Disease Pathway Framework by Innovation Think Tank as a tool for co-creation, pain point identification and solution ideation across patient care plan

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Abstract

With the rising global disease burden, it becomes increasingly important to focus on the complete patient journey in order to deliver quality patient centric care. It can be challenging to obtain a holistic view of the stakeholders and pain points throughout the disease life cycle, recognize interdependencies between the stages, and prioritize solutions as per customer needs.

To address these clinical needs across disease care plans, the Innovation Think Tank (ITT) team created a structured approach to elaborate on the pathways for diseases with a huge impact worldwide. Several co-creation sessions were held within ITT and with its partner universities and hospitals to identify the pain points, ideate on innovative solutions, and validate them through clinical and technology experts. The collected data on disease epidemiology, stakeholders, pain points and solutions were represented as infographics showcasing facts and figures and care plan depicting the patient journey, the two elements of the disease pathway framework.

With a focus on open innovation in healthcare, this framework has been utilized to create pathways for over 25 diseases, as a result of which more than 2000 pain points and solutions each have been analyzed and proposed, respectively. Moreover, this approach has been applied in over 60 projects, workshops, and capacity building programs at Siemens Healthineers, as well as Ministries, universities, and hospitals since its conceptualization in 2018. By facilitating information sharing and delivering high-quality solutions, this novel structure fosters collaborations with key stakeholders and paves the way for innovative advancements in healthcare.

Keywords: Disease pathways, framework, healthcare system, global burden, care plan, pain points, solutions, Innovation Think Tank

Introduction

The global disease burden represents the collective impact of diseases and health conditions on populations worldwide. It encompasses various factors such as mortality rates, morbidity rates, disability rates and socioeconomic indicators to assess the overall health challenges faced by different regions and populations [1, 2].

A World Health Organization (WHO) research states that 55.4 million deaths occurred worldwide in 2019. 74% of these were caused by non-communicable diseases (NCDs), with ischemic heart disease, stroke, and chronic obstructive pulmonary disease contributing to >30% of the deaths collectively [3]. Among other NCDs, the global cancer burden is estimated to increase by 47% in the next 2 decades [4]. In contrast, there has been a notable reduction in the incidence and mortality due to communicable diseases such as Human immunodeficiency virus, acquired immunodeficiency syndrome (HIV AIDS) and tuberculosis over the years [3].

Understanding and examining the disease burden is crucial to identify priorities, allocate resources efficiently and develop strategies to improve global health outcomes and address the evolving challenges posed by this shift in disease burden [2, 3]. Moreover, as healthcare is transitioning from curative to preventive care, it requires stakeholders such as Ministries of Health, healthcare professionals, medical device manufacturers, as well as patients to shift from a reactive to a proactive mode.

To achieve optimal patient care on a global scale, it is necessary to adopt an innovative approach that addresses clinical needs across disease care plans. This requires a sustainable innovation ecosystem and technological advancements based on a structured, dynamic, and customer-centric framework. However, consolidating the perspectives of diverse

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stakeholders, their pain points, and understanding the interdependencies between different stages of a disease can be challenging. Prioritizing solutions according to customer needs is also a complex task. To address these challenges, a holistic framework for disease pathways has been proposed. The disease pathway framework is a novel tool that outlines the procedures involved in healthcare provision throughout the development of several diseases. With an emphasis on open innovation in healthcare, this framework has been applied to over 25 diseases [Table 1] [5].

Disease cluster	Disease
Certain infectious and parasitic diseases	Infectious diseases Tuberculosis Human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS)
Neoplasms	Lung cancer Breast cancer Liver cancer Oral cancer Prostate cancer Colorectal cancer Cervical cancer Leukemia
Diseases of the nervous system	Alzheimer's disease Dementia Parkinson's disease Multiple sclerosis
Diseases of the respiratory system	Chronic obstructive pulmonary disease Interstitial lung disease Pulmonary embolism
Diseases of the genitourinary system	Chronic kidney disease
Injury, poisoning and certain other consequences of external causes	Traumatic injury Wound healing disorder
Diseases of the circulatory system	Stroke Coronary artery disease Structural heart disease Peripheral vascular disease
Endocrine, nutritional, and metabolic diseases	Diabetes
Mental and behavioral disorders	Depression

Table 1: Disease clusters for 25+ global diseases, based on the International Statistical Classification of Diseases and Related Health Problems - 10 (ICD-10) classification system. Disease pathways have been created for these diseases using the ITT disease pathway framework

Material and methods

The idea for the disease pathway framework was conceptualized in 2018. Diseases with a high global burden were identified and divided into clusters. To create the disease pathway framework, Innovation Think Tank (ITT) methodology and the ITT Healthcare System Framework (ITT HSF) were taken as reference [5-7].

Global ITT teams formed groups and were assigned topics based on their expertise. A transdisciplinary team of over 50 participants comprising of clinical, biomedical, and technical experts came together in 30 co-creation sessions to understand the disease, create a disease care plan, and analyze pain points throughout the disease life cycle. Ideation sessions were held to generate innovative solutions for the identified pain points. To gain insights from various disciplines, topics were periodically rotated among the groups. Furthermore, valuable inputs were gathered from capacity building programs at numerous universities and hospitals worldwide [5].

The outcome of this exercise was the assortment of key data on disease facts and figures, stakeholders, pain points and related solutions gathered from multiple sources such as public statistics, expert opinions, open innovation workshops, and research. This information was tailored for optimization and design of the infographics and care plan. Ultimately, thorough validation of the same was obtained from

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experts within and outside Siemens Healthineers (SHS) [Figure 1] [5].

The disease pathways need to be updated regularly to reflect the latest trends and challenges. Therefore, although the first set of disease pathways were published on the SHS website in 2019, they were adapted to highlight the impact of SARS-CoV-2 after the COVID-19 pandemic in 2020 [5]. Thereafter, the next set was published in 2021. Recently, the disease pathways have been updated with further information in the facts and figures section, additional stakeholders, new illustrations, pain points and solutions, incorporation of the access to care element, other solution categories to depict whether the solution exists in healthcare sector, is under research or futuristic, inclusion of references, and design improvements. The care plan stages have also been modified to better reflect the patient journey. Furthermore, most existing pathways have been customized according to the requirements of various projects, specific stakeholders, hospitals, or healthcare institutes of different regions.
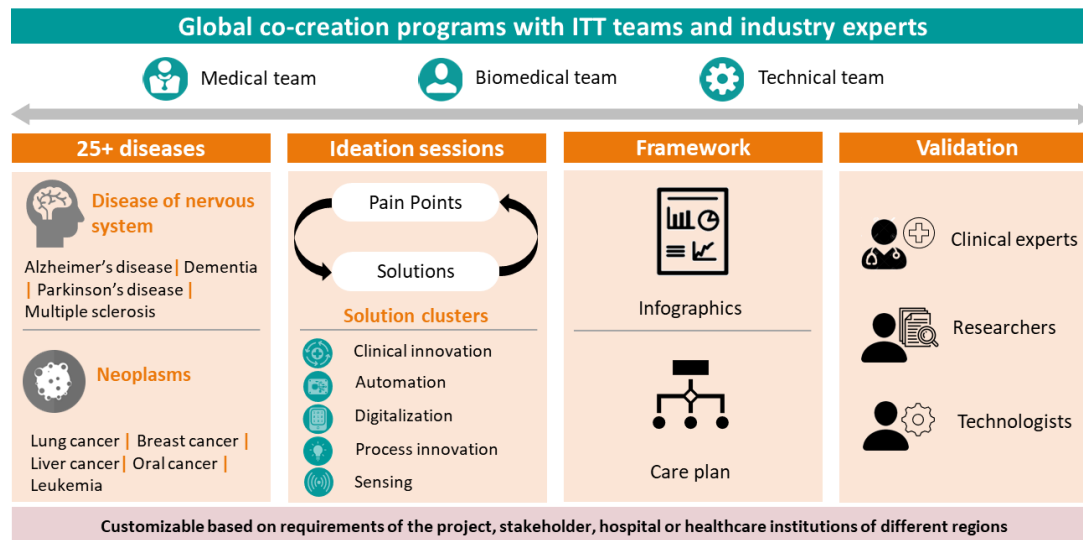

Figure 1: Disease pathway framework methodology [5]

Results

A framework for disease pathways was developed to elaborate on diseases with a huge global burden [Figure 2]. The core elements of the proposed framework are [5]:

1. **Infographics template for facts and figures:** it provides a consolidated overview of global and regional disease statistics in terms of health indicators, gender distribution, economic burden, risk factors, signs and symptoms, and impact of COVID-19.
2. **Disease care plan:** it showcases the patient journey through various stages of disease via scenarios and illustrations, stakeholders involved in each stage, their pain points, interdependencies, as well as solution proposals.

The disease care plan model is categorized into the stages outlined below. The number of stages depends on the nature of the disease [5].

1. Prenatal: occurring or existing before birth.
2. Prevention: measures to prevent the disease from occurring or halt its progression.
3. Symptoms: patients begin to experience the physical and psychological effects of the disease.
4. Diagnosis: identifying the nature of the illness or other issues through clinical, laboratory, or radiological examinations.
5. Treatment: care provided to a patient for an illness or injury by appropriate medical, surgical, or other therapeutic interventions.
6. Rehabilitation: helping patients return to their daily routines through various interventions.
7. Follow up: care provided to the patient post-treatment.

Disease pathways for over 25 diseases were created utilizing this framework. As a result, more than 30 stakeholders have been analyzed, over 2000 pains

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and solutions each have been identified and proposed, respectively. These solutions, influenced by clinical or technological advancements, business models, or process improvements, are distributed across five key areas: digitalization (internet of medical things, 5G, artificial intelligence, blockchain), automation (robotics), clinical innovation (new diagnostic methods, digital pathology, minimally invasive procedures), sensing (biosensors, smart wearables), and process innovation (healthcare process, policies, business models). ITT labs at several locations have already been working on some of the proposed solutions.
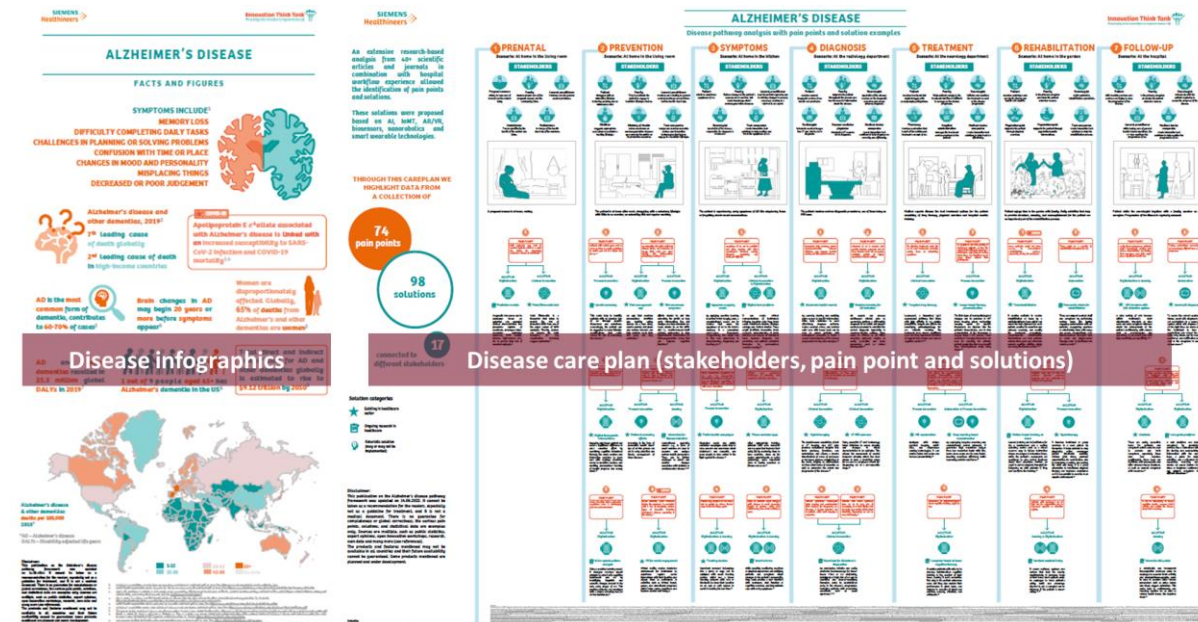

Figure 2: Disease pathway for Alzheimer's disease created by utilizing the disease pathway framework which consists of infographics template for facts and figures and care plan stages inclusive of scenarios, illustrations, stakeholders, pain points and solutions. The disease pathways can be customized to align with the trends, challenges, and location specific requirements of universities and hospitals, in collaboration with ITT regional laboratories [8]

Discussion

Health systems worldwide encounter a multitude of challenges, encompassing inadequate infrastructure, shortage of skilled workforce, rise of chronic diseases, and lack of access to quality patient-centric care. Recently, the COVID-19 pandemic also highlighted the fragility of our health system. Addressing these challenges necessitates the inclusion of a global multidisciplinary team comprising of researchers, policy makers, clinicians, medical technologists, strategy and innovation experts, who can work collaboratively to identify the healthcare needs and develop innovative solutions to improve patient outcomes. This approach precisely aligns with the disease pathway framework implemented by ITT [5].

This framework, which provides a basic structure that can be used to curate disease pathways for all diseases, can be utilized for: (1) Stakeholder analysis,

(2) Pain point and root cause analysis, (3) Portfolio mapping and white spot analysis, (4) Product definition and decision proposition. Furthermore, it serves as a common discussion basis for individuals from diverse backgrounds, including clinicians, engineers, administrators, product managers, and students, to reflect their perspectives, ideate on pain points, map these ideas across the patient journey, explore innovation potentials, and propose solutions using emerging technologies to tackle real-world challenges. Institutions can use this tool to collect their own pain points for their relevant stakeholders and come up with customized solutions [5].

The disease pathways developed through this framework have been extensively utilized in over 60 projects, workshops, and capacity building programs. The approach was applied to optimize its use in 30 product and portfolio definition projects, in addition to co-creation programs with universities, and hospitals. These pathways have played a vital role in

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recognizing improvement potentials in several imaging modalities and laboratory diagnostics equipment. Moreover, they have helped uncover new potential disruptive areas with respect to technology and start-ups, expand product portfolio, streamline clinical workflows, and enhance patient centered care [5].

However, the proposed framework is not without limitations. Firstly, the disease pathways that have been curated using this framework cannot be generalized to all regions as they highlight only a limited number of compiled pain points and best practices. Secondly, these pathways need to be periodically updated based on the latest challenges, trends, and advancements in healthcare. Finally, it is not always possible to have access to a global infrastructure of trusted partners and a transdisciplinary team which is often required to create these pathways [5].

Future scope of this framework includes development of a digital tool (web/ mobile application) which could be utilized during co-creation programs and enable stakeholders from across the world to use this common platform to share their challenges, experiences, and solution ideas, and contribute towards the betterment of care delivery [5].

Conclusion

The disease pathway framework is a novel ITT tool developed to provide a structured approach depicting the entire patient journey across the disease life cycle, along with the stakeholders involved, their pain points and solution ideations. It offers a foundation for collaboration among several stakeholders including healthcare providers, medical device manufacturers, and start-ups, as well as aids in gap analysis, enhancing clinical workflows, facilitating patient centered care, defining product requirements, and assessing business impact. This framework can be customized based on the customer, institution, and country specific requirements. The innovative ideas outlined here could be incorporated to tackle the current healthcare system challenges as well as aid in creating self-innovating hospitals addressing patient life cycle, enhancing the future of healthcare.

Author contributions

SH designed the disease pathway framework as the base for the study, conceived the original idea, and supervised and supported the project with respect to Siemens Healthineers. SH, AG, EW, SS, MM, SM, DH, and NN carried out the experiment. SH, AG, NN, and MM wrote the paper with support from EW, SS, SM, and DH. All authors contributed to the article and approved the submitted version.

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Disclaimer

The disease pathway framework has been updated from its previous versions. It is not intended to be taken as a standard of medical care for the readers. Sources are multiple, including public statistics, research, key opinion leader interactions, and open innovation workshops. Large language models were utilized for paraphrasing purposes only.

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