and prototype and testing) and with the focus on the categories and themes that emerged from the interviews. The first analysis step focused mainly on a basic understanding of the text (the first reading of all participants' answers to the same question) and its interpretation to form sequences of meaning (coding procedure, highlighting important words or phrases). Writing brief descriptive that included keyword-like summaries and finding commonalities appearing in each response was the outcome of the initial text analysis. Main categories were then created by grouping together similar characteristics and when these categories grow too long and are no longer meaningful, they are broken into smaller groups.

After conducting the qualitative content analysis, we summarized the main findings to present them in this section.

4.1 Empathy

To understand patients' needs, most doctors suggested it is important that they make patients feel comfortable and earn their trust. This might be also due in part to the conditions in the Indian hospitals (e.g., the scepticism in the healthcare Indian system). For example, I8 reports that 'a hundred years after the first heart surgery less than 20 % of the world's population can afford it, and 80 % of the world's population is a silent bystander'. Another emerging category was 'doctors' attitudes toward patients' that included attitudes such as respect, addressing patients' needs/concerns, preferences, or barriers, and adding explanations to foster their understanding/ build relationship. A participant in the study, Dr GN, confirms the attitudes of doctors towards patients. He said that the success of patient education depends on the success of your assessment of a large number of patient-centred factors. Effective communication was also relevant for several doctors, along with care planning or consulting the patient's previous records.

Collaborative contexts and multidisciplinary teams were essential: 'It is of utmost importance to collaborate with a team to ensure that the patient's needs are met more holistically. Working with a multidisciplinary team made me feel more efficient and more satisfied with the care we were giving to our patients' (Dr SRK). Although doctors

consented that it enhances cooperation, active listening, and faster outcomes, they have also identified various challenges: accountability, conflict management, decision-making, reflection, coaching, expertise, time and money, and the absence of an evidence-based framework.

For instance, Dr NVP admits that 'the main focus of such a team should be developing new and powerful wearable health applications, but this requires time, money, and a combined expertise of many different disciplines.' Doctors acknowledged the potential lack of collaborative implementation contexts or multidisciplinary teams in their settings.

4.2 Ideation

Most participants suggested they have used creativity in their work, which can even be a great tool for sorting out things. For example, despite medical skills, creativity was a plus when a diagnosis was not obvious ('not by the book'). Creativity was also linked with re-imagining things, better delivery in healthcare, creative thinking, and adopting elements from other industries. Dr NVP gives an example of how he uses creativity with his patients, saying that 'creativity is a must, especially when I am in a brainstorming session and an employee comes up with the idea that I disagree with. "No" sends a negative message, meaning that I should find ways to reimagine his concept so that my answer will be a positive one.'

The most important beliefs that surgeons reported applying in their work were the importance of respect and staying focused on their work activity. The testimony of a surgeon is very suggestive in this sense: 'I believe that respecting my work and my patients is of paramount importance. If you respect what you do, you will always have the best interest at heart, which will motivate you to help the patient with focus and dedication' (Dr GS).

Other secondary beliefs were related to work ethic: 'To my mind, having a solid work ethic is extremely important because people with a good work ethic place a high value on their professional success and exhibit moral principles that make them outstanding in their field' (Dr GN).

Integrity was also mentioned: 'What is more, staying focused and motivated as well as proving the integrity toward my organization is essential to the good functioning of my work' (Dr GN).

Honesty, a positive attitude, taking responsibility, enthusiasm, and confidence were also considered relevant among doctors. For instance, the surgeons usually expressed several beliefs during the interview: 'The sets of beliefs I usually apply in my work are as follows: work ethic, respect amongst co-workers - whether a senior or a very junior staff - motivation at the workplace, positive attitude and atmosphere, confidence in accepting a challenge, and vision to move ahead in life' (Dr DP).

Developing and assembling ideas into tangible solutions were mainly acquired through brainstorming and innovation. Adding improvements to previous ideas along with collaboration or simply sitting down and discussing with co-workers, patients, or other medical professionals could also be helpful. Visual thinking, storytelling, and mind mapping were other interesting methods to generate ideas and implement solutions.

Surprisingly, one of the surgeons truly considered these kinds of methods:

'Storytelling is exactly like it sounds: the ability to weave together a story rather than just making a series of points. Storytelling is a close relative of visualization — another way to make new ideas feel real and compelling. Visual storytelling is the most compelling type of story. All good presentations — whether analytical or design-oriented — tell a compelling story' (Dr CJ).

Another surgeon, Dr IAC, added: 'I generate ideas through brainstorming and assemble them with mind mapping.'

However, these methods were not mentioned by the majority of the participants as compared to brainstorming or innovation.

Finally, holistic approaches to innovation were preferable to classic ones. For example, Dr JK suggests that 'sometimes, it is crucial to see the patient as a whole and not as separate working systems. By doing this, you find all the possible causes of the problem.' According to the participants, they provide a better understanding of people's needs, encourage collaboration, and maximize outcomes.

4.3 Prototype and Testing

Surgeons perceived their patients as being satisfied through direct communication, assessments, or other types of feedback (e.g., reviews, social media interactions, recommendations). For instance, surgeons noticed that 'receiving positive feedback is a

great sign that the patient is satisfied with the care. When they are happy, they do not hesitate to post reviews of their experiences on their social media handles and at other places across the web' (Dr GN). Other relevant information was if patients came back to the clinic or if they seemed happy.

Most feedback was reported to be obtained through surveys. Forms were also mentioned along the surveys: 'Feedback is critical. Both feedback forms and engagement surveys are some of the most important tools', says Dr SRK. Doctors may ask for feedback directly during consultations or in other cases patients usually respond to follow-up emails. Interestingly, it was also mentioned that feedback may be a part of other teams' processes (e.g., community support, customer care).

The majority of the participants reported they used prototyping of new solutions in the healthcare field. The use of prototyping was directly linked with technology advancements and finding effective solutions. Other advantages were that it can help save time and money.

Participants agreed that they also improved their ideas through user testing. Similarly, user testing was thought to maximize resources (time and money saver). It was also considered a useful tool for innovation and medical healthcare development, especially because it inspires and facilitates insights (e.g., which part of the product is helpful) by addressing users' struggles.

The participants in this study seem to have knowledge about different steps of the DT process, even though they do not seem to have a big picture of DT. Although they might talk about different components of DT, they are not always insightful. Furthermore, several participants have more of an intellectualized language which hampers them from expressing more meaningful ideas. More specifically, their discourse seems to convey more with a predefined rationale than with an actual insight of things. Overall, the participants expressed distinct ideas and we could not identify the presence of a framework or if the potential use of DT provides affordable healthcare in this context.

Given these results, we further investigated the various constructs that we could identify while analysing the data.

Table 6. The observed constructs in the text analysis

CONSTRUCTS	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**Q**	**R**
TOTAL COUNTING	**12**	**6**	**14**	**11**	**13**	**6**	**14**	**10**	**3**	**8**	**7**	**3**	**6**	**13**	**5**	**3**	**3**	**4**
Dr MS	X	X	X	X	X	X	X	X			X			X	X	X		
Dr GN	X		X		X	X	X	X	X	X	X		X	X		X		X
Dr SRK	X	X	X	X	X		X							X	X			
Dr NVP	X	X	X	X	X		X	X		X	X	X	X	X	X			
Dr MR		X	X	X	X		X	X					X	X				
Dr DD			X	X	X	X	X	X	X	X	X	X	X	X			X	X
Dr RV	X	X	X		X	X	X	X		X				X	X			
Dr PB	X	X	X	X	X		X	X			X			X				
Dr AG	X		X	X	X		X	X						X				X
Dr CJ	X							X	X	X			X	X				
Dr DP			X		X		X	X		X	X	X			X		X	
Dr GS	X		X	X			X							X		X		
Dr JK	X		X	X	X	X	X			X							X	X
Dr HS	X		X	X	X	X	X							X				
Dr IAC	X		X	X	X		X			X	X		X	X				

The analysis of the responses in the interviews with doctors resulted in a number of 18 constructs.

A. Empathy/Empathic

B. Education centeredness

C. Multi-/inter-/cross-disciplinary collaboration

D. Teamwork

E. Creativity

F. Critical thinking

G. Holistic view/consider the problem as a whole

H. Open to different perspectives

I. Experimentation or learn from mistakes

J. Learning oriented

K. Experiential intelligence/Bias toward action

L. Resilience/Resilient

M. Mindfulness and awareness of process

N. Patient/User centeredness

O. Affordable healthcare

P. Equity

Q. Values efficiency

R. Innovation oriented

A measure of DT constructs is relevant for research and practice by measuring the impact of distinct factors and creating design frameworks that are more balanced and comprehensive.

Definition of the DT Constructs

A. Empathy/ Empathic – Having empathy or being empathic refers of showing empathy among patients and colleagues, also operating within collaborative multidisciplinary group (Saidi, 2021).

B. Education centeredness – Focusing on an educational approach to design healthcare or improving health care solutions and develop educational experience for patients (Silver et al., 2017).

C. Multi-/ inter-/ cross-disciplinary collaboration – A connection between people from various disciplines, the importance of interorganizational networks and coalition building (Lister et al., 2018).

D. Teamwork – The need of working in a team during the various phases of Design Thinking (Eines et al., 2019).

E. Creativity - Healthcare is under increasing pressure to use creativity and innovation to address important health issues, enhance quality and access, and lower costs (Zuber & Moody, 2018). According to Zuber and Moody (2018), there are many techniques and instruments accessible in this stage of the approach, even though brainstorming is probably the part of human-centred design that is most well recognized.

F. Critical thinking – Formulating a critical appraisal method to benefit design-thinking approaches over traditional healthcare interventions (Altman et al., 2018).

G. Holistic view/ consider the problem as a whole – The integrative nature of the design approach, examining the situation from various perspectives and identify connections between various factors (Lam, 2017)

H. Open to different perspectives – Taking into consideration novel ways to approach a situation or potential ways of resolving a problem (Roberts et al., 2016).

I. Experimentation or learn from mistakes - Alternate between divergent and convergent modes of thought and to testing and make use of an iterative process (Dosi et al., 2018); failure is viewed as a chance to explore new options and an opportunity to learn (Avsec, 2021).

J. Learning oriented – Being focused on the learning outcomes of Design Thinking and applying learnings in new ways (Taheri et al., 2016).

K. Experiential intelligence/ Bias toward action - Designers have long recognized and utilized experience components to improve client interactions with products (Clark & Smith, 2008). Experience-based intelligence is the capacity to comprehend and utilize all five of the senses to create innovation tangible, recognizable, and dynamic (Clark & Smith, 2008).

L. Resilience/ Resilient – Considering elements of a Design Thinking approach while tolerating ambiguity, deal with uncertainty, and manage failure (Repchick & Barrella, 2020).

M. Mindfulness and awareness of process - Design Thinkers understand the process because they are aware of where they are in it, whether they are in a converging or diverging phase, and if they need to be very generative or converge on a solitary path to the resolution at a given time (Schweitzer et al., 2016).

N. Patient/ User centeredness - Design thinking can be described as a set of innovative practices with a human-centred design ethos. i.e., innovation based on a thorough

understanding of people's needs, wants, desires, likes, dislikes, and everyday behavioural minutiae, by way of direct observation (Brown, 2008). Design thinking is about adopting the appropriate design methods to meet people's needs and create a consistent business strategy while using feasible technological tools and adding customer value and market opportunity (Brown & Wyatt, 2010).

O. Affordable healthcare – Implementing innovative solutions that are affordable, robust, and feasible over time (Anderson & Billou, 2007). It is a relevant fact for developing countries, especially their rural areas. Efficiency also depends on socio-cultural realities and economic affordability of the countries.

P. Equity – It relies upon understanding the main role of social determinants of health in influencing individuals' contexts, options, and behaviours— and consequently their health outcomes (Golden & Wendel, 2020). A major preoccupation of equity refers to policies, structures, and structures that circumscribe individuals' choices, access, and information.

Q. Values efficiency - All kinds of efforts and system of values related to improving efficiency in organizations based on the use of various tools and techniques and implementing change strategies (Wyrwicka & Chuda, 2019).

R. Innovation oriented - Innovation in healthcare companies and hospitals typically entails new services which can provide considerable benefits (Clack & Ellison, 2019).

We have observed that the identified constructs are very different in each participant's discourses. However, starting from these constructs, we can propose an integrative DT framework for affordable healthcare in Indian settings that has to be further tested.

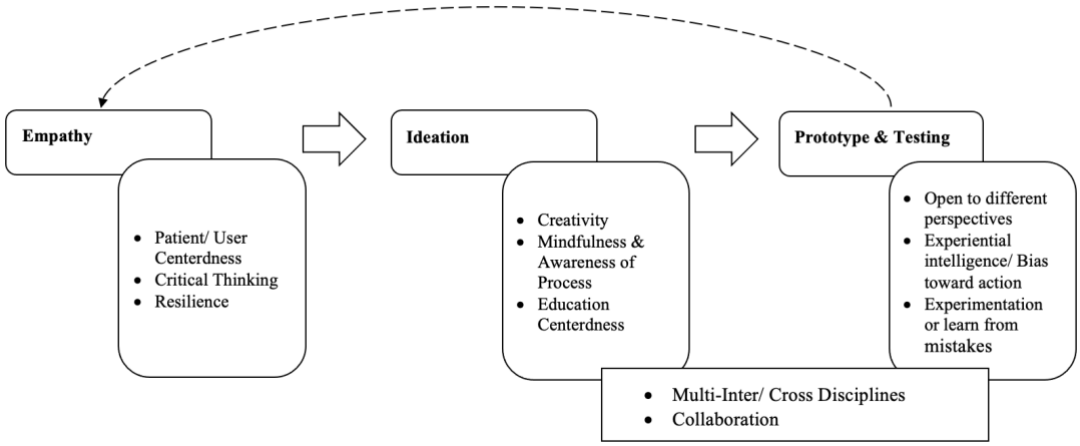

Figure 3. Integrative Design Thinking Framework (a)

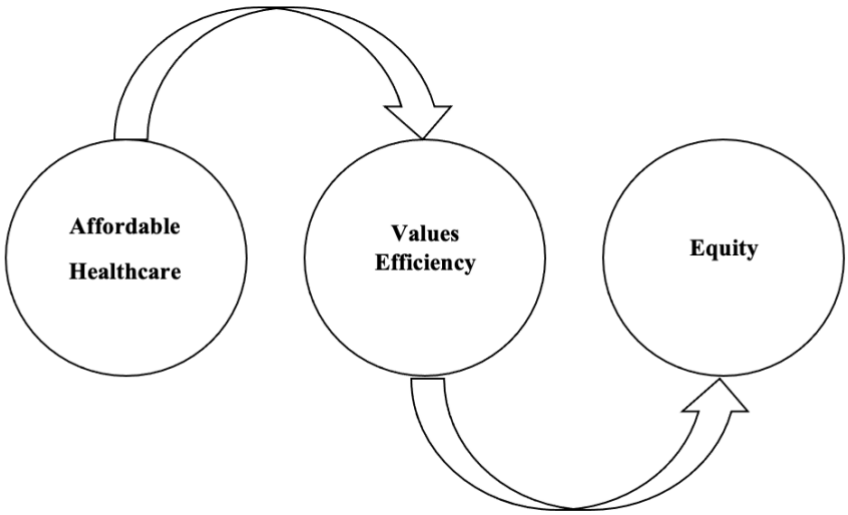

Figure 4. Integrative Design Thinking Framework (b)

We considered the DT principles and elaborated the framework given the constructs we identified within the interviews. For each step of the DT, we suggested specific significant elements that could be addressed in the future research in the healthcare. Education centredness was also considered to be a focus in this framework along with multi-inter/ cross disciplines, collaboration, and teamwork. Several principles and values-related aspects in our focus were also stated: affordable healthcare, values efficiency, and equity.

Chapter 5: Conclusions

Evidence of the presence of DT and the interest for it in healthcare suggests that Design Thinking has notable implications in this respect. Either one follows DT principles in a technical way or intuitively, DT is not something to be neglected in healthcare. A concerning aspect is applying DT with no robust groundings that could be useful.

A lack of technique and interest for finding best solutions in the organizations could affect the outcomes. Even though there are different contributions to DT, there still are many facets that need to be discover.

This study aimed to explore the applicability of DT in Indian Healthcare at the BoP level and its potential to provide affordable healthcare in this context. The main questions we intended to address were: Do healthcare providers apply Design Thinking (DT) to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

We conducted a content analysis to explore insights of Indian surgeons into this matter. The outcomes suggest that Indian physicians are still facing a lot of challenges when considering applying DT in healthcare but remain open to acknowledging it and experimenting with it more.

The participants in this study seem to have knowledge about different stages of the DT process, even though they do not seem to have a big picture of DT. On the empathy stage, most doctors suggested it is important that they make patients feel comfortable and earn their trust. Another emerging category was 'doctors' attitudes toward patients' that included attitudes such as respect, addressing patients' needs/concerns, preferences, or barriers, and adding explanations to foster their understanding/build relationship. Effective communication was also relevant for several doctors along with care planning or consulting previous records of the patient. Collaborative context and multidisciplinary teams were considered to be essential. Although doctors consented that it enhances cooperation, active listening, and faster outcomes, they have also identified various challenges: accountability, conflict management, decision making, reflecting on progress, coaching, expertise, time and money, and the lack of evidence-based framework. Doctors acknowledged the potential lack of collaborative implementation contexts or multidisciplinary teams in their settings.

On the ideation stage, most of the participants suggested they have used creativity in their work, and it can even be a great tool in sorting out things. Creativity was also linked with

re-imagine things, better delivery of healthcare, creative thinking, and adopting elements from other industries. The most important beliefs that surgeons reported applying in their work were the importance of respect and staying focused on their work activity. Other secondary beliefs were related to work ethic. Integrity was also mentioned along with honesty, a positive attitude, taking responsibility, enthusiasm, and confidence. Generating ideas and assembling them into tangible solutions were considered to be acquired mainly through brainstorming and innovation. Finally, holistic approaches to innovation were preferable to classic ones.

With regard to prototype and testing, surgeons perceived their patients as being satisfied through direct communication, assessments, or other types of feedback (e.g., reviews, social media interactions, recommendations). Most feedback was reported to be obtained through surveys. Forms were also mentioned along the surveys. The majority of the participants reported they used prototyping of new solutions in the healthcare field. Participants agreed that they also improved their ideas through user testing.

A measure of DT constructs is relevant for research and practice by measuring the impact of distinct factors and creating design frameworks that are more balanced and comprehensive. Eighteen constructs were identified to be significant in the participants' discourse: 1. Empathy/ Empathic 2. Education centeredness 3. Multi-/ inter-/ cross-disciplinary collaboration 4. Teamwork 5. Creativity 6. Critical thinking 7. Holistic view/ consider the problem as a whole 8. Open to different perspectives 9. Experimentation or learn from mistakes 10. Learning oriented 11. Experiential intelligence/ Bias toward action 12. Resilience/ Resilient 13. Mindfulness and awareness of process 14. Patient/ User centeredness 15. Affordable healthcare 16. Equity 17. Values efficiency 18. Innovation oriented.

The findings suggest that DT has certain applicability in this respect, but it is not at the core of the Indian Healthcare system. We could not find a well-known framework in doctors' discourses, but we extracted some components that had been later assembled into a potential framework that has to further be tested. This framework could be used as a self-reported measure, being useful to assess the development of DT to provide affordable healthcare.

5.1 Limitations

This study has some limitations, such as the use of only surgeon professionals in the sample or the participants' limited experience in DT. Due to the given time, we were only interviewing 15 doctors, only from 3 hospitals and in India. Also, we have not studied the users, the patients in our study and this is a qualitative approach. Therefore, the outcomes are not as robust as those in the quantitative studies and there is a limited generalization of these results.

Also, the studies in the literature review did not assume causality. Most of them do not consider the health trends or they do not give a defined pathway of implementation. The analysed articles do not fulfil the objective criteria of a Design Thinking system in the healthcare system. The majority of them do not give a defined pathway of implementation or consider evaluating human settings and socio-cultural elements in the analysis. We could also take into consideration a larger variety of samples in the studies to come.

Future research should address these issues and further test these results. In conclusion, we believe this study can impactfully advance knowledge about DT in healthcare in low and middle-income countries and offer practical insights for healthcare professionals in those countries who want to apply DT in their work.

References

Alharahsheh, H. H., & Pius, A. (2020). A review of key paradigms: Positivism VS interpretivism. *Global Academic Journal of Humanities and Social Sciences*, *2*(3), 39-43. https://doi.org/10.36348/gajhss.2020.v02i03.001

Altman, M., Huang, T. T., & Breland, J. Y. (2018). Peer-reviewed: Design thinking in health care. *Preventing chronic disease, 15*. https://dx.doi.org/10.5888%2Fpcd15.180128

Anderson, J., & Billou, N. (2007). Serving the world's poor: innovation at the base of the economic pyramid. *Journal of Business Strategy*. https://doi.org/10.1108/02756660710732611

An Introduction to Design Thinking PROCESS GUIDE. (2022, September 1). Retrieved from web.stanford.edu: https://web.stanford.edu/~mshanks/MichaelShanks/files/509554.pdf

Avsec, S., & Jagiełło-Kowalczyk, M. (2021). Investigating possibilities of developing self-directed learning in architecture students using design thinking. *Sustainability*, *13*(8), 4369. https://doi.org/10.3390/su13084369

Bailey. (2018). Exploring the relationship between institutional factors and FDI attractiveness: A meta-analytic review. *International Business Review*, 139-148. https://doi.org/10.1016/j.ibusrev.2017.05.012

Bouwman, H., de Vos, H., & Haaker, T. (Eds.). (2008). *Mobile service innovation and business models*. Springer Science & Business Media.

Brennan, P. F., Downs, S., & Casper, G. (2010). Project HealthDesign: rethinking the power and potential of personal health records. *Journal of biomedical informatics*, *43*(5), S3-S5. https://doi.org/10.1016/j.jbi.2010.09.001

Brenner, W., & Uebernickel, F. (2016). Design thinking for innovation. *Research and Practice*. https://doi.org/ 10.1007/978-3-319-26100-3_1

Brown, T., & Wyatt, J. (2010). Design thinking for social innovation. *Development Outreach*, *12*(1), 29-43. https://doi.org/10.1596/1020-797X_12_1_29

Brown, T. (2008). Design thinking, *Harvard Business Review,* 86(6), 84.

Chokshi, S. K., & Mann, D. M. (2018). Innovating from within: a process model for user-centered digital development in academic medical centers. *JMIR human factors*, *5*(4), e11048. https://doi.org/10.2196/11048

Clack, L. A., & Ellison, R. L. (2019). Innovation in service design thinking. In *Service Design and Service Thinking in Healthcare and Hospital Management* (pp. 85-92). Springer, Cham. https://doi.org/10.1007/978-3-030-00749-2_6

Clark, K., & Smith, R. (2008). Unleashing the power of design thinking. *Design Management Review*, *19*(3), 8-15. Retrieved from: http://www.choiceflows.com/wp-content/uploads/2017/07/DMI-DesignThinking.pdf

Coons, J. C., Patel, R., Coley, K. C., & Empey, P. E. (2019). Design and testing of Medivate, a mobile app to achieve medication list portability via Fast Healthcare Interoperability Resources. *Journal of the American Pharmacists Association*, *59*(2), S78-S85. https://doi.org/10.1016/j.japh.2019.01.001

De Ana, F. J., Umstead, K. A., Phillips, G. J., & Conner, C. P. (2013). Value driven innovation in medical device design: a process for balancing stakeholder voices. *Annals of biomedical engineering*, *41*(9), 1811-1821. https://doi.org/10.1007/s10439-013-0779-5

De Couvreur, L., & Goossens, R. (2011). Design for (every) one: co-creation as a bridge between universal design and rehabilitation engineering. *CoDesign*, *7*(2), 107-121. https://doi.org/10.1080/15710882.2011.609890

de Reuver, M., Bouwman, H., & MacInnes, I. (2009). Business models dynamics for start-ups and innovating e-businesses. *International Journal of Electronic Business, 7(3),* 269-286. https://doi.org/10.1504/IJEB.2009.02653

Dopp, A. R., Parisi, K. E., Munson, S. A., & Lyon, A. R. (2019). A glossary of user-centered design strategies for implementation experts. *Translational behavioral medicine*, *9*(6), 1057-1064. https://doi.org/10.1093/tbm/iby119

Dosi, C., Rosati, F., & Vignoli, M. (2018). Measuring design thinking mindset. In *DS 92: Proceedings of the DESIGN 2018 15th International Design Conference* (pp. 1991-2002). https://doi.org/10.21278/idc.2018.0493

Eines, T. F., Angelo, E., & Vatne, S. (2019). Discourse analysis of health providers' experiences using service design. *Nursing open*, *6*(1), 84-92. https://doi.org/10.1002/nop2.191

Frankenberger, K., Weiblen, T., Csik, M., & Gassmann, O. (2013). The 4I-framework of business model innovation: A structured view on process phases and challenges. *International journal of product development*, *18*(3-4), 249-273. https://doi.org/10.1504/IJPD.2013.055012

Ghosal, A., Bhaskar, A., & Sharma, A. (2015). Business Model Innovation in Health Care Infrastructure in India. http://hdl.handle.net/11718/14125

Golden, T. L., & Wendel, M. L. (2020). Public health's next step in advancing equity: re-evaluating epistemological assumptions to move social determinants from theory to practice. *Frontiers in Public Health*, *8*, 131.https://doi.org/10.3389/fpubh.2020.00131

Green, S., Southee, D., & Boult, J. (2014). Towards a design process ontology. *The Design Journal*, *17*(4), 515-537. https://doi.org/10.2752/175630614X14056185480032

Greenhalgh, T., Hinder, S., Stramer, K., Bratan, T., & Russell, J. (2010). Adoption, non-adoption, and abandonment of a personal electronic health record: case study of HealthSpace. *B*MJ, *341*. https://doi.org/10.1136/bmj.c5814

Haidar, S., Arif, N., & Abbas, Y. (2020). Language and Addiction: Exploring the Role of Discourse in Drug Addiction. *Pakistan Journal of Criminology*, *12*(2), 52-68.

Hassi, L., & Laakso, M. (2011, June). Design thinking in the management discourse: Defining the elements of the concept. In *18th International Product Development Management Conference, IPDMC* (pp. 1-14).

Hevner, A., & Chatterjee, S. (2010). Design science research in information systems. In *Design research in information systems* (pp. 9-22). Springer, Boston, MA. http://dx.doi.org/10.1007/978-1-4419-5653-8_2

Hwang, J., & Christensen, C. M. (2008). Disruptive innovation in health care delivery: a framework for business-model innovation. *Health Affairs, 27(5),* 1329-1335. https://doi.org/10.1377/hlthaff.27.5.1329

IFC - International Finance Corporation. (2007). The Business of Health in Africa: Partnering with the Private Sector to Improve People's Lives. Washington (District of Columbia): International Finance Corporation.

India, I. (2017). Expanding Access to Low-Cost, High-Quality Tertiary Care: *Spreading the Narayana Health Model Beyond India.* Retrieved from: https://collections.nlm.nih.gov/master/borndig/101718851/taylor_expanding_lowcost_highquality_model_narayana_cs.pdf

IRDAI (2017). Insurance Regulatory and Development Authority of India, Annual Reports 2017-2018. Retrieved from: https://www.irdai.gov.in/

Kim, S. H., Myers, C. G., & Allen, L. (2017). Health care providers can use design thinking to improve patient experiences. *Harvard Business Review, 95(5),* 222-229.

Koelsch, L. E. (2013). Reconceptualizing the member check interview. *International journal of qualitative methods*, *12*(1), 168-179. https://doi.org/10.1177/160940691301200105

Lam, B. (2017). Applying strategic design as a holistic approach to investigate and address real world challenges. *Strategic Design Research Journal*, *10*(2), 164-171. https://doi.org/ 10.4013/sdrj.2017.102.09

LeRouge, C., Ma, J., Sneha, S., & Tolle, K. (2013). User profiles and personas in the design and development of consumer health technologies. *International journal of medical informatics*, *82*(11), e251-e268. https://doi.org/10.1016/j.ijmedinf.2011.03.006

Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P., ... & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. Journal of clinical epidemiology,62(10), e1-e34. https://doi.org/10.1016/j.jclinepi.2009.06.006

Lister, C., Payne, H., Hanson, C. L., Barnes, M. D., Davis, S. F., & Manwaring, T. (2017). The public health innovation model: merging private sector processes with public health strengths. *Frontiers in Public Health*, *5*, 192. https://doi.org/10.3389/fpubh.2017.00192

Matheson, G. O., Klügl, M., Engebretsen, L., Bendiksen, F., Blair, S. N., Börjesson, M., ... & Ljungqvist, A. (2013). Prevention and management of non-communicable disease: the IOC consensus statement, Lausanne 2013. *Sports Medicine*, *43*(11), 1075-1088. https://doi.org/10.1007/s40279-013-0104-3

McDonagh, D., & Thomas, J. (2010). Disability+ relevant design: Empathic design strategies supporting more effective new product design outcomes. *The Design Journal*, *13*(2), 180-198. https://doi.org/10.2752/175470710X12735884220899

McLoughlin, I. P., Maniatopoulos, G., Wilson, R., & Martin, M. (2012). Inside a Digital Experiment: Co-producing Telecare Services for Older People. *Scand. J. Inf. Syst.*, *24*(2), 1. https://doi.org/10.1080/1369118X.2012.711845

Mueller, A. E. and Segal, D. L., 2014. Structured versus semistructured versus unstructured interviews. *The Encyclopedia of Clinical Psychology*, pp. 1-7.

Narayanamurthy, G., Gurumurthy, A., & Lankayil, A. A. (2018). Experience of implementing lean thinking in an Indian healthcare institution. *International Journal of Lean Six Sigma* https://doi.org/10.1108/IJLSS-10-2016-0062

Niccum, B. A., Sarker, A., Wolf, S. J., & Trowbridge, M. J. (2017). Innovation and entrepreneurship programs in US medical education: a landscape review and thematic analysis. *Medical education online*, *22*(1), 1360722. https://doi.org/10.1080/10872981.2017.1360722

O'Rourke, P., Ekins, R., Timmins, B., Timmins, F., Long, S., & Coyle, E. (2014). Crucial design issues for special access technology; a Delphi study. *Disability and Rehabilitation: Assistive Technology*, *9*(1), 48-59. https://doi.org/10.3109/17483107.2013.806599

Oliveira, M., Zancul, E., & Fleury, A. L. (2021). Design thinking as an approach for innovation in healthcare: systematic review and research avenues. *BMJ Innovations, 7(2).* http://dx.doi.org/10.1136/bmjinnov-2020-00042

Queirós, A., Faria, D. and Almeida, F., 2017. Strengths and limitations of qualitative and quantitative research methods. European journal of education studies. https://doi.org/10.5281/zenodo.887089

Repchick, K. M., Frye, L. Q. D., & Barrella, E. (2020, June). WIP: Understanding Impact of a Design-thinking Intervention on Students' Resilience. In *2020 ASEE Virtual Annual Conference Content Access*. https://doi.org/10.18260/1-2--35577

Roberts, J. P., Fisher, T. R., Trowbridge, M. J., & Bent, C. (2016, March). A design thinking framework for healthcare management and innovation. In Healthcare (Vol. 4, No. 1, pp. 11-14). Elsevier. https://doi.org/10.1016/j.hjdsi.2015.12.002

Saidi, B. (2021). *Design Thinking for Promoting Social Innovation in Small Businesses.* Carleton University.

Schweitzer, J., Groeger, L., & Sobel, L. (2016). The design thinking mindset: An assessment of what we know and what we see in practice. *Journal of design, business & society*, *2*(1), 71-94. https://doi.org/10.1386/dbs.2.1.71_1

Sharma, U. (2020). We have plans to open 25 centres in the next two year. *Express Healthcare*, Retrieved from https://www.expresshealthcare.in/finance/we-have-plans-to-open-25-centres-in-the- next-two-years/416823/

Sharma, N. G. (2013). Narayana Health–Heart in the Right Place!. *Cases in management*, 85-106.

Silver, J. K., Binder, D. S., Zubcevik, N., & Zafonte, R. D. (2016). Healthcare hackathons provide educational and innovation opportunities: a case study and best practice recommendations. *Journal of medical systems*, *40*(7), 1-7. https://doi.org/10.1007/s10916-016-0532-3.

Smith, J. A., Flowers, P., & Larkin, M. (2009). *Interpretative Phenomenological Analysis: Theory, Method and Research*. Sage Publications, London.

Stampfl, G. (2014). The Process of Business Model Innovation - An Empirical Exploration – Doctoral Dissertation, Retrieved from https://www.researchgate.net/publication/274715585_The_Process_of_Business_Model_Innovation_-_An_Empirical_Exploration

Taheri, M., Unterholzer, T., Hölzle, K., & Meinel, C. (2016, March). An educational perspective on design thinking learning outcomes. In *ISPIM Innovation Symposium* (p. 1). The International Society for Professional Innovation Management (ISPIM). https://hpi.de/fileadmin/user_upload/fachgebiete/meinel/papers/Design_Thinking/2016_taheri_unterholzer_ispim.pdf

Uehira, T., & Kay, C. (2009). Using design thinking to improve patient experiences in Japanese hospitals: a case study. *Journal of Business Strategy*. https://doi.org/10.1108/02756660910942418

Valentine, L., Kroll, T., Bruce, F., Lim, C., & Mountain, R. (2017). Design thinking for social innovation in health care. *The Design Journal*, *20*(6), 755-774. https://doi.org/10.1080/14606925.2017.1372926

Vechakul, J., Shrimali, B. P., & Sandhu, J. S. (2015). Human-centered design as an approach for place-based innovation in public health: a case study from Oakland, California. *Maternal and Child Health Journal*, *19*(12), 2552-2559. https://doi.org/10.1007/s10995-015-1787-x

Venable, J. (2006, February). The role of theory and theorising in design science research. *In Proceedings of the 1st International Conference on Design Science in Information Systems and Technology (DESRIST 2006) (pp. 1-18).*

Viljoen, A., Klinker, K., Wiesche, M., Uebernickel, F., & Krcmar, H. (2021). Design Principles for mHealth Application Development in Rural Parts of Developing Countries: The Case of Noncommunicable Diseases in Kenya. *IEEE Transactions on Engineering Management* https://doi.org/10.1109/TEM.2021.3072601

Walton, T., & Matthees, K. (2017). *Improving emerging markets healthcare through private provision* http://hdl.handle.net/10986/30358

Web of Science. (2022, January 02). Retrieved from www.webofscience.com

von den Eichen, S. F., Freiling, J., & Matzler, K. (2015). Why business model innovations fail. *Journal of Business Strat*egy. https://doi.org/10.1108/JBS-09-2014-0107

Woods, L., Cummings, E., Duff, J., & Walker, K. (2018). Conceptual design and iterative development of a mHealth app by clinicians, patients, and their families. *Stud Health Technol Inform*, *252*, 170-5. https://doi.org/10.3233/978-1-61499-890-7-170

Wyrwicka, M. K., & Chuda, A. (2019). The diagnosis of organizational culture as a change's factor in the context application of design thinking. *LogForum*, *15*(2). https://doi.org/10.17270/J.LOG.2019.319

Zuber, C. D., & Moody, L. (2018). Creativity and innovation in health care. *Nursing Administration Quarterly, 42*(1), 62-75. https://doi.org/10.1097/NAQ.0000000000000267

Annex

Annex A: Literature Review

No.	Paper Reference	Type	Model	Contributions	Limitations
1	Brown (2008)	Qualitative Design	This study proposes a Design Thinking model to improve products and process development innovation. This model has nine steps.	The research study has articulated a cyclical interpretation of the design thinker's system dynamics for interpreting human behaviour. The study also gives the rationale of qualitative research in Design Thinking systems.	The main limitation is the absence of quantitative consideration in the analysis of modular design elements. The solution to the main research question is based on human behaviour factors without considering empirical trends.
2	Uehira & Kay (2009)	Qualitative Design	This paper used a two-phased study model. The first phase involved qualitative interviews with experts from outside of hospitals. The second phase	This study articulated that ample opportunities exist behind the user-centric innovations in Japan-centred healthcare settings. It also offers insights into the patient waiting experience at	This study has two main limitations. Firstly, the research question is not universally applicable. Second, the objectives do not consider the healthcare design settings' indifference to other

No.	Paper Reference	Type	Model	Contributions	Limitations
			involved in-depth interviews of patients and healthcare professionals.	hospitals. Finally, it enlists a user-centric approach in a healthcare setting.	product development processes.
3	Greenhalgh et al. (2010)	The mixed-method with the multilevel case study	The paper uses the socio-technical model. It considered the influence of the adoption and lack of modular design innovations at macro and micro levels. It uses critical discourse analysis principles to support the model evaluation.	The contribution involves the introduction of a socio-technical framework to analyze the user-centred design techniques for patient adoption and use. The paper also indicates modular design elements for integrated health policymaking in the UK.	The study does not define fundamental criteria for a socio-technical model. The main research question does not establish defined criteria to overcome data collection subjectivity.
4	Brennan et al. (2010)	Qualitative Design	The model of this study involves design-centred prototypes or computer	It formulated a standard and identity management approach for personal health	The main research question does not incorporate the diverse inclusion of patients.

No.	Paper Reference	Type	Model	Contributions	Limitations
			applications to enhance and support the human health of chronic patients.	information systems. It also enunciates the process for identification of challenges in the acceleration of Personal health records (PHRs)	The main problem for the research on 'Personal health Record Management' does not give a defined implementation pathway.
5	McDonagh &Thomas (2010)	Qualitative research design with intuitive outcomes	The research paper uses an intuitive research design model to explore the correlations among user needs, living experiences, and existing products for humans.	The main contribution is formulating an intuitive approach to designing products to improve a person's quality of life. It also contributes an innovative rationale for design thinkers to formulate Design Thinking factors.	The main question of the research uses a generalized approach to evaluate a design-thinker-centric approach. It does not consider evaluating human settings and socio-cultural elements in the analysis. Also, the intuitive solution to the main research problem is subjective. The intuitive model of Design Thinking has less objectivity in nature.

No.	Paper Reference	Type	Model	Contributions	Limitations
6	De Couvreur & Goossens (2011)	Qualitative Design	The study uses the innovative network design method to study the universal Design Thinking approach for disabled patients in clinical hospitals in the UK. Its main purpose is to study the qualitative design experiences of disabled patients.	The research study has articulated an open, innovative approach to analysing the cognitive needs of patients in the healthcare setup. It also illustrates the use of personal assistive artefacts for understanding the context of medical problems during the design thinking mechanism.	The main limitation is the non-consideration of digital trends such as crowdsourcing, user-generated content, and peer influence in healthcare therapies under the Design Thinking process. The solution to the main research question is based on the open-innovative approach neglecting the importance of the focused approach.
7	LeRouge et al. (2013)	Qualitative Design	The paper used the user-centred design to analyse the role of consumer health technologies (CHT) in mitigating diabetes across China. The study has utilised a	The study articulated that the conceptual design of the older population can be seen as an input for the development of Consumer Health technologies (CHT). The user-centred design	There are two main limitations of the study. Firstly, the research question does not consider the health trends of diabetes worldwide. It is only focused on the Chinese population.

No.	Paper Reference	Type	Model	Contributions	Limitations
			methodological approach using patients' personas and user profiles. This approach gives a rationale for a design-thinking model for the ageing population in China.	gives a user-centred model for the special care needs of diabetic patients in China.	Secondly, the research does not fulfil the objective criteria of a Design Thinking system in the healthcare system.
9	De Ana et al. (2013)	Qualitative Design	The model involves a human-centred design model in developing disease prevention programs. It also uses professional sports and fitness medicines to treat chronic diseases.	The study has been conducted on the generic prevention and control process model for treating chronic diseases through complex Design. It identifies knowledge areas to implement user-centred Design in treating chronic diseases.	The main research question does not incorporate the hands-on design-thinking model for treating chronic disease. The consensus of the participants is not oriented to the implementation of design-thinking for the treatment of non-communicable diseases.
10	Matheson et al. (2013)	Mixed (Qualitative	This research paper introduces the spiral	The main contribution is the spiral innovation process that	The main question of the research uses a generalized

No.	Paper Reference	Type	Model	Contributions	Limitations
		and Quantitative)	innovation process for developing a medical device. This medical device is developed on user-centred design factors, including various 'voices' impersonating the customer, the business, and the technology.	replaces the traditional funnel process. It also contributes an innovative rationale for aligning the design-thinking process with the spiral innovation process.	approach to evaluate design-thinker centric approach. It does not consider the evaluation of human settings and socio-cultural elements in the analysis. Also, the innovative spiral process is a new design for developing an IT application. It does not find a solution for complex, integrated design processes in commercial healthcare settings.
11	McLoughlin et al. (2013)	Qualitative Design	The study proposes a user-led innovation process for a co-production mechanism in developing telecare systems for the elderly.	The research paper identifies that engagement of those who provide service to the users and end-users has been a primary problem. It develops an information system model to integrate	The key limitation of the study is the lack of quantitative data supporting the main research question. The solution to the main research question is based on qualitative factors such as device

No.	Paper Reference	Type	Model	Contributions	Limitations
				human-centred Design with telecare systems for the elderly.	provide/user literacy of device providers. It neglects the modular elements, such as the subject population's abnormal human perception of digital literacy.
12	O'rourke et al. (2014)	Mixed (Qualitative and Quantitative)	The paper uses a six-question Delphi study to identify the design issues in the specified Assistive Technology domain. A modified morphological matrix studies the product design process to fulfil patient needs in the UK health sector.	The study highlighted various design issues in developing special assistive technology in the UK health sector. It also gives a method for customizable special access technology. It highlights that poor device design is the main factor in integrating a better user-centred experience in developing a device.	There are two main limitations of the study. Firstly, the research question does not comprehensively overview the literature about product development. Second, the cost-benefit analysis of the low-cost devices is not elaborated for studying the SAT development in research work.
13	Vechakul et al. (2015)	Qualitative	The paper uses a critical	The contribution involves	The study's research design is

No.	Paper Reference	Type	Model	Contributions	Limitations
		Design	overview approach to study the human-centred approach and its relevance to public health. The paper also uses the Design Sprint model to value the importance of Design Thinking in the public health of California, USA.	the introduction of the Design Sprint model. This model gives a rationale for social innovation for community engagement.	focused on the public health problems of three major cities in California. It lacks the objectivity of universal application. The main research question does not establish defined criteria to overcome data collection subjectivity.
14	Coons et al. (2016)	Qualitative Design	The model of the study involves the use of Design Thinking approaches for students to prevent infectious diseases.	It has formulated a generic approach for balancing the Design Thinking process issues with community engagement. It also enunciates the process for identifying challenges in accelerating the Design Thinking process in public	The main research question does not elaborate on the importance of quantities of data in the design-thinking process. The step guide for human-centred Design is not supported by a literature review of the global health sector.

No.	Paper Reference	Type	Model	Contributions	Limitations
				health policymaking.	
15	Roberts et al. (2016)	Qualitative Design	Health systems should improve their ability to recognize and articulate stakeholder needs and aspirations, both explicit and implicit.	Through human-centred research, collaborative and varied cooperation, and fast prototyping, DT may develop fresh approaches to challenging healthcare challenges.	The proposed ideas cannot be generalized. The healthcare challenges in the USA are significantly different from those of BoP markets.
16	Silver et al. (2017)	Qualitative Design	The report gives an overview of the event Hackathon to improve health care solutions and develop educational experiences for patients.	The main contribution is formulating an educational approach to design healthcare facilities to raise a person's quality of life. It also contributes an innovative rationale for design thinkers in formulating the design-thinking model for a healthcare setting.	The main question of the research uses a generalized approach to evaluate design-thinker centric approach. It does not consider the evaluation of human settings and socio-cultural elements in the analysis. The intuitive Design Thinking model is less objective and does not involve using an empirical model.

No.	Paper Reference	Type	Model	Contributions	Limitations
18	Niccum et al. (2017)	Qualitative Design	The study proposes a thematic analysis to evaluate Innovation and Entrepreneurship (I/E) to train medical students in complex solution design. It also gives landscape analysis for developing the competency model in I/E.	The research study has articulated a thematic interpretation of the design thinker's system dynamics for I/E in medical education. The study also gives the rationale for qualitative research in Design Thinking systems.	The main limitation is the absence of a support program for implanting the design programs. The research question does not involve human-behaviour factors to study empirical system design trends in the global healthcare system.
19	Valentine et al. (2018)	Qualitative Design	The study presents a strategic framework for building a Design Thinking culture in health care for social innovation. It uses the system design theory with contemporary health care approaches.	The study articulated that some strategic mechanisms are needed to connect design thinking, social care, and social innovation. It also gives a method for using Design Thinking in cultural transformation.	The study's main limitation involves using design theory for the social care model. The design theory limits the healthcare model's behaviour influence, strategic mapping, and behavioural structuralism loopholes.

No.	Paper Reference	Type	Model	Contributions	Limitations
20	Narayanamurthy et al. (2018)	Qualitative Design	The lean thinking (LT) model is proposed for healthcare institutions.	Location-specific, such as India, measures the before and after implementing lean methods at a specific hospital. Based on the results, a framework for LT implementation is generated.	The long-term consequences of LT implementation in healthcare need to be studied. Validation of the suggested framework for LT implementation is required in different healthcare settings.
21	Lister et al. (2018)	The mixed-method with behavioural conception	The paper gives the public health innovation model for innovation leaders to integrate innovation with the Design Thinking practice. It also gives the principal formula for transformational leadership in the human-	The contribution involves the introduction of the Public Health Innovation Model (PHIM) for strategic integration of innovation and public health. It also elaborates on cross-collaboration principles, community buy-in, and rapid prototyping for enhanced	The study does not relate to the practical application of the PHIM model. The main research question does not establish defined criteria to overcome subjectivity in the data collection.

No.	Paper Reference	Type	Model	Contributions	Limitations
			centred design system.	user experience.	
22	Altman et al. (2018)	Qualitative Design	The model of this critical study is peer-reviewing published articles on the internet, renowned journals, and websites. It studies the use of design-thinking approaches in health intervention methods.	It formulated a critical appraisal method to benefit design-thinking approaches over traditional healthcare interventions. Traditional healthcare interventions lack benefits compared to design-thinking healthcare interventions.	The main research questions do not involve the measures for studying the deviation index or the authenticity of the research. The main problem of the research 'Design Thinking Healthcare Intervention Approaches' is not given a defined implementation pathway.
23	Zuber & Moody (2018)	Qualitative Design	The research paper uses a human-centred design model to explore the correlations between user needs, living experiences, and organisational stakeholder expectations.	The main contribution is the formulation of empathy mapping to design the decision-making processes for improving organisational innovation. It also contributes an innovative rationale for	The main question of the research uses a generalized approach to evaluate a design-thinker-centric approach. Empathy mapping is not considered under the purview of the Design Thinking theory. The thematic model of Design

No.	Paper Reference	Type	Model	Contributions	Limitations
				design thinkers in formulating the Design Thinking factors.	Thinking has less objectivity in nature.
24	Chokshi & Mann (2018)	Qualitative Design	The study proposes a practical process model for developing a digital user-centred approach in Health in Information Technology (HIT).	The research study has articulated a comprehensive model for digital innovation in the medical field. It gives lean and agile approaches for HIT development in the healthcare field.	The solution to the main research question is based on human behaviour factors without considering empirical trends. The four-phased model pertains to the characteristics of the research question. It lacks a concrete implementation strategy.
25	Eines et al. (2019)	Mixed Design	The paper used a two-phased study model for analysis. The first phase involved qualitative interviews with nurses and assistants in	The study articulated that ample opportunities exist behind user-centred innovations in nursing management. It also gives a user-centred	There are two main limitations of the study. Firstly, the research question does not fulfil the need for universal application. Second, the research objectives do not consider the healthcare

No.	Paper Reference	Type	Model	Contributions	Limitations
			the healthcare sector. The second phase involved an in-depth analysis of the selected service model with modular elements.	service model for nursing management in the health sector.	design settings' indifference to other product development processes.
26	Dopp et al. (2019)	The mixed method with the multilevel case study	The paper uses an exploratory model for user-centred Design. It also studies the prevalent evidence-based practices in user-centred design.	The contribution involves the glossary of various user-centred categories of the system design process. It also uses the hypothetical medical intervention for the relative benefits of an intervention approach.	The study does not define the fundamental criteria for applying the design-centred approaches. The main research objective does not involve the behavioural study of medicines used in these approaches.
27	Woods et al. (2018)	Quantitative Design	The model of the study involves an innovative participatory user-centred approach for	It gives the cluster of strategies between implementation science and a design focused on the user.	The research design is purely quantitative. It lacks the necessary conceptual analysis for interpretation of the Design Thinking elements.

No.	Paper Reference	Type	Model	Contributions	Limitations
			designing and developing a mobile health (mHealth) application.	It establishes a multidisciplinary connection with the implementation of science and a design centred on the user for sustainability in healthcare services.	The main problem of the 'Interdisciplinary approach' research is that it is not characterized by flexibility.
28	Holman & Kane (2020)	Mixed Design	The research paper elaborates on a digital model to attain global health equity. It presents a case study of digital health initiatives for understanding the Design of complex systems.	The main contribution is the design formulation of the design concept to integrate digital technology in global healthcare. It also defines the importance of human factors in stakeholder participation, perception needs, etc.	The main question of the research uses a generalized approach for evaluating the complex Design in digital technologies. Similarly, the research discussion does not comprehend the role of Design Thinking in digital initiatives. So, there lies a research gap in studying complex design's role in digital healthcare initiatives.
29	Viljoen et al. (2021)	Qualitative	Proposes a multi-layered	Applying the DT principle, a	The solution cannot be

No.	Paper Reference	Type	Model	Contributions	Limitations
		Design	solution using design principles elements to design a prototype and, subsequently, a solution.	mobile-based healthcare application was built to support community users in the BoP market.	generalized; further validation is needed.
30	Oliveira et al. (2021)	Qualitative Design	This study uniquely proposes DT in a three-phase approach, and each phase's objectives were customized.	The study proposes a framework for addressing innovation in healthcare development by finding a balance between contextual factors. DT principles have been used for innovative approaches to finding solutions in low-resource situations.	Future interventions must be in conjunction with Design and health and should approach systematic guidelines.

Annex B: Interview Transcripts

Interview #1

Date: 20 May 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patient and their needs?

Patient education allows patients to play a bigger role in their care. It also aligns with the growing movement toward the patient and family-centred care. To be effective, patient education needs to be more than instructions and information. The success of patient education depends largely on how well you assess your patient's needs, concerns, readiness to learn, preferences, support, and barriers and limitations (such as physical and mental capacity, and low health literacy or numeracy).

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- Working in a collaborative environment along with a multidisciplinary team is essential in our profession. They enable us to successfully work towards a common goal with others by communicating clearly, actively listening to others, taking responsibility for mistakes, and respecting the diversity of our colleagues.
- Successful collaboration requires a cooperative spirit and mutual respect. This means that you should keep communication open, and never withhold information necessary to carry out tasks. You should also reach a consensus about goals and methods for completing projects or tasks, offering recognition of the others' contributions, giving credit where credit is due, and placing the patient's treatment goals above personal satisfaction. Finally, apologizing for missteps and forgiving others' mistakes are of paramount importance since holding a grudge or sabotaging the efforts of other team members destroys collaboration.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- If you go to the Caribbean region, there are roughly 35 medical colleges, training professional doctors for the US in a rented 50,000 square foot in a shopping mall. Why are we spending 400 crore rupees/$ 51.536 760 and creating this edifice? It is ridiculous all over the world since medical colleges do not have this rigid requirement, that is, they don't need 140 faculty members to train a hundred students. 140 faculty members get into a medical college with a thousand students. So, when the whole world has changed, we haven't. Therefore, it is very important to create a space where creativity is encouraged. That's why I'm asking a very simple question: How can we improve it to make it better – or the best?

Which are the sets of beliefs you usually apply in your work?

- To my mind, having a very strong work ethic is extremely important. This is because people with a good work ethic place a high value on their professional success and exhibit moral principles that make them outstanding in their field. What is more, staying focused and motivated as well as proving the integrity toward my organization are essential to the good functioning of my work.

How do you generate ideas and assemble them into tangible solutions?

- Through brainstorming while sitting down with the other care providers and finding a solution that best meets the needs of the patient.
- However, before coming up with the best solution, we focus on the causes of the problem. This sometimes turns out to be more effective because by finding potential causes, you can work proactively to resolve or prevent the cause of the problem.

Do you consider using a holistic approach to innovation?

- Definitely. We believe in the necessity of adopting a holistic view rather than focusing solely on technological innovation. Innovation is both a process and an output. It also takes multiple forms, which can radically change the value chain of the healthcare industry.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- Receiving positive feedback is a great sign that the patient is satisfied with the care. When they are happy, they do not hesitate to post reviews of their experiences on their social media handles and at other places across the web.
- Another quick giveaway of a happy patient is that you either receive few or almost no complaints. Moreover, if any issues arise, they decently express them.

How do you obtain feedback from your customers?

- The best way for you to know what your patients think about the treatment received is to collect feedback during follow-up consultations directly from them, by speaking about their problems, and their post-treatment feelings, and asking them what improvements they have noted since the treatment started.
- Before the start of the treatment, we usually ask them what they hope to achieve by the end of the treatment. Then in later sessions, we evaluate which goals have been met.

Do you use prototyping of new solutions in your healthcare field?

- Yes, we do. Prototyping plays a vital role in the medical industry. Technological advancements now create new possibilities for the future of medical instruments and product design.

Do you improve your ideas through user testing?

- Yes. Testing is a fundamental part of the overall healthcare industry since it provides inspiration, guidance, and validation that is needed to provide patient-centred treatment. It also helps to find where users struggle and what they like.

Interview #2

Date: 22 May 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patients and their needs?

- Before the start of any treatment, it is imperative that you understand the patient's needs. This can be done through effective communication with them, which would shed light on important variables such as their problems, fears, and hesitation regarding the treatment plan together with its cost and duration. Additionally, the patient must be made clear not only the cost of the treatment but also the future medical care cost.

Can you describe your working experience in a collaborative context/ in a multidisciplinary team?

- A multidisciplinary team approach brings professionals with different skills and expertise together to solve a problem. By doing this one can broaden the conversation, solve problems, and realize faster outcomes. The concentrated effort of many hands and minds is transformative in most organizational applications because there is greater expertise.
- Working in a multidisciplinary team is a dynamic process in which two or more health professionals with complementary backgrounds and skills share common health goals and exercise concerted physical and mental effort in assessing, planning, or evaluating patient care. This generates a value-add to the patient, organizational and staff outcomes.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- Yes, I do. All patients are different, and they come with different sets of problems and different comorbidities. I think that the Internet of Things can revolutionize the healthcare system. Imagine a truly modern healthcare system, which is accessible to all from the comfort of your home. A system that utilizes the internet of things, allowing us to monitor our health, share data with our care providers, and alert others when we are in

need. Embedding intelligent functionality into our homes would allow patients to be monitored around the clock

Which are the sets of beliefs you usually apply in your work?

- Humility, respect, honesty, focus, ingenuity, and creativity to name a few.
- Besides, identifying core values can provide structure and instruction, especially when dealing with a certain decision or dispute.

How do you generate ideas and assemble them into tangible solutions?

An open mind is a valuable resource. When you are interested in new possibilities and able to think creatively, you are more likely to stay energized and one step ahead. You must break old thinking patterns; make new connections and get a fresh perspective.

Do you consider using a holistic approach to innovation?

- In the fast-paced world of technology, everything you do is at risk of becoming obsolete, especially in the healthcare industry. To avoid that we need to look at the bigger picture and understand what we can do to constantly improve our product so that it benefits people enough to not become outdated.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- There are many forms of patient engagement, but the key is to be in a constant dialogue with them. If you behaved to them as you did to a friend, then you would certainly know whether they are satisfied or not.

How do you obtain feedback from your customers?

Feedback is critical. Both feedback forms and engagement surveys are some of the most important tools.

Do you use prototyping of new solutions in your healthcare field?

- As we face more complex challenges in health care, we have to shift away from prescriptive approaches and move towards a learning mentality. New problems require new approaches, and we need new methods to develop and test new systemic solutions. All systems, including health systems, have a variety of inputs: societal needs, funding

streams, people, and the roles they play, including clients and staff, technologies, etc. Systems also have outputs, which can be thought of as outcomes or results. The only way to ascertain how a system will respond to a new set of inputs is to provoke a response, and then revise and refine based on the observed result.

Do you improve your ideas through user testing?

- Certainly. User testing is valuable to prevent negative user thoughts. It is vital to the success of the treatment provided.

Interview #3

Date: 25 May 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patients and their needs?

- During the first consultation, it is very important that I should talk about the treatment options on offer and ask the patient about their concerns or worries. Since I deal with patients who have been diagnosed with cancer, making them understand the diagnosis, the prognosis, and the treatment options is vital. That's why I give the patients leaflets and booklets about diagnosis and treatment and discuss with them any concerns they might have in greater detail. A lot of the questions are centred on the challenges of chemotherapy, and on the financial impact of taking time off work. Money worries are always a concern, and that's a fact.

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- It is of utmost importance to work in collaboration with a team to ensure that the patient's needs are met more holistically. Working with a multidisciplinary team made me feel more efficient and more satisfied with the care we were giving to our patients.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- Yes, I do. No two clients are alike, and this is where creativity enters. A Holistic Needs Assessment and Care Planning questionnaire has been developed. The patient is required to fill out the questionnaire in detail and list out the worries, and the concerns that they might have. I then spend about half an hour going through the assessment along with the patient. All the information is then provided to the patient, particularly information about the financial services on offer, reference to a benefits advisor, and reference to a support line. Finally, a care and support plan are developed. As the patient's needs change, more

assessments are done, and the plan is updated. The initial 30-minute assessment is truly person-centred and makes all the difference to people's cancer journeys.

Which are the sets of beliefs you usually apply in your work?

- First and foremost, listen actively and with a great deal of patience to whatever the patient has to share. Since each patient is different and has his/her own set of problems and concerns, strongly believe that they need to be addressed in a different manner, which best suits them.

How do you generate ideas and assemble them into tangible solutions?

- Updating my knowledge about the latest treatments that are available and working in tandem with the patients to provide them the treatment which best caters to their needs.

Do you consider using a holistic approach to innovation?

- Yes, it is a must for me to consider using a holistic approach. For the same reason, I have developed a Holistic Needs Assessment questionnaire, that is to have a better understanding of the patient's needs, concerns, and medical requirements.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- I am certain that the assessments help to structure conversations and make sure I will be able to cover everything during consultations, reducing the patient's anxiety levels and, as a result, reducing the number of phone calls.

How do you obtain feedback from your customers?

- As the patient's needs change, more assessments are done. Some of them are done at home with the help of a community support team. Consequently, further treatments are tailored after a careful understanding and discussion.

Do you use prototyping of new solutions in your healthcare field?

- Yes. Real-time monitoring of health through connected devices can save lives in the event of a medical emergency such as heart failure, diabetes, and asthma attacks, to name a few. However, we must continue expanding the technologies that can be created for this industry starting with medical prototyping.

Do you improve your ideas through user testing?

- Yes, I do. User testing is a great way of getting user feedback first-hand and allows us to take quick action to improve. That is why feedback is priceless.

Interview #4

Date: 27 May 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patient and their needs?

- It is very important that I should take the time to establish a rapport by doing a comprehensive assessment. This practice is valuable as it provides a broader understanding of the patient's needs. For example, I ask the patient if they are comfortable having other people involved in their care process, and if they agree, I make sure the person in charge is compatible with the patient's preferences. This means you should know the hospital staff very well to choose the most suitable one for the case.

What other components of a comprehensive assessment are there?

- Generally speaking, the three main parts of a comprehensive assessment are learning about the patient's history - namely their past medical experiences, physical examination, and measurement of their vital signs

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- Multidisciplinary teams have been established as best practices for optimal patient care when it comes to many disciplines in healthcare. However, there are challenges that healthcare teams face which commonly relate to accountability, conflict management, decision-making, reflecting on progress, as well as coaching. The main focus of such a team should be developing new and powerful wearable health applications, but this requires time, money, and a combined expertise of many different disciplines.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- Creativity is a must, especially when I am in a brainstorming session and an employee comes up with an idea that I don't agree with. "No" sends a negative message, meaning that I should find ways to reimagine his concept so that my answer will be a positive one. Gathering a compatible group of people is essential to reaching the best version of an idea.
- Many people are trying to build wearable health applications to work towards value-based healthcare, but they lack the accuracy and versatility to reach this goal

Which are the sets of beliefs you usually apply in your work?

- One of my strong beliefs is that having a positive attitude and outlook on the world by looking on the bright side of things, as well as showing my willingness to make efforts, positively impacts situations and people. Little things like showing up on time, doing my best at work, and taking responsibility for my actions have proven the previous point I've made. Whatever you do in life, there will always be setbacks at some point, that's why I make sure to not let them get ahead of me.

How do you generate ideas and assemble them into tangible solutions?

- By carefully evaluating any input that I get mixed with my instinct. I have also learned to spot the paths of connectivity along the journey which taught me that what may be your "core idea" today can grow into something bigger as you discover other principles that naturally associate with your main concept along the way. My advice is to never stop connecting the dots.

  Moreover, I always try to better the idea, so that I will not become complacent. As there is always room for improvement, when I began to see how the dots connect, I challenged myself and my board of advisors towards creating the best version of a project.

Do you consider using a holistic approach to innovation?

- Yes, I do. Today, the word 'innovation' is everywhere, and rightfully so, as it is extremely important to our evolution. In my opinion, a holistic approach to innovation starts with a challenge, problem, or need and ends with finding a solution that didn't exist before.

How do you envision a holistic approach to innovation?

- The way I see it, a holistic approach to innovation is an interconnected system between inventing, designing, harmonizing, and delivering a complex product.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- Client satisfaction has always been an important factor when it comes to delivering any kind of service and it has recently gained notoriety in the healthcare field. Patients are more demanding than they used to be and expect a certain level of service from their providers. I know that my patients are happy with how they've been treated when they communicate that to me or with the aid of social media platforms where they leave reviews.

How do you obtain feedback from your customers?

- Despite the technical quality of care delivered, provider empathy is the main teller of whether a patient will or will not be satisfied. Patients also perceive empathic care as technically better than less personal care.
- Even doing simple things like increasing eye contact with patients will boost satisfaction and engagement.

Do you use prototyping of new solutions in your healthcare field?

- Certainly. As stated by the famous architect, Frank Lloyd Wright, "It's easier to use an eraser on the drafting board than a sledgehammer at the construction site". In other words, it is easier to learn and adapt to user feedback during the rapid prototyping phase rather than the development phase.

Do you improve your ideas through user testing?

- Yes, I definitely do, as it provides insights about which parts of our product help, and which frustrate our users.

Interview #5

Date: 30 May 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patient and their needs?

- By acknowledging patient education as essential to the discipline of medicine and as an integral part of each patient encounter, as well as by valuing the opportunity to utilize "teachable moments" in a patient-physician encounter.
- Besides, I engage the patient using trusted relationships to increase participation in advanced care planning.

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- Working in a collaborative context/with a multidisciplinary team is of utmost importance since teamwork breakdowns continue to be a primary cause of errors and near misses in healthcare, with root cause analysis suggesting a lack of effective teamwork.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- Yes, I do, as I believe creativity leads to better delivery of healthcare. Creative thinking has helped me create a better health care experience for the patients and obtain more meaningful results. Creativity is for everyone regardless of their position and it enables focusing on the big picture which makes healthcare providers emotionally involved in their work and less fearful of failure.

Which are the sets of beliefs you usually apply in your work?

- I truly believe taking responsibility and accountability for my actions are essential to the relationship with my patients and the organization I work for.

Why are these beliefs essential?

- By accepting responsibility and taking accountability I understand my mistakes and accept them which results in me becoming a grounded professional and, overall, a better version of myself.

How do you generate ideas and assemble them into tangible solutions?

- No matter how smart, passionate, or focused we are, when it comes to work, without balance burnout is imminent. Our mind, body, and soul must be properly aligned. What I do is make balanced work and personal life a priority. This gives me clarity of thought and enables keeping things in perspective, which helps me generate the best ideas and solutions.
- Successfully converting an idea into a reality is a marathon, not a sprint. Pace yourself so that you can reflect upon the mission at hand. Always be aware of what you want to accomplish. Don't overwhelm your mind and give yourself some room to breathe to allow your creativity to expand.

Do you consider using a holistic approach to innovation?

- When you say design and innovation, people think of products, but it is much more to it. It is more about the way it gets built and the communication around it.

Could you please expand this idea a bit?

- To my mind, a holistic approach is more about collaboration and everything that stands behind the final product which is mainly represented by the minds that work together toward this

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- An important sign which shows me a patient is satisfied is if they trust us enough to come back for regular check-ups or if they recommend us to their family and friends.

How do you obtain feedback from your customers?

- The most innovative way to take a patient satisfaction survey is to develop mobile apps.

These mobile or android apps on tablets will help patients to give their feedback after finishing every touch point. And this will make it easy for them to give their feedback and utilize their waiting time in the best way.

- I also hear real stories from my patient because patient satisfaction is an important and commonly used indicator for measuring health care quality. Patient satisfaction affects clinical outcomes, patient retention, and medical malpractice claims

Do you use prototyping of new solutions in your healthcare field?

- Yes, I do. As stated by the famous architect, Frank Lloyd Wright, "It's easier to use an eraser on the drafting board than a sledgehammer at the construction site." It is more effective to learn and adapt to user feedback during the rapid prototyping phase rather than the development phase.

Do you improve your ideas through user testing?

- Prototypes are the cornerstone of medical healthcare development. They are powerful and important tools that transform ideas, thoughts, and theories into something real. Prototypes also become a catalyst for deep collaboration and clear communication.
- It can be overwhelming, however, trying to keep track of the variety and purpose of the prototypes used in product development. This is especially true when developing a medical product that must adhere to regulatory guidelines or be utilized across development teams with differing levels of engagement; or both.

Interview #6

Date: 31 May 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

QUESTIONS FOR OUR STUDY

(1) EMPATHY

How do you proceed in understanding your patient and their needs?

- I'm a doctor by training, but I currently work as a consultant for health and social services organizations on topics like creativity, innovation, complex systems, and leadership where we discuss ways of bringing creativity and innovation into health and social services. This has taught me a lot about patients and their main needs. The conclusion which I have drawn is that old problems need new solutions rather than the ones we have got accustomed to.

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- Healthcare practice is highly dynamic, increasingly multidisciplinary, ad hoc, and largely dependent on distributed human collaboration. Primary care may comprise multidisciplinary teams of up to 30 professionals. Collaboration between team members to deliver integrated patient-centred care is considered crucial and has been found to improve outcomes in patients.

How do these teams improve outcomes in patients?

- Multidisciplinary teams allow comprehensive care as each doctor deeply focuses on his area of expertise which allows a better understanding of the patient's needs.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- Everyone can be creative. We just need to take 30 minutes of our time and put our heads together and see what we can come up with rather than making it an overwhelming process as it would without teamwork involved.
- It's really interesting to analyse how other industries view their process of creativity and think of a way of adopting them into healthcare. We must rethink the things we already apply and innovate them. Being open to other ideas and introducing them to our field results in a more efficient system.

Which are the sets of beliefs you usually apply in your work?

- I would say resilience is very important. We all make mistakes. Learning from mistakes in a way in which I still feel motivated and believe in my ability to grow is important. During our work, problems arise and how we deal with them can either make employers confident in us or make them lose their trust.

How do you generate ideas and assemble them into tangible solutions?

- I successfully mix creativity and communication to create a direct link between ideas and actions

Do you consider using a holistic approach to innovation?

- To create a culture of strategic and innovative thinking in the organization, many different fronts have to be pushed, and a holistic approach is needed.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- Client satisfaction can be easily measured through some psychological tools such as understanding nonverbal cues. For example, reading facial expressions, eye contact, and body posture.

How do you obtain feedback from your customers?

- It's no secret that collecting and analysing customer feedback can be highly valuable for improving our product or service. However, obtaining that feedback can often prove to be a tricky challenge.

- Some examples of feedback obtaining means are sending follow-up emails, initiating SMS surveys, adding feedback surveys, creating paper feedback cards, sending surveys via a mobile beacon, reviewing live chat transcripts, and conducting customer interviews.

Why is obtaining feedback a tricky challenge?

- Well, some patients tend to not take these kinds of things seriously as they don't realize the importance feedback has to our growth as an organization.

Do you use prototyping of new solutions in your healthcare field?

- As the world of technology is in full bloom, it is surprising that the technology used by medical professionals is often outdated. There is no excuse for this lack of innovation. We can help to redeem this situation by improving the medical equipment doctors, clinics, and hospitals have at their disposal.
- We have come to understand that medical professionals rely heavily on diagnostic tools when evaluating patients. Limitations and errors in these instruments mean limitations and errors in a doctor's ability to diagnose and treat patients. People suffering from chronic illness also need better solutions for monitoring their condition on a daily basis. Those working in the healthcare field are familiar with all of these challenges because they see them every day. They know what functionality is needed to elevate the level of care but lack the technical ability to implement it.

Do you improve your ideas through user testing?

- User testing helps with user satisfaction improvement by targeting the real problem right away, so our team doesn't spend time 'fixing' the wrong issue - our time and money are invested in the right problem.

Interview #7

Date: 2 June 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patient and their needs?

- Understanding your patients' needs is something every medical practice owner ought to do continuously. What I do is spend time getting to know what the patient wants, how they want it, and what price they are willing to pay for it.
- With most patients using multiple channels to communicate with their medical providers, we must make sure that the interaction feels like a single, seamless conversation.

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- In today's health care system, delivery processes involve numerous interfaces and patient handoffs among multiple health care practitioners with varying levels of educational and occupational training. During a 4-day hospital stay, a patient may interact with 50 different employees, including physicians, nurses, technicians, and others. Effective clinical practice thus involves many instances where critical information must be accurately communicated. Therefore, team collaboration is essential. When health care professionals are not communicating effectively, patient safety is at risk

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- I certainly do, that is why I do not sell myself short, even the craziest idea that I think is completely off can often be the one idea that people latch onto.
- Firstly, I realize that every product, service, method, and aspect of my job can be done differently and better, this challenges my imagination and creative thinking.

- Secondly, I ask my patients what problems they encountered with the healthcare staff that took care of them. Moreover, I ask suppliers for ideas regarding cost savings and quality improvements. I also take my colleagues' opinions into account about what could be improved. People from outside your field have other viewpoints and can see problems, gaps, and opportunities that you might miss. I suggest networking outside of work with people in other fields and discussing their approaches to some of the topics that concern you.

Which are the sets of beliefs you usually apply in your work?

- Honesty should be the bedrock of our foundation, as it will define who we are before we even allow others to know more about us. If we are always truthful, we will live a life with fewer worries. We can use our minds to think of new ideas, rather than rely on lies and excuses. Honesty in speech and actions attracts others' attention and respect.
- Another belief I apply is you'd better take risks rather than regret not taking chances. Fire is enthusiasm. Its unbridled passion and excitement for living your life on your terms.

How do you generate ideas and assemble them into tangible solutions?

- Ideas are the key to innovation. Without them, there isn't much to create and because execution is the key to learning, new ideas are necessary for making any kind of improvement.
- Idea challenge is a focused form of innovation where you raise a problem or opportunity with the hopes of coming up with creative solutions.

Do you consider using a holistic approach to innovation?

- Moving towards a holistic and modern approach identifies and maximizes innovations.
- Encourage extensive collaboration across cross-functional departments, retaining all ideas, concepts, and insights from employees and leveraging the collective expertise as a powerful asset.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- While health technology can do a lot for improving patient satisfaction, providers need to remember that it starts with them.
- Understanding patient experience is a key step in moving toward patient-centred care. By

looking at various aspects of patient experience, one can assess the extent to which patients are receiving care that is respectful of and responsive to individual patient preferences, needs, and values. Evaluating patient experience along with other components such as effectiveness and safety of care is essential to providing a complete picture of healthcare quality.

How do you obtain feedback from your customers?

- Surveys are the bread and butter for getting feedback. They're easy to set up, easy to send out, easy to analyse and scale very well.
- You need to ask your patients the right questions at the right time.
- Email is one of the most convenient ways to gather customer feedback as it is still a popular support channel.

Do you use prototyping of new solutions in your healthcare field?

- When we prototype, we do it in a very specific way so that we learn from it quickly, cheaply, and early on. It is far preferable to mess up at this stage of the game. To do so requires a different mindset, but if you can master that mindset, your team is going to make bolder decisions because the cost of failure drastically decreases.
- When we're designing our clinics, everyone will have assumptions about the room, whether they're architects, facilities planners, interior designers, or nurses. We'll mock the room up out of foam core, build the walls, put in furniture, bring the physicians in, and run a code scenario. This is a great way to get feedback from our physicians and then communicate with our architects. It allows us to make mistakes and figure out friction points early on, which is a huge time and money saver.

Do you improve your ideas through user testing?

- User testing highlights the most valuable, marketable, and useful ideas. This maximizes resources, reduces costly inefficiencies, and helps you build more competitive and robust products that satisfy your end-users.

Interview #8

Date: 4 June 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patient and their needs?

- Making the patient comfortable and earning the trust and confidence of the patient is very important. What I do is introduce myself and explain my role in their care. I also review their medical record and ask basic get-to-know-you questions. Showing respect and treating each person with compassion and without judgment is essential.

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- Safe and effective patient care depend on the teamwork of multidisciplinary healthcare professionals. Unfortunately, the field currently lacks an evidence-based framework for effective teamwork that can be incorporated into medical education and practice across health professions. India needs 2 million heart operations a year, and all the heart hospitals in the country put together far from 120,000 heart surgeries. Now, what happens to the rest? A hundred years after the first heart surgery less than 20% of the world's population can afford it, and 80% of the world's population is a silent bystander. Something has to change. India has to change. The West has to change. Europe has to change. Our purpose is to democratize healthcare.

What are the advantages of democratized healthcare?

- Democratized healthcare implies more knowledge and power for patients to decide upon themselves and enables doctors to collaborate in a way that benefits the patient.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- Creativity in the workplace has become a must-have. Today we operate in a highly competitive, global environment, making creativity crucial. Being creative at work generally means taking risks, which can make some people hesitate. Fear of the unknown is powerful, especially if it means you might fail. We would like the right quality healthcare to become a global phenomenon. We want everyone to have access to high-tech healthcare with dignity.

Which are the sets of beliefs you usually apply in your work?

- Integrity. Discipline. As surgeons, our life is very tough since we work 16-18 hours a day, six days a week. Then when we go home and get a call at two o'clock in the night that somebody is bleeding and even at this stage of my career, I still do it, and what sets us apart is the power of purpose. It's pointless talking about all the developments in healthcare if people can't afford it.

How do you generate ideas and assemble them into tangible solutions?

- Converting an idea into a reality (regardless of the required investment of time and money) is never an easy task. In fact, it is extremely difficult. First and foremost, it is important to believe in yourself. You can't take action until you believe in yourself enough to handle the consequences of your decisions. Then you need to surround yourself with people who are more intelligent than you are. Finally, after hearing their ideas you proceed with finding a solution.

Do you consider using a holistic approach to innovation?

- Yes, it is a must to consider using a holistic approach. I believe that India will become the first country in the world to dissociate healthcare. India will prove to the world that the wealth of the nation has nothing to do with the quality of healthcare its citizens can enjoy and once that happens in India, it will be very easy for other countries to follow. We need to do 2 million heart surgeries a year, and all the heart surgeons in the country put together perform only 120,000 heart surgeries. What happens to the rest? 1.9 million people die within the next few years, because they couldn't afford the heart operation and, in the process, we perhaps produce one of the largest numbers of young widows in the

world.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- Patient satisfaction boils down to three points: communication, provider empathy, and care coordination. What we find is that loyalty is primarily being driven by number one, communication. There's a difference between waiting and not knowing why you're waiting. Then we have empathy in our delivery of care which is essential to patients' wellbeing. Last but not least, coordination of care is equally important since patients want us to be working as teams.

How do you obtain feedback from your customers?

- Healthcare service providers have all realized that patient feedback plays a crucial role in patient care. Therefore, the patient is asked to fill out a pre- and post-appointment questionnaire/survey. Before, during, and post-appointment, a patient encounters a series of experiences including the waiting staff, staff efficiency, and friendliness, experience with the doctor, patient's perception of the level of treatment, and availability of medicines at the pharmacy, etc. Based on these patient experiences, the patients build their perception of your healthcare centre. Therefore, taking post-appointment patient feedback is a great idea to allow the patients to share their experiences (good and bad) with you directly. It makes the patients feel like you care about their experience, and it gives you valuable information about their experience during the appointment. This allows you to also improve on recurring patient issues and make amends in improving patient satisfaction.

Do you use prototyping of new solutions in your healthcare field?

- Yes. Prototyping is one of the key pillars for true technology innovation. Prototyping helps us to understand the strengths and weaknesses of the proposed technology solution.

It is usually more of an adaptive process than a planned project.

- It allows teams to test the usability and feasibility of their products early in the development cycle.

Do you improve your ideas through user testing?

- Yes, I do. Insights from observing how people use a product are well worth it when it comes to innovating our products.

Interview #9

Date: 8 June 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patient and their needs?

- What I do to understand my patients is taking the time to listen to them and make them feel comfortable in my presence so that patient-doctor trust is earned.

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- Working in multidisciplinary teams allowed me to understand the patient from more perspectives as in this type of team there are doctors from different fields. This way diagnosing and finding the right treatment is way easier.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- I definitely do! We, as clinical practitioners, sometimes need to apply creativity when using our medical skills to make the right diagnosis and prescribe the treatment as some illnesses might connect with other health problems and not present the basic symptomatology.

Which are the sets of beliefs you usually apply in your work?

- Respect and dignity are my core values when it comes to work. Respecting the patient and co-workers enough to never go behind their back will ensure that your dignity remains intact which will give you a forever peace of mind

How do you generate ideas and assemble them into tangible solutions?

- The way in which I generate ideas is through the process of brainstorming. After gathering all the ideas that come to my mind, I choose the one which I consider best and focus on making it become reality. What I do is constantly read about new innovative systems in my field and the process of their creation inspires me to keep going until my solutions come to life.

Do you consider using a holistic approach to innovation?

- Holistic approaches are the future, so I consider using such an approach. Looking at something as a whole interconnected system enables a broader understanding of it and facilitates innovative processes.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- To obtain an overall vision of our health care quality I always evaluate the patient in terms of how respected, heard, safe, and understood they felt. By directly communicating to the patient and paying close attention to what they're saying I find all the answers I need, including their level of satisfaction. Comprehending where all patient's complaints come from will create a system strongly focused on the patient.

How do you obtain feedback from your customers?

- By asking them directly about how they felt during their visits. I also send out emails

requesting feedback or give them hand-outs at the end of the treatment.

Do you use prototyping of new solutions in your healthcare field?

- I certainly do as it enables early discoveries of design problems as well as it helps us estimate production cost and manufacturing time. Using prototyping relieves us from wasting money and time.

Do you improve your ideas through user testing?

- Yes, we do as it shows us how effective, efficient, engaging, prone to errors, and easy to learn our product is. It also motivates us to think from a user's perspective.

How does that motivate you?

- As we are constantly analysing user testing results and improving our product based on them, we have to pay closer attention to details to make this process more efficient and less costly.

Interview #10

Date: 11 June 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patient and their needs?

- You see, modern medicine has undermined the importance of touch and compassion on the face of a doctor. When a patient comes to me, he/she has done all the investigations. I know exactly what's happening with the patient. I don't need to put on a stethoscope and listen to his heart and lungs, but I still do it. I don't need to touch him/her. But I still do it because the power of touch is phenomenal. The moment I touch the patient, I put

my hand around his/her shoulders. That's very reassuring. I only have five minutes or 10 minutes of interaction in that period.

- I have to convince him/her to undergo an operation, during which he can potentially die. He/she has to make a decision, so she/he has to trust me. I have to look into his/her eyes, talk to him/her and connect with him/her, and that's very important because it has a larger healing power than all the surgical tools and medicines I have in this world. But unfortunately, the whole philosophy of touch, compassion, and care is gradually losing ground. Yet, I hope it gets restored.

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- The term 'multidisciplinary' and the possibility of working across disciplines has always attracted me.
- Strong collaboration skills make you an active listener, who is willing to take the initiative but also to be led by others. People with strong collaboration skills are more likely to get work done faster but without sacrificing quality.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- A well-facilitated ideation session or brainstorming with a diverse team will generate plenty of great ideas for any business challenge.
- I look at what principles other industries apply, and I get inspired by them. How do other organizations in different fields tackle the sorts of challenges that you face? What do they do in the entertainment industry, in retail, or in charities? What do businesses similar to yours do in Singapore, Holland, or Shanghai? I find the answers to these questions by researching them on the internet. Then I implement some of their great ideas and apply them in my organizations.

Which are the sets of beliefs you usually apply in your work?

- Hard work. What can be said that isn't already about working hard? For the sceptics who are quick to point out that hard work doesn't always make sense, don't worry, I agree. I believe in intelligent hard work. Busting your tail for something without thinking it through is a fool's game. But working hard, with focus and desire is the key to getting ahead.

- A major component of confidence is the value you place on yourself. Confidence is about the faith you have in your abilities, the person you are, and how you view your most important relationship, which is the one with yourself.

How do you generate ideas and assemble them into tangible solutions?

- Visualization is about using images. It's not about drawing; it's about visual thinking.
- Storytelling is exactly how it sounds: weaving together a story rather than just making a series of points. It is a close relative of visualization — another way to make new ideas feel real and compelling. Visual storytelling is the most compelling type of story. All good presentations — whether analytical or design-oriented — tell a persuasive story.

Do you consider using a holistic approach to innovation?

- Approaching innovation holistically is extremely important as it enables seeing your project from different perspectives which is a great asset in the long run.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- Patient satisfaction is an indicator of a patient's happiness with the treatment and the services provided in a hospital or a healthcare centre. With Patient Satisfaction, you can easily know the extent of a patient's happiness with their healthcare and overall experience in the hospital.

How do you obtain feedback from your customers?

- By creating Customer Surveys and sending personalized emails.
- In my opinion, email is one of the most convenient ways.

Why is email one of the most convenient ways?

- Well, patients can read and answer emails from the comfort of their own home when they feel like it without any pressure.

Do you use prototyping of new solutions in your healthcare field?

- Not really. Even though prototyping is very important.

Why do you consider it important?

- Prototyping shows the physical form of a project which is better than just imagining it while talking about it. This boosts effectiveness and takes a lot less time.

Do you improve your ideas through user testing?

- I have not explored user testing to its fullest, but from what I learned about it I can say that it is one of the best ways of innovating your project as you get information from your target users.

Interview #11

Date: 14 June 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patient and their needs?

- As part of medical practice, it is challenging every day to understand the different patient categories and their requirements in the context of treatment.
- Patient categories can be classified as poor, middle class, and rich, and their mindset is different when it comes to treatment.
- As a doctor, it is very difficult to satisfy a patient or patient party because you cannot anticipate all scenarios.
- Unfortunately, few patients are so down to earth that they will be thankful to doctors for the service and treatment they have received.
- On the contrary, I have seen patients in the rich category that have attitude issues and they will simply order and ask the doctor to do as they want it to be done, which is against my working policy.
- Just to keep the patient party and patient happy at times the only solution is to listen and work silently as I want to; otherwise, if the situation gets difficult it is better to move the case.
- Clarity and trust are two important things required in this profession. In conclusion, although a lot of things are being provided, it will still be less for the patients.

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- Working in a collaborative environment with a multidisciplinary team is very important. Because everybody depends on each other to make the quality work run smooth. As there are lots of practical work to do, we need to keep a well-mannered, well-skilled person appointed in a particular position, because a mistake can lead to big Medicolegal complications.
- A doctor – nurse – technician - ward boys - other departments everyone is dependent on each other and keeping a quality team over the head is also important because they can monitor whether the work is getting done in a systematic proper way.
- When the base is strong, it will be easy and every one of the medical staff to work in an easy professional way.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- Yes, I do use creativity in my work because every day there is a new challenge to handle, and it is really important to plan a day and workload in a certain way that saves time. Though it is difficult to work on the plan every day, as per my experience I have learned and I am still learning from my co-workers also that how work can be divided and framed in a way, along with documentation, that in case of any issues at workplace how these things help to sort out the issue in a later stage. Handling patients in OPD then inwards then on calls plus documentation everything needs to be pre-planned. Preplanning is really important.

Which are the sets of beliefs you usually apply in your work?

- The sets of beliefs I usually apply in my work are as follows: work ethic, respect amongst co-workers - whether a senior or a very junior staff - motivation at the workplace, positive attitude and atmosphere, confidence in accepting a challenge, and vision to move ahead in life.

How do you generate ideas and assemble them into tangible solutions?

- Discussions with co-workers or someone who can understand the situation are really important, and at times decisions to be taken at the workplace might work against us. Therefore, I must have a good team with whom I can sit and discuss the issues faced and take time before implementing a decision. I sometimes work under a lot of pressure, and I am forced to make a decision based on my personal experience, however, I happen to regret it later. That's why, finding a solution to the problem, along with the help of co-

workers, can make things easy.

Do you consider using a holistic approach to innovation?

- Yes, I do. This kind of approach implies factors that come from a broader vision which creates a well-rounded product.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- When they give us positive feedback, as well as when they visit us again in case they are in need and when they recommend us to their family and friends.

How do you obtain feedback from your customers?

- Sometimes during the consultation, patients talk about what they liked and what they did not like during their medical visit. Another way of obtaining feedback is with the help of our customer care team which communicates with the patients and asks relevant feedback questions.

Do you use prototyping of new solutions in your healthcare field?

- Yes, I do as I find it essential in innovating our hospital. I believe that it reduces our expenses and reduces time consumption.

Do you improve your ideas through user testing?

- Yes, I do. I consider user testing to be a very important tool when it comes to developing a service. Without the data collected through user testing, the process would be much longer and more resource-consuming.

Interview #12

Date: 18 June 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patient and their needs?

- The way we proceed in understanding our patient's needs is by talking to them and acknowledging their desires. Sometimes, we cannot provide exactly what they want. For example, a patient might ask for medication that is not suitable for them. What I do is inform them by patiently explaining why the wanted treatment is not the best for them, which includes giving examples of day-to-day life to make the information easier to comprehend.

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- Collaboration is essential to child and adolescent psychiatry. I work with paediatricians, occupational therapists, and psychologists so we can understand the patient from all viewpoints and find more solutions to the problems. It is important to have a team as it brings more value than working separately.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- I think that physicians, such as surgeons, need to apply creativity in their work, but in psychiatry, it is pretty hard to do that as we have to respect older doctors and their research published in scientific journals.

Which are the sets of beliefs you usually apply in your work?

- I believe that respecting my work and my patients is of paramount importance. If you have respect for what you do, you will always have the best interest at heart, which will motivate you to help the patient with focus and dedication.

How do you generate ideas and assemble them into tangible solutions?

- In psychiatry it's easier as we collaborate with the patient and other mental health professionals. Together we come up with new solutions, implement them and then see if they would work in the long term.

Do you consider using a holistic approach to innovation?

- Yes, I do. In my opinion, by approaching innovation holistically we can maximize the potential of our goals.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- As a doctor, it is harder to know if your patient is satisfied because they would rather be honest with other medical staff, such as medical receptionists, and nurses.

How do you obtain feedback from your customers?

- The hospital has surveys for the patients and their families at the front desk.

Do you use prototyping of new solutions in your healthcare field?

- No, I don't use prototyping, but I wish I could do that in the future as it is beneficial when it comes to finding better solutions in the most effective way.

Do you improve your ideas through user testing?

- Usually, we have very strict guidelines that we have to follow specifically with procedures and medication. Although we try to think outside the box, it is really hard to improve ideas through user testing. We can only test our ideas in laboratories or on a fair number of people.
  It is not impossible to do it, but it is very hard.

Interview #13

Date: 21 June 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patient and their needs?

- I believe that I can easily tune into how my patients feel rapidly and intuitively, thus making them feel understood and comfortable in my presence. This helps them open up and not feel ashamed of any particular symptoms.

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- Working in teams is extremely important. In order to be a valuable part of a team, learning to accept the group's decision even when you don't agree is of paramount importance. Qualities like flexibility, being a good listener and curiosity are essential.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- Yes, I do every day. Some cases go beyond science with symptoms that do not manifest by the book. By carefully observing the data I have at hand and by listening to my intuition I make the diagnosis. I think that being able to connect information outside of what you are already used to is a creative process.

Which are the sets of beliefs you usually apply in your work?

- Always listing to my intuition is my number one rule. I believe that when you have pure and genuine intentions your intuition will positively guide you toward the best solutions.

How do you generate ideas and assemble them into tangible solutions?

- I generate ideas by always reading about innovation in the medical field and get inspired

by the information I find. Transforming ideas into tangible solutions is a process that needs the collaboration of my team. I present to them my ideas, we choose the best one, and then we proceed in finding the shortest way of implementing it.

Do you consider using a holistic approach to innovation?

- Yes, I do. Sometimes it is crucial to see the patient as a whole and not as separate working systems. By doing this you find all the possible causes of the problem.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- Some patients tell you straight what they liked and what they didn't like.

How do you obtain feedback from your customers?

- I ask them to complete a survey and then analyse the answers to fix what is wrong.

Do you use prototyping of new solutions in your healthcare field?

- Yes, I do. Without prototyping, finding new solutions would be extremely time-consuming.

Do you improve your ideas through user testing?

- Yes, I definitely do if it's not something that might be harmful to the user.

Interview #14

Date: 23 June 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patient and their needs?

- Before the COVID-19 pandemic started, I used to connect with the patients face-to-face and be able to understand their non-verbal cues which gave away emotions and gestures that helped the consultation process to a degree. Since 2020, the digitalization process escalated, and I had to adapt to new techniques with the aid of email and video conferences.

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- Working in teams has become indispensable as we have had a lot of Indian and international patients since we started the online consultations. I prefer working in collaboration with my colleagues as it enables sharing of knowledge and because I am comfortable with people having diverse perspectives and abilities from mine.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- I am constantly applying creativity since our hospital's online expansion. I always have to find new and creative ways of attracting patients with the help of social media platforms. Moreover, as a cardiologist, I find online consultations to be more demanding as I don't dispose of all the medical equipment a hospital might have, so I have to come up with more detailed questions that help me understand the patient in-depth.

Which are the sets of beliefs you usually apply in your work?

- To my mind, consistency is key. Working every day, even for one hour has made positive

changes in my routine and career evolution.

How do you generate ideas and assemble them into tangible solutions?

- Ideas form in my head after I read stories of people more successful than I am, listen to podcasts, as well as follow what other doctors in my field do. Assembling them into tangible solutions depends on my team's perspective as I am more of a dreamer, rather than a practical person.

Do you consider using a holistic approach to innovation?

- This kind of approach plays a vital role in obtaining the wanted results as it helps us measure the external and internal factors that affect the solution we are proposing.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- I know that my patients are satisfied when they regularly choose our hospital for their problems.

How do you obtain feedback from your customers?

- At the end of every call or email there is a survey designed for receiving feedback.

Do you use prototyping of new solutions in your healthcare field?

- Yes, we totally do. Prototyping helped our hospital grow digitally as we tried assembling many different ideas before putting the best one into practice.

Do you improve your ideas through user testing?

- Yes, I do. Every digital decision we make has already been user-tested on users from all countries we work with.

Interview #15

Date: 27 June 2022

RQ: Do healthcare providers apply Design Thinking to provide affordable healthcare at the bottom of the pyramid (BoP)? And if they do, how? Are they using a framework? And if yes, which one?

INTERVIEW QUESTIONS

(1) EMPATHY

How do you proceed in understanding your patient and their needs?

- As an ophthalmologist empathy, knowledge, and clarity are my main principles when it comes to understanding my patients. What is do is try to identify with my patients and use verbal acknowledgment such as "I see you are doing a great job by consistently using your drops" to make them feel at ease and encouraged. Knowledge is power, the more you know the better you understand the patient, this is why I keep myself updated on all the discoveries in my field. Finally, communicating clearly and at the patients' level is very important. If the patient does not understand the message you are trying to get across, they won't be able to answer efficiently, which affects the communication process.

Can you describe your working experience in a collaborative context/ with a multidisciplinary team?

- What I have learned from ophthalmologists, general practitioners, optometrists, and allied health professionals working together is that collaboration is the future. Gone are the days in which one doctor did everything by himself. The world is moving faster and faster, so to adapt and innovate, you must have a team.

(2) IDEATION

Do you apply creativity in your work? If so, how do you do that?

- Yes, I do. For example, I use creativity if my patients are children and I have to explain the process as a story so that they are less fearful of the visit.

Which are the sets of beliefs you usually apply in your work?

- I truly believe that all patients have the right to the same attention and behaviour no matter what their background is.

How do you generate ideas and assemble them into tangible solutions?

- I generate ideas through brainstorming and assemble them with mind mapping.

Do you consider using a holistic approach to innovation?

- Yes, I do as it enables me to observe the bigger picture which results in finding more efficient solutions.

(3) PROTOTYPE AND TESTING

When do you know that your clients are satisfied?

- The way I know my patients are satisfied is by reading their feedback.

How do you obtain feedback from your customers?

- Patients can leave a review with the help of a tablet which they can find at the hospital's front desk.

Do you use prototyping of new solutions in your healthcare field?

- Yes, I do. Prototyping is the key to successful results.

Do you improve your ideas through user testing?

- Yes, I do, especially when it comes to the computer or mobile applications, we use to improve our communication with the patients.