WHITE PAPER

Novo Nordisk, Inc., and ZS unravel the complex cardiometabolic patient journey

By Kate Mulroney, Umang Lahoty, Ayush Chauhan

Understanding and quantifying the patient journey is a critical component for life sciences organizations seeking to analyze markets and design effective intervention strategies across the enterprise. While patient journey mapping within a single therapeutic area (TA) is well-established, cardiometabolic diseases present a far more intricate challenge. These conditions are characterized by extensive cross-linkages across TAs, with patients often starting with one condition and eventually progressing to multiple interconnected diseases due to the nature of cardiometabolic disorders.

Patients navigate these complex journeys in diverse ways. So, it is essential to comprehend the pathways that span from disease onset through progression, treatment and monitoring—not only within a single condition but also across interrelated cardiometabolic diseases (for instance diabetes, obesity and atherosclerotic cardiovascular disease [ASCVD]).

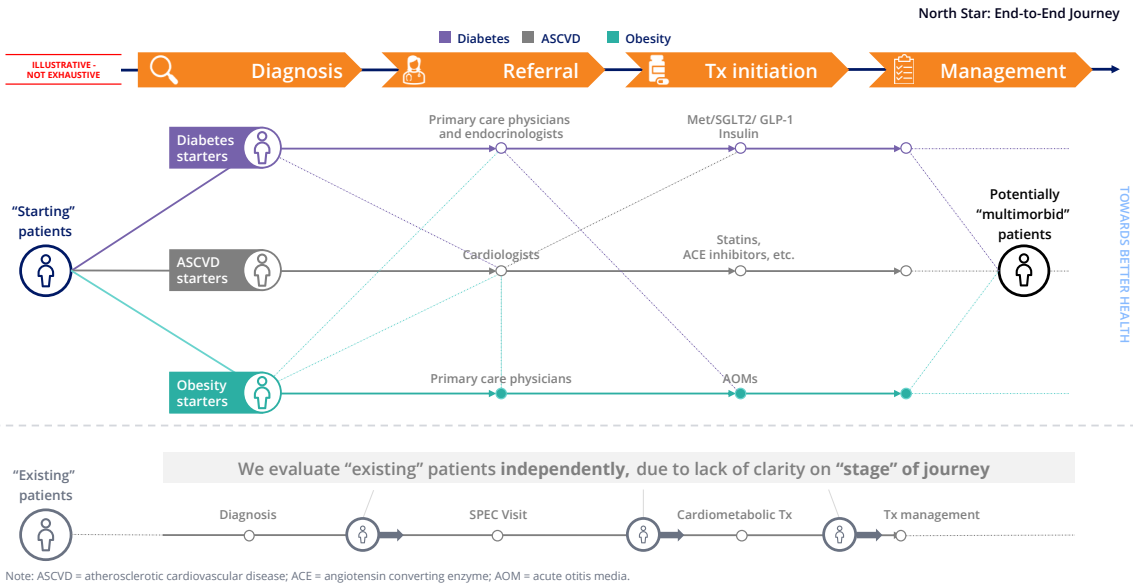
With a growing therapeutic pipeline aimed at addressing these conditions, our objective in creating the analysis was to identify and quantify cardiometabolic patient pathways by developing distinct "archetypes." These archetypes are based on a scalable framework designed to minimize manual intervention and enable the efficient re-creation and adaptation of patient segments for additional indications and populations in the future.

The cardiometabolic disease landscape

The cardiometabolic patient journey is a multifaceted and prolonged process, characterized by numerous complexities that arise at various stages. This journey encompasses several critical phases, each presenting unique challenges and considerations. Details surrounding multiple steps of the journey are highlighted in the figure below.

FIGURE 1:

The cardiometabolic patient journey has multiple pathways due to the interconnected nature of the TAs involved



Note: ASCVD = atherosclerotic cardiovascular disease; ACE = angiotensin converting enzyme; AOM = acute otitis media.

Symptoms and diagnosis

The initial phase of the cardiometabolic journey involves identifying and diagnosing conditions. Many cardiometabolic conditions, such as MASH and obesity, are notoriously difficult to diagnose accurately. These often are underdiagnosed because patients do not pursue treatment due to stigma associated with the condition (obesity). Consequently, some conditions remain undiagnosed for extended periods, complicating the patient's journey, exacerbating their disease progression and delaying necessary interventions. Patients start their journey from certain conditions and then may later develop additional comorbidities triggered by the underlying disease. Increasing the complexity of finding the starting point of a medical journey: Disease progression and comorbidities happen to individuals in a different order within patient populations.

Referrals and specialist involvement

As the journey progresses, given the interconnectedness of diseases, patients often require referrals to multiple specialists to manage their symptoms and disease. Involving healthcare professionals—including primary care physicians, endocrinologists, cardiologists, hepatologists, gastroenterologists and nephrologists—is crucial. This multidisciplinary approach is essential for comprehensive care but can also lead to fragmented communication and coordination challenges.

Treatment initiation

Treatment in the cardiometabolic journey involves the initiation and management of medications tailored to address specific comorbidities. The choice of first-line treatments varies depending on the primary condition and factors such as drug efficacy, clinical awareness, media influence, access and affordability. The drug of choice also often varies due to variation in effectiveness across multiple diseases. These factors not only affect healthcare providers' (HCPs) decisions but also shape consumer perceptions and adherence to treatment plans, ultimately affecting patients' health outcomes.

Treatment and disease management

Due to the chronic nature of cardiometabolic conditions, patients may experience changes in their treatment regimens. Switching to a different class of medication or discontinuing treatment altogether is not uncommon. These changes can result from a variety of factors, including perceived lack of seriousness, side effects or evolving health needs. Understanding these patterns is crucial for optimizing patient outcomes and ensuring continuity of care.

Why it is important to understand the patient journey

Understanding the patient journey is vital for stakeholders to align their strategies with patient needs, improve healthcare outcomes and drive business success. By leveraging data and insights, stakeholders can create more effective and patient-centered healthcare solutions.

Some reasons for developing an understanding of patient journeys:

- **Creating a patient-centric approach:** For pharmaceutical companies, the end consumer is the patient. Understanding the patient journey allows these companies to adopt a patient-centric approach, ensuring that the treatments and services they provide align with the actual experiences and needs of patients.
- **Identifying gaps and opportunities:** By analyzing the patient journey, companies can identify gaps in care and opportunities for intervention. This understanding helps in developing strategies to improve patient outcomes and enhance the overall healthcare experience.
- **Tailoring communication and support:** Different patient archetypes and profiles require tailored messaging and support. Understanding these differences allows companies to create targeted communication strategies for HCPs and patients, improving engagement and adherence to treatment plans.
- **Strategic decision-making:** Insights from the patient journey inform strategic decisions, such as product development, marketing strategies and resource allocation. This ensures that efforts are aligned with patient needs and market demands.

What it means for stakeholders inside pharma

For **pharma companies,** understanding the patient journey is essential for developing effective marketing strategies and improving product offerings. It helps in identifying patient archetypes across different TAs and tailoring strategies and tactics to meet their specific needs.

Medical teams use the patient journey to create a comprehensive market map of patients and HCPs. This helps in crafting medical narratives that can be communicated effectively to key opinion leaders, ensuring that the medical community is well-informed and aligned with the latest insights and strategies.

For **marketing teams,** understanding the patient journey is crucial for making strategic decisions regarding product positioning. It aids in targeting the right HCPs and patients through appropriate channels, ensuring that marketing efforts are efficient and impactful.

Analytics teams rely on the patient journey to develop capabilities for generating quick insights. By analyzing the journey, they can support other departments with data-driven insights that enhance decision-making processes and strategic planning.

Market access teams focus on identifying and addressing any gaps in the patient journey compared to what it ideally should be. This helps in ensuring that patients have access to necessary treatments and that any barriers to access are minimized.

With the understanding of friction points and prior interaction with a patient hub or patient support program offering, **patient support teams** can plan and manage the next intervention point to provide more informed care to the patient.

What it means for stakeholders outside of pharma

For **HCPs**, insights into the patient journey can enhance patient care by identifying critical touch points and potential barriers to treatment. This knowledge enables providers to offer more personalized and effective care.

A well-understood journey means better access to information, support and treatments for **patients**. It can lead to improved health outcomes and a more satisfactory healthcare experience.

For those involved in **research and analytics**, understanding the patient journey provides a framework for analyzing data and generating insights that can drive innovation and improvement in healthcare delivery.

Better defining patient archetypes

The overlap between patients and HCPs across TAs creates a more intricate landscape than standard patient journeys. Patients often develop multiple comorbidities, with varying timelines for their development. This variability affects HCP interactions, as the specialty required can differ based on the specific comorbidities present. Additionally, treatment needs evolve over time, and there is a lack of standardized care guidelines for patients with such complex conditions.

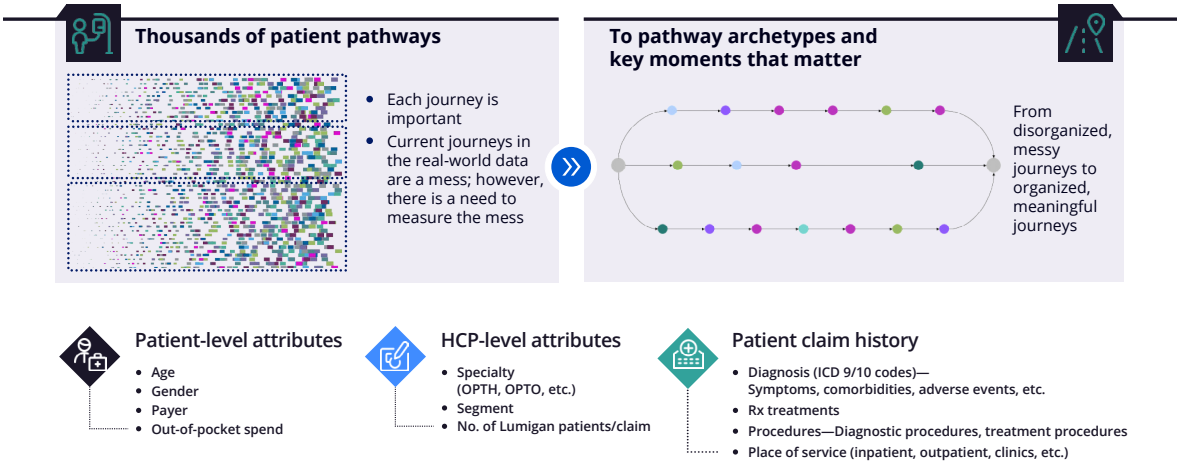
To address these, Novo Nordisk, in collaboration with ZS, has been developing capabilities to better understand patient journeys and archetypes across all TAs that can be leveraged across the organization.

Methodology: Building scalable patient journey archetypes

At Novo Nordisk, the focus was on leveraging secondary data, such as claims and social drivers of health (SDOH), to understand the patient journey. Tools like Wayfinder, which use deep learning models, are used to create cohorts and archetypes, which currently are feeding into various business use cases (see the figure below).

FIGURE 2:

Converting the individual patient into relevant archetypes

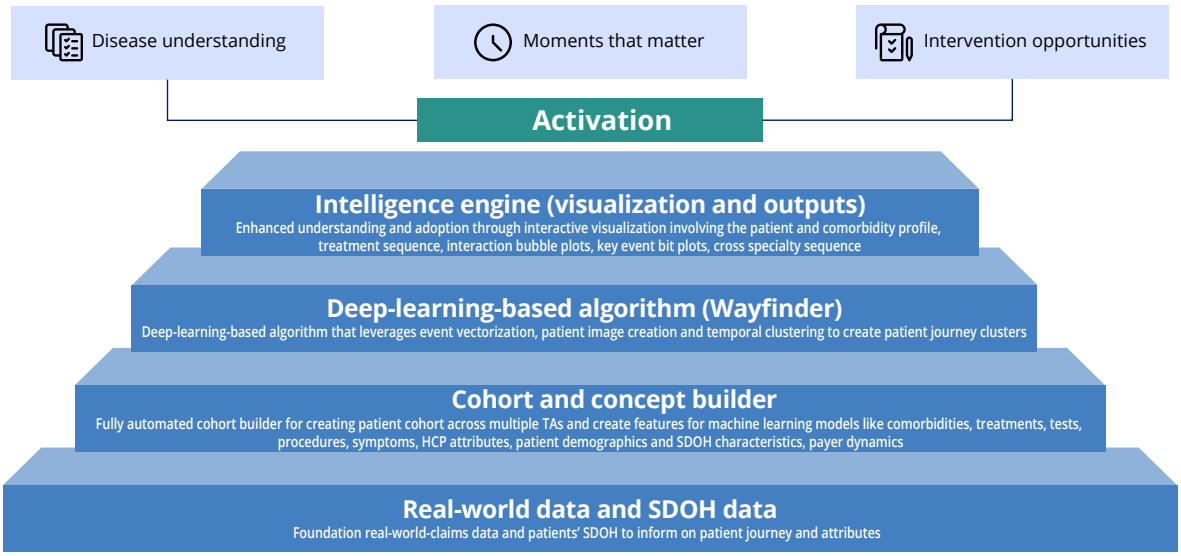


The approach began with analyzing postdiagnosis data from secondary sources covering over 100 million patients. This data serves as a robust foundation for understanding patient journeys. Leveraging this data, a deep learning-based algorithm was used to create patient journey clusters. The algorithm considers all the events occurring in the patient journey, starting from the diagnosis of the primary condition and the diagnosis of other comorbidities, symptoms and side effects, testing, treatments and procedures, etc. It converts this transactional claims data into 3D images. These images then became inputs for a convolutional neural network model, which was trained to learn from these images and create embeddings for each patient journey. On top of these numerical vectors other contextual variables like age, gender, ethnicity and income were added, and a clustering algorithm was applied to group them into clusters that are meaningfully distinct and homogeneous.

To ensure scalability, an operationalized process was developed that takes simple transactional data from relevant patients and returns their corresponding archetypes, making the solution easily repeatable and scalable across TAs. The solution was able to create patient journey archetypes for patients with diabetes, obesity and ASCVD, with the potential to expand to other cardiometabolic diseases.

FIGURE 3:

Framework for archetype development



Another critical requirement for this capability was developing visual ways to show the nuanced and complex patient journey insights in response to various key business questions asked by analysts or other stakeholders. Multiple outputs and visualizations were developed, including Sankey charts to show transitions in the patient journey. In addition to interactive bubble plots and bit plots that visualize the relative occurrence of events across the journey, profiles for each archetype and other facets of the journeys were built. These visualizations help illustrate the patient journey and identify areas where interventions can be made to improve patient outcomes and streamline processes. All this output generation was also automated, making the process scalable across multiple TAs.

Key insights: Archetypes of cardiometabolic patient journeys

Patient journey archetypes were constructed across various TAs, encompassing patients with diabetes, obesity, ASCVD and related comorbidities (such as chronic kidney disease and MASH). Subsequently, a unified solution was developed to address cardiometabolic actionability requirements across multiple stakeholders. Some key insights from the solution follow.

Diabetes patient journey archetypes: Diabetes is primarily diagnosed by primary care physicians (PCPs), and HCPs' referral and prescribing patterns have a key impact on the patient's treatment decision. Treatment decisions are also influenced by the level of multimorbidity in the patient.

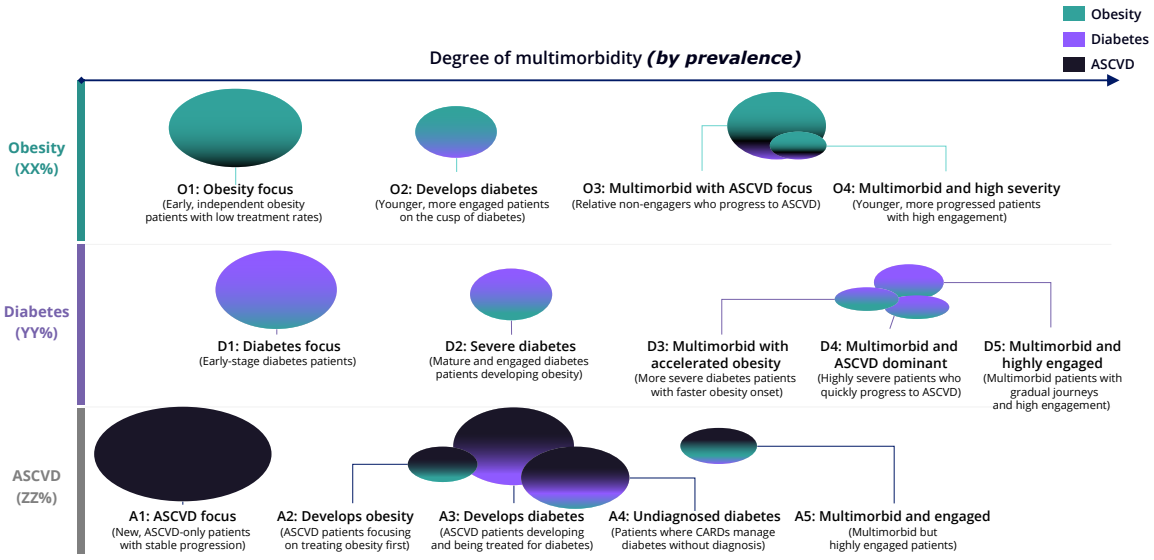
Obesity patient journey archetypes: Obesity patients are also primarily managed by PCPs and have low treatment rates. Patient and physician characteristics influence the treatment of obesity. Treatment is also influenced by the presence of other comorbidities, as obesity is often sidelined in the presence of other comorbidities.

ASCVD patient journey archetypes: ASCVD patients are managed and diagnosed by both cardiologists and PCPs (with significant involvement from cardiologists), influencing the treatments for the patients. Other comorbidities and referrals to specialists also play a key role in the add-on treatment while patients mostly continue their ASCVD treatments.

Multiple patient journey archetypes were further created among each broader archetype based on the journey and influencing parameters across the journey (see the figure below).

FIGURE 4:

Multiple archetypes were created across different therapeutic areas based on the patient journey and degree of multimorbidity



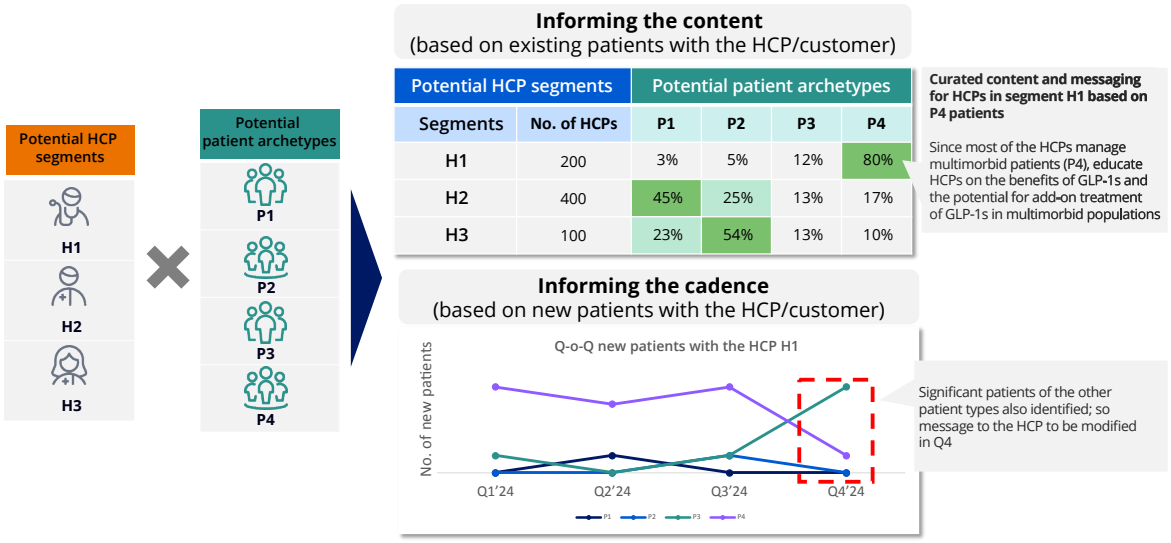
These archetypes are further being leveraged to drive last-mile actions to overcome identified friction points. The quantitative journey capability developed at Novo Nordisk has gained significant traction among stakeholders. They have started to see its benefits, using it in business review meetings and for strategy creation related to messaging and targeting. This has led to increased trust and reliance on the insights derived from the patient journey, enhancing overall strategic alignment and effectiveness across the organization.

Some use case examples

By overlaying the patient archetypes with HCP archetypes to create a market map, high-value physician segments can be identified and targeted. This allows for personalized HCP messaging and campaigns based on patient behaviors across different archetypes of patients they interact with.

FIGURE 5:

Creating a market map will help inform the content and the cadencing of the messaging to the right customers



Leveraging patient journey archetypes also helps us understand care gaps and key intervention points. We can then form a robust implementation strategy based on disparities within the archetypes, with key focus on archetypes with higher disparities.

A comprehensive approach to the cardiometabolic journey

By addressing diagnostic challenges, improving specialist coordination, optimizing treatment strategies and leveraging data effectively, HCPs and researchers can enhance cardiometabolic patient outcomes and better navigate the intricacies of this multifaceted journey.

Although secondary data does have some limitations in providing a complete picture (for example, pre-diagnosis and overcoming other biases, such as obesity stigma), it provides a valuable representation of the U.S. Census and epidemiology. This allows us to make a detailed analysis of various clinical and nonclinical factors. To bridge any gaps, additional data such as primary market research, patient support programs and marketing interactions can be further added to create a more holistic and integrated patient journey. Novo Nordisk is on this journey to have an integrated patient journey to improve patient outcomes.

About the authors

Kate Mulroney leads the advanced analytics and AI team at Novo Nordisk, where she is responsible for delivering innovative data science and AI-based solutions for the U.S. organization. She has been with NNI for over 20 years and has worked in the pharmaceutical industry for over 30 years in a variety of organizations and functions, developing expertise in applying data and technology to deliver business value.

Umang Lahoty is a manager in ZS's Princeton office. He has been working across global life sciences companies for more than a decade and has more than 12 years of insights and analytics expertise across industries. He has helped solve a lot of commercial and patient analytics-related business problems. Umang's deep expertise in understanding data to generate business insights has been explored across several projects by companies. He leads all commercial and patient analytics for an account at ZS.

Ayush Chauhan is a manager in ZS's Philadelphia office with over seven years of consulting and analytics experience. He has a blend of deep analytics and healthcare domain expertise and has been a key driver across multiple AI-based solutions, like identifying care gaps, creating patient journey archetypes and patient and HCP identification.

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